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WESTERN ELECTRICIAN

EVERY SATURDAY

VOLUME XXXIX.

NUMBERS 1—26

July 7—December 29, 1906

ELECTRICIAN PUBLISHING COMPANY
CHICAGO

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[In this Index subjects, titles and authors' names are all included, for convenience, in one alphabetically arranged list. Where necessary, articles are indexed under two or more headings. Often the Index is consulted by persons who have only a vague or general idea of the title or nature of the article sought. In such case a search under every heading that might relate to the subject should be made. A number of cross-references are given to assist in this purpose. The asterisk (*) is equivalent to "Illustrated."]

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WESTERN ELECTRICIAN

EVERY SATURDAY

Vol. XXXIX. CHICAGO, JULY 7, 1906 No. 1

The Building of the Elgin-Belvidere Electric Railway.

Located in a wealthy and prosperous section of Illinois, the electric railway of the Elgin and Belvidere Electric Company, which is now getting well on toward completion, will begin operations with every indication of success. The route taken by this road is well shown in the map. The cities of Elgin, 22,500 population, and Belvidere, 7,000 population, form the terminals of the line, which is about 36½ miles long, and there are located along the route nine other cities and villages. The system is some 40 miles northwest of Chicago, and will ultimately form the connecting link between the Aurora, Elgin and Chicago third-rail line and the Wisconsin system connecting Beloit and Janesville, and ultimately Madison, with Rockford and Freeport, Ill. Arrangements have been made whereby passengers and freight will be carried jointly by the three roads. The population on and immediately tributary to the Elgin-Belvidere line is estimated to be about 52,000.

Power for operating the cars between Elgin and Belvidere will be furnished by the Aurora, Elgin and Chicago. The transmission-line voltage will be 26,400, which will be stepped down and transformed from three-phase alternating current to direct current at three sub-stations, located at Garden Prairie, Union and Gilberts. The sub-stations are equipped with rotary converters and the necessary transformer and switching apparatus. The buildings also contain passenger, freight and baggage rooms.

Though the line is not yet completed, there are many interesting features about the construction work and the equipment which is being installed. The accompanying illustrations are views taken along the line as the work progresses, and the diagrams show the details of the construction.

A few details of the roadbed will first be given. The width of the roadbed at the grade line is 14 feet for single track and 27 feet on sidings. As shown in one of the pictures, the laborers while working grading the line were lodged in comfortable tents or shanties close to the scene of the activities.

Bridges are pile trestle and reinforced concrete. At the Kishwaukee River, near Belvidere, one of the largest bridges was built, comprising four spans, 87 feet six inches center to center of the piers. The bridge is designed to carry regularly two standard 40-ton interurban cars. Where small quantities of water must be carried through the roadbed, tile drains are used, and in all other details the work is being done in a manner conforming to steam-railroad practice.

One of the illustrations shows where a fill was made in a marsh or sink hole. Work at this point was seriously delayed, owing to the almost impossible task of filling up the sink hole, which was 40 feet deep down to the clay bottom, being filled with an unstable soil of decayed vegetation. Though the bog was perfectly level at the start, the filling-in process, as the work progressed, slowly pushed the loose peat up on each side of the roadbed into the form of an embankment, as shown in the picture.

The track construction is of a durable nature. The ties are of tamarack, hemlock and cedar. The rails, in 33-foot lengths, weigh 70 pounds to the yard. Ballasting of the track has not yet been done, as shown in the pictures. Such parts of the track as are on private right-of-way will be ballasted with gravel. On public highways or on the streets the space will be graveled or paved, as required by ordinance.

Line construction as exemplified on this road is of a high order. The high-tension transmission lines, direct-current feeders and telephone lines are carried on one pole line. The brackets supporting the trolley wire are also mounted on these poles, as shown in one of the accompanying diagrams.

Timber used for the cross-arms is of thoroughly seasoned, straight-grained southern pine or Norway pine. The high-tension cross-arms for the three-phase line are 3¾ by five inches in cross-section, those for the low-tension feeders being 3¾ by 4¼ inches. The high-tension cross-arm pins are of wood, with porcelain base, and are not less than 13 inches in length. The pins for the low-tension cross-arms are constructed with a wood top and a half-inch galvanized steel bolt.

All insulators are of glazed porcelain. Those for the high-tension work are made in two pieces cemented together, and are about eight inches in diameter and seven inches high, with a grooved top for a one-fourth-inch conductor. These insulators are designed for a working voltage of 26,400, and are tested at not less than 70,000 volts. The low-tension insulators are constructed in one piece, with double petticoats about four inches in diameter and three inches in height, with a top groove for a 1⅛-inch conductor.

The high-tension line wires are equal in conductivity to a No. 6 hard-drawn copper wire, and were shipped in lengths not less than one mile. The low-tension wires are of two sizes, the larger size equivalent to a 500,000-circular-mil copper cable and the smaller size equivalent to a 300,000-circular-mil copper cable. The trolley wire is a No. 000.

As will be noted in one of the diagrams, the trolley wire is supported over the track by a horizontal bracket fastened to the poles carrying the transmission and low-tension lines. These brackets are made of 1½-inch structural-steel tubing nine feet long. They are equipped with a five-sixteenths-inch stranded span wire provided with two strain

Filling in a Sink Hole to a Depth of 40 feet.
Camp for Laborers who Work on the Line.

Locomotive and Gravel Cars Used on the Work.
Sub-station Building at Gilberts.

THE BUILDING OF THE ELGIN-BELVIDERE ELECTRIC RAILWAY.

insulators. All trolley hardware is suitable for a No. 000 grooved trolley. The trolley hangers are of approved style, with galvanized malleable-iron yokes. Clamping ears are of the screw-clamp type at least 12 inches long. Strain insulators are made of wood 1¼ inches in diameter, with galvanized malleable-iron fittings.

In the construction of the line the standard spacing of the poles has been 100 feet. Special spacing is, however, required at curves and turnouts. In towns where cross-suspension construction is required the poles are set inside of the curbs, and are so spaced as to be approximately as near as possible to the property lines. On straight lines the poles are set vertical, and upon curves of three degrees and less they are set with a rake, so that the span wires and circuit wires will draw them up to a vertical position. Concrete settings are used in soft ground. Double cross-arms and bracings are used at all line crossings, railroad crossings, and at corners. Ground strips of double galvanized iron are used upon every fifth pole.

For spans of 100 feet, the conductors are pulled up so that the sag will correspond to the following amounts for given temperatures:

	30°F. Inches.	60°F. Inches.	90°F. Inches.
High-tension line	4	8	16
Ground wire	2	3	5
Low-tension feeders	4	8	16
Telephone wires	3	4	7

Lightning arresters are installed at intervals of 2,000 feet, the ground wires for the arresters being No. 6 B. & S. gauge. Ground plates at the Kishwaukee River and at two other points are of copper, one-eighth inch thick and 12 by 24 inches in dimensions. They are buried in the embankments below the water level. A copper conductor not smaller than No. 0 B. & S. gauge is soldered to each ground plate and to both track rails. This in general is the layout of the line construction. There is, besides this, some special work, however, notably at the Chicago, Milwaukee and St. Paul crossing, the Fox River line crossing, at station connections, the Northwestern Railroad crossing and at various telephone-line crossings.

As before mentioned, there are three sub-station buildings, deriving their current from the Aurora, Elgin and Chicago system. One of these sub-stations is shown by one of the accompanying illustrations. The buildings are very substantially built of brick, with masonry and concrete foundations. The roofs are of cinder, concrete and steel construction. The first installment of apparatus for the sub-stations will comprise one rotary for each, together with the necessary switching and transforming apparatus. The rotary converters are 300-kilowatt 600-volt 25-cycle three-phase machines. There is a 45-kilovolt-ampere oil-cooled reactance coil supplied with each. The transformers are 10 in number, oil-cooled, of 110 kilowatts capacity each. They step the 26,400-volt current down to 370 volts for the alternating-current side of the rotaries.

Each switchboard equipment consists of the following apparatus: One outgoing line panel of a capacity of 1,200 kilowatts and 62 by 16 by two inches; one direct-current rotary panel of a capacity of 300 kilowatts; two direct-current feeder panels, one rotary-converter starting panel; one 750-volt voltmeter on swinging bracket; one 26,400-volt lightning-arrester equipment of the three-phase multiplex type, with double-blade disconnecting switches, choke coils, etc., and all necessary instruments, switches and circuit-breakers.

There will be first required for the operation of the line six double-truck, single-ended closed interurban passenger cars, having main passenger compartment, smoking compartment and vestibule. The passenger entrance is in the rear end only. The cars are of the Pullman style of construction with dull mahogany finish, semi-empire ceilings and provided with walk-over rattan seats in the passenger compartment and smoking compartment. The length over bumpers is 47 feet one inch; width over outside sheathing, eight feet six inches; height from outside of sills to top of roof, nine feet four inches. The roof of the car is of the monitor-deck type, extending the full length of the car body. There are 15 cross seats, four permanent longitudinal seats and three folding seats in the smoking compartment. In each car is a toilet room with all appointments. A speaking tube connects the motorman's cab with the rear vestibule. An efficient arc headlight is provided, and the front of each car carries a locomotive type of pilot, which does not, however, prevent two cars being connected head on.

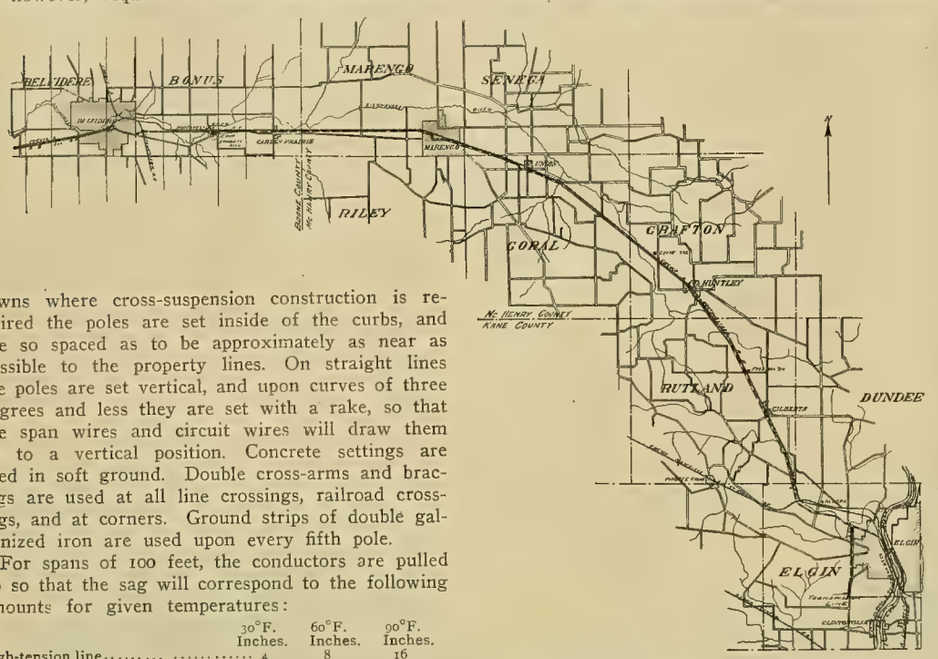
All wires are concealed and run in iron pipe conduits located, as far as practicable, beneath the car floor.

The motor equipments for each car are four in number, with parallel-control apparatus. These motors are of 74 horsepower each. The weight of the four motors carried under each car is approximately 15,000 pounds. Air brakes are provided throughout; also hand brakes for emergencies.

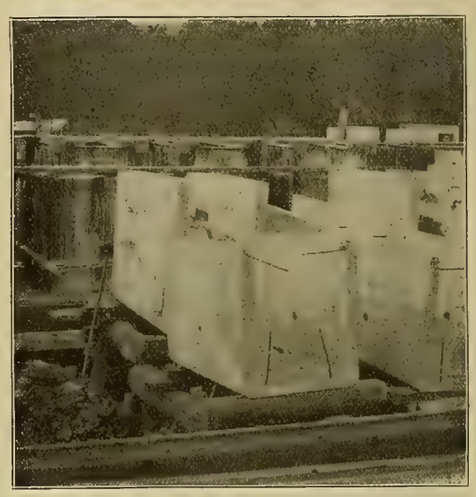
Besides the cars just described, there will be required two double-truck combined baggage and express cars. The length of these cars is 45 feet over all, with a width over outside sheathing of eight feet six inches. A straight air-brake equipment is furnished for each; also a hand brake for emergencies. They will have four-motor equipments of 65 horsepower each, which will be able to develop a maximum speed of 30 miles an hour. The external appearance of the car is made to conform to that of the passenger cars.

Just outside of the city limits of Marengo a car house is in course of construction for the accommodation of the rolling stock. This is substantially built of brick, concrete and structural steel. The building is 105 feet long by 91 feet 3½ inches wide, with a wing 51 feet long by 20 feet wide. The latter contains the boiler room, storage space, paint room, etc. The main building is devoted to trackage for the cars, and contains also offices, storage room and winding room.

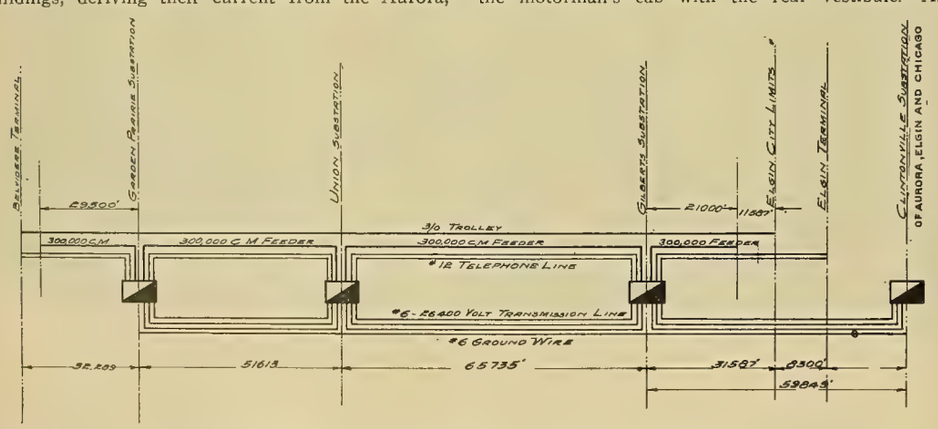
The officers of the Elgin-Belvidere Electric Company are: President, Hamilton Browne, and secretary and treasurer, R. G. Arnold. Others interested in the project are Bion J. Arnold and W. L. Arnold. The Arnold Company, Chicago, has charge of the engineering of the line, and the Main Construction Company is doing the construction work. Arthur T. Browne is president of the Main Construction Company and R. G. Arnold is secretary and treasurer. The offices of the Elgin-Belvidere Electric Company are at 181 La Salle Street, Chicago.



MAP SHOWING ROUTE OF ELGIN-BELVIDERE RAILWAY.



CONCRETE BLOCKS FOR KISHWAUKEE BRIDGE ON ELGIN-BELVIDERE RAILWAY.



CONNECTIONS BETWEEN SUB-STATIONS ON ELGIN-BELVIDERE RAILWAY.

Rochester to Toronto by Trolley.

The incorporation at Ottawa, Ont., of the Trans-Niagara Bridge Company is regarded as an important step toward the construction of a through trolley line from Rochester, N. Y., to Toronto, by way of Niagara Falls, St. Catharines and Hamilton, with a branch to Port Colborne at the Lake Erie end of the Welland Canal. The immediate purpose of the bridge company, which is capitalized at $1,000,000, is the construction of a bridge across the Niagara Gorge north of the upper steel arch bridge, which will carry the tracks over the river. Among the capitalists are Frederick Nicholls, H. M. Pellat and E. R. Wood of Toronto. It is said to be the purpose of the Buffalo, Lockport and Rochester company to build a trolley line that will connect Lockport with Rochester, and, under an interchange of traffic agreement with the International Railway Company, with Niagara Falls and Buffalo. West of the Niagara River the Mackenzie-Mann syndicate has the control of the Niagara, St. Catharines and Toronto Railway Company. This syndicate is organizing the Toronto, Hamilton and Niagara Falls Railway Company, which will construct the electric road around the west end of Lake Ontario that will give the contemplated connection between Niagara Falls, Hamilton and Toronto.

Hogan Engineering Club.

The J. J. Hogan Engineering Club of La Crosse, Wis., organized February 6, 1906, held a meeting on June 23d. The club consists of 25 active members and a number of honorary members, and was organized by employes of the Wisconsin Light and Power Company. Meetings are held semi-monthly. The meeting referred to was a special one. C. H. Williams, manager of the company and president of the association, read a very interesting paper on "Steam Turbines." "The Losses Between the Coal Pile and the Consumer's Appliances" was a paper read by O. B. Cahoon, superintendent of the company. James T. Barry explained the principle and uses of the auto-starter.

Practical Operation of Overhead Lines.

[From the Question Box of the National Electric Light Association.]

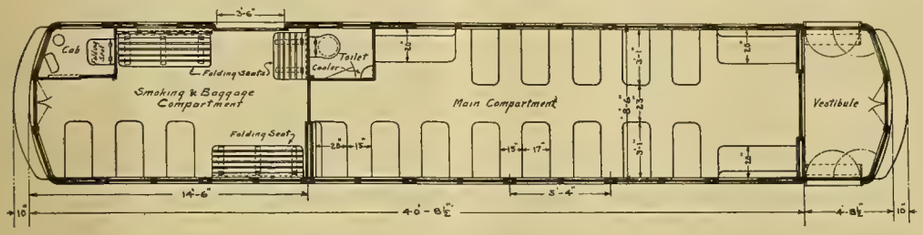
QUESTIONS.

Does your experience in the supply of current in districts where there is no underground service show the advisability of using an alternating or a direct-current system for the supply of current to motors? Why? What is the best system?

ANSWERS.

E. H. Mather, Portland Lighting and Power Company: For supplying current to motors an alternating current if motors are of small size, say five horsepower or less; connect them all on same secondaries, which should be three-wire, 115-230 volts; all motors two horsepower or over, to be 230 volts. Use ample transformer capacity to assure good regulation—2,400-volt 60-cycle three-wire two-phase.

Ralph R. Laxton, Grears, S. C.: It is impossible to class one system above the other for all purposes. From the stantion man's standpoint, the alternating-current system is probably the more desirable, but in almost every community there will be found a certain class of industries demanding



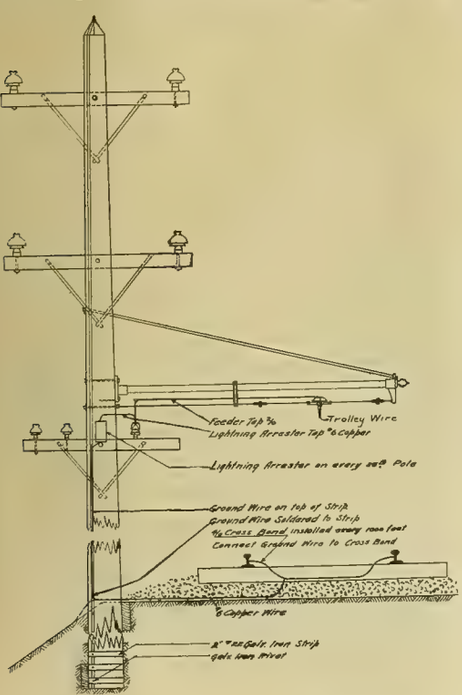
PLAN OF STANDARD CAR FOR ELGIN-BELVIDERE RAILWAY.

alternating system should be used, because the power can be transmitted at higher potential and, therefore, with less loss; further, because the alternating motor is simpler and more economical for the customer to maintain. Where lights are to be used from the same circuits that supply motors, the three-phase system is, perhaps, the most satisfactory in large cities, and the two-phase system in small cities or towns.

F. C. S., Malden Electric Company, Malden, Mass.: To answer this question properly, I think it would be necessary to give some specific case, as the distance is the feature that must be considered in the advisability of using alternating current. Leaving this feature aside, the writer thinks that the alternating current is preferable, as the alternating motor is a much simpler and more reliable motor than the direct-current for general use.

L. L. Elden, Edison Electric Illuminating Company of Boston: With the exception of apparatus requiring variable speeds, the alternating-current system furnishes a most satisfactory power service. Careful attention to special demands that are not readily adapted to the alternating-current service will usually result in the development of apparatus to meet the emergency satisfactorily. Three-phase service for motors of large capacity and single-phase service for small motors seems to be the preferable and most satisfactory system to employ.

Fred. W. C. Bailey, Cincinnati, Ohio: If both alternating and direct three-wire current are supplied from plant, it is largely a question of the relative copper to reach the motors. Alternating-current motors are best served on power feeders independently from the lighting. Small single-phase motors may be connected with advantage to alternating-current secondary mains.



POLE-LINE CONSTRUCTION FOR ELGIN-BELVIDERE RAILWAY.

C. A. Keller, Chicago Edison Company: In general, an alternating-current system is preferable, especially where the supply covers a large district. The three-phase four-wire 60-cycle system, with 2,300 volts between phase and neutral, is the best system for nearly all conditions when an alternating system will satisfy commercial demands.

Beacon Light Company, Chester, Pa.: Use wide ranges of speed control in the application of power, and these conditions are best met with the direct-current system.

H. A. Strauss, Milwaukee, Wis.: Think direct current preferable for the condition cited, unless area of distribution is too great to give satisfactory economy with 500-volt direct-current service, principally because direct-current motors permit of

RAISING POLES FOR THE ELGIN-BELVIDERE RAILWAY.

simpler and more satisfactory arrangements for speed variations.

The Colorado Springs Electric Company: We have a direct-current power system installed. Within limits of territory covered by this service we require direct-current motors. In outlying districts the alternating-current motors may be used. It is an open question as to which is the better system, as so many conditions enter into the case.

Ernest F. Smith, Chicago Edison Company: Very satisfactory results are obtained by the use of overhead three-wire direct-current system in densely loaded territory of limited extent adjacent to converting sub-stations, with large motors connected to outers and small motors connected between neutral and either outer. In extended territory, where the load density is low, three-phase four-wire 2,400-4,150-volt 60-cycle system is very satisfactory. Large motors of the three-phase type are connected between the three-phase wires, while small single-phase motors are connected between the neutral and the respective phase wire.

QUESTION.

What is the greatest radius commercially practicable for a 110-220-volt three-wire direct-current system?

ANSWERS.

L. L. Elden: Moderate amounts of current can be delivered economically by a 110-220-volt three-wire system over a radius of from 2,500 to 3,000 feet. After this limit is reached it is usually found advisable to install new distributing sub-stations. In districts where large amounts of current are distributed it becomes, in many cities, more economical to limit the distributing radius to from 1,000 to 1,500 feet, or even less.

Fred. W. C. Bailey: The greatest economical radius is determined by the distribution of the load and the fuel costs, which largely determine the copper. The greatest economical radius will be from 4,000 to 7,000 feet.

P. S. Biegler, Chicago Edison Company: The maximum practicable radius for a 110-120-volt system depends upon the distribution and extent of the load, and the revenue derived. If the revenue derived from the system permits the installation of a large amount of copper per 50-watt lamp, then the practical radius of distribution is great. In his "Electrical Transmission of Energy," Art. 599, Mr. A. V. Abbott gives a table showing the radii of profitable districts that may be served with five per cent. drop in pressure for installation with 12.5 pounds and 25 pounds of copper per 50-watt lamp. The following are the figures given for a three-wire feeder and main:

Radius Profitable District with 5 per cent. drop.

	Copper 12½ pounds per 50-watt lamp.	Copper 25 pounds per 50-watt lamp.
Three-wire system	2,300 feet	3,500 feet
Three-wire feeder and main	4,000 feet	6,000 feet

Experience in general indicates that economical radius is less than given, especially where load is dense, as in very large cities.

QUESTION.

Assuming that in the use of four-pin cross-arms for single-phase work the ideal method of construction is to run the two wires on adjacent pins on the same side of the pole, is the saving in inductive loss effected thereby sufficient to warrant the increased cost of construction for guying arms that is made necessary when the above rule is followed for both primary and secondary work? Two thousand-volt primary, 110-volt secondary; population of the town, 35,000.

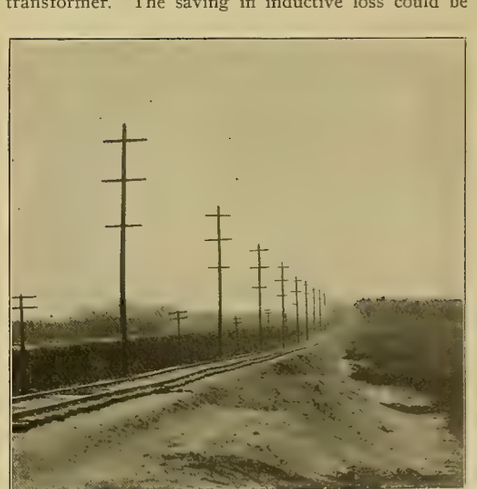
ANSWERS.

H. B. Gear, Chicago Edison Company: In 2,000-volt primary distribution the increased inductive drop due to carrying wires on opposite sides of the pole instead of on the same side is generally so small as to be negligible with all sizes of wire smaller than No. 0 B. & S. With wires from No. 0 to No. 0000, if the drop with 12-inch centers is 10 per cent., the drop with 24-inch centers would be about 11.5 per cent. With means for independent feeder regulation at the station this additional drop would not warrant any increased cost for construction made neecssary by keeping all wires on one side of the pole. On a 110-volt secondary of No. 0000 wire, on which there was a drop of two per cent. with 12-inch centers, the drop would be increased to about 2.3 per cent. by increasing the centers to 24 inches. This would not ordinarily warrant any increased expense for line construction to keep the wires close together.

F. D. Sampson, Catawba Power Company, Charlotte, N. C.: All single-phase circuits of either 125 or 60-cycle frequencies should be placed on adjacent pins on same side of pole with four-pin arms. The increased cost of construction, if any, should not determine the practice in this case, the inductive losses, assuming a certain size of wire for a given length would be material, dependent upon the spacing of the wires of the same circuit. You would have perceptible pulsations in other arrangement if you happened to be operating two single-phase alternators at the same time on the two circuits strung parallel on the same pole.

Ralph R. Laxton: I think decidedly more would be gained by maintaining the usual arrangement and changing over the secondary system to 110-220-volt, three-wire. Ground neutral every 250 feet for protection against cross with primary or punctured transformer. The saving in inductive loss could be figured only in the light of detailed information as to size of wire, load, distance, etc. This would probably be but a small fraction of the gain by doubling the secondary voltage.

Dugald C. Jackson, Madison, Wis.: Unless the conditions are somewhat unusual the inductive loss would not be serious if the primary wires were placed on the outside pins of the four-pin cross-arms described in the question.



TRACK ON THE ELGIN-BELVIDERE RAILWAY BEFORE BALLASTING.

The Ardmore Electric Power Company has been granted a franchise for an electric street-railway system in Ardmore, I. T.

Transporter Bridge or Aerial Ferry at Marseilles, France.

Electrically operated aerial ferries, while not an entirely new departure, being in operation in a few places in this country and in Europe, nevertheless possess much technical interest. The transporter bridge or aerial ferry at Duluth, Minn., was described in the Western Electrician of August 12, 1905, and was at that time one of the first in operation. The accompanying illustrations show the new electrically operated aerial ferry across the Dieux Port at Marseilles, in France. This structure was built after the design of F. Arnodin, and is now operated under the direction of V. Vaudin.

The total length of the cantilever of this bridge is 245.505 meters, while that portion between the supporting towers is 165 meters in length, the

ELECTRICALLY OPERATED AERIAL FERRY AT MARSEILLES, FRANCE.

cantilever extending 35 meters beyond the supporting tower on the Fort St. Nicolas side and 40.458 meters beyond the supporting tower on the Fort St. Jean or northern side. The total height of the trolley bridge which supports the hanging car is 50.08 meters above the surface of the water. This is sufficient height so that the largest vessel can pass underneath without interfering in the slightest degree. The total height of the supporting towers is 86.625 meters, these towers being two in number and located on masonry and cement piers placed on rock foundations. Each tower has four supports, which are 20 meters apart from center to center across the bridge, and 10 meters apart in the north and south directions. The diameter of the caissons on which the towers are mounted varies from five to 5.5 meters.

The traveling car which moves between the two landinsg, Fort St. Nicholas on the southern side of the Port Vieux and Fort St. Jean, on the northern side, is supported by cables about 50 meters in length from a traveling trolley running on rails on the cantilever above. This trolley is 32 meters in length and eight meters in width, and supports a car or platform having an area of 10 meters by 12 meters. This car will carry a load of 11,000 kilograms, and is used for transporting passengers, freight and vehicles between the two landings.

Electric power is utilized for moving the car across the cantilever bridge, the current utilized being 344 kilowatt-hours per trip. The ends of the cantilever bridge are anchored by means of vertical cables at each of the landings, and observation buildings are provided on the cantilever beyond the supporting tower, while a series of winding steps are arranged on each tower, so that persons may mount to the level of the bridge and cross on two walks from 10 to 12 feet in width.

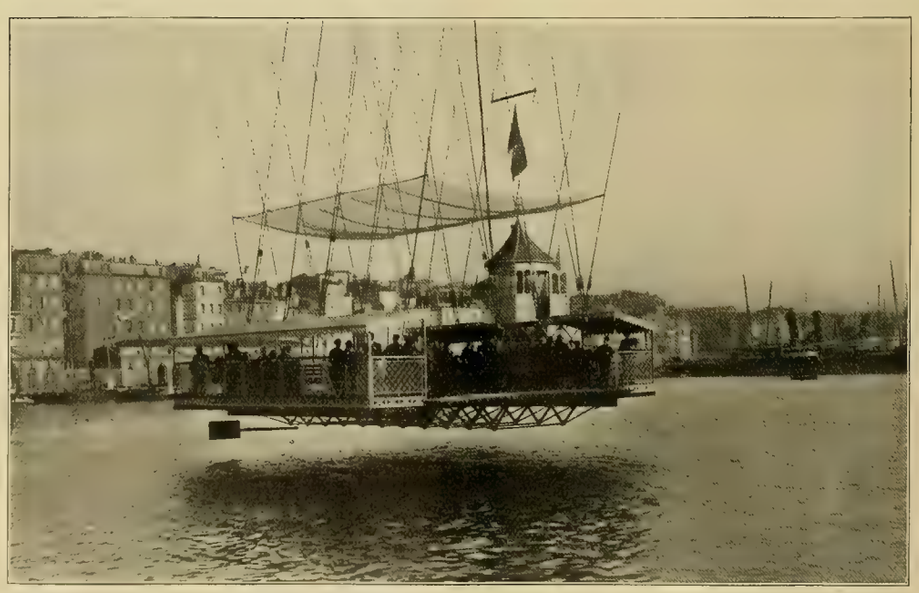
The charges for crossing on this electrically operated aerial ferry are five centimes, or about one cent, for a foot passenger, the same for a sheep, lamb or goat, and 10 centimes, or two cents, for a horse, mule or cow, while the vehicles are charged for at the rate of 50 centimes, or 10 cents, for an automobile, and from five centimes, or one cent, to 25 centimes, or five cents, for other vehicles, according to the weight, merchandise being charged for also in proportion to the weight.

This aerial electric ferry has been running for a sufficient length of time to prove its satisfactory operation, covering the distance with considerable speed, and without interfering with the traffic of the merchant vessels in the slightest degree. P.

Aggressive Policy of the Kokomo Central Station.

Except for lighting purposes, not much effort was made by the Kokomo, Marion and Western Traction Company of Kokomo, Ind., toward the introduction of electric current for use in the home until the beginning of this year. Since that time, however, this company has been experimenting, and as a result has undertaken a systematic campaign for extending and augmenting its general lighting and power business, and particularly toward building up the day load. The results so far attained have been so encouraging that the company has already placed orders for additional electrical and power equipment, which has become necessary to take care of the new business. At the present time the company handles at one station the electric-lighting load of Kokomo and Swayzee and also operates the street-railway system of Kokomo and the interurban railway between Kokomo and Marion.

The new equipment now on order consists of a 1,000-kilowatt Allis-Chalmers turbo-generator unit, wound for 60 cycles, 2,300 volts, three-phase,



LOADED CAR ON AERIAL FERRY AT MARSEILLES, FRANCE.

which corresponds with the current generated at present in the company's plant for distribution in Kokomo. For transmission to the sub-station at Swayzee, however, 10,000 volts are used. It is there stepped down and supplied to the interurban railway and for lighting at 208 volts on the three-wire system. Other electrical machinery consisting of a 30-kilowatt direct-connected engine-type exciter set and a 35-kilowatt motor-generator set, together with switchboard condenser and piping, will also be furnished.

Kokomo has a population of 16,000 people. Eight hundred consumers are now connected to the company's circuits; a year ago there were 485. The company has at the present time 14,000 incandescent lights in operation, while a year ago there were scarcely 8,000. A commercial power load of 400 horsepower is carried now, whereas a year ago the motor load was 40 horsepower. All along the line between the Swayzee sub-station and the Kokomo power house, where the demand is sufficient to justify it, a transformer is installed and the current stepped down to the voltage suitable for lighting and power purposes.

Electrical Methods for Determining the Location of Metallic Ores.

For several years there has been discussion of the practicability of an electrical method for determining the location of metallic ore deposits. Particular interest was aroused in 1901 by a method devised by Fred H. Brown, formerly of Oak Park, Ill., who received patent rights on a device of this character which he sold to a company in Chicago. In the Western Electrician of November 16, 1901, a complete description of the working of the apparatus was given, with an illustration showing a party in the field using the equipment. Later, in the issue of April 25, 1903, editorial mention was made of an equipment patented in England by Leo Daft and Alfred Williams, and the system was compared with the Brown invention.

Among the devices for locating metals in the ground, which have been tried from the days of the divining rod to the present time, these two systems stand out prominently as perhaps the most scientific. There is no reason, apparently, why a bed of iron ore, for instance, should not make its presence felt by properly adjusted sensitive instruments which are susceptible to the conductive effects of the ore. The use of such instruments, however, for reasons, probably, of inherent defects in the apparatus, rather than to unsound principle, has never been extended, though they have been found by actual trial to locate metallic deposits with a fair degree of accuracy.

It is interesting to note, therefore, in relation to the work thus far done in this direction, the almost simultaneous issuance recently of two more patents on the above apparatus, one to Messrs. Daft and Williams of Wimbledon, England, and one to Mr. Brown, now of Los Angeles, Cal. The date of the first of these was April 10, 1906, and of the second April 17, 1906. They both relate to improved methods, and in view of the possibilities which they present, as well as the scientific interest which is attached to the subject, a brief description of the working of the two systems as proposed in the later patents will be of interest.

In the apparatus devised by Mr. Brown one object is to provide an apparatus for locating metals beneath the surface of the earth by a signal given off by a differentially wound telephone receiver caused by sending currents of different potential through the coils on the receiver.

Another object is to furnish a device by which the resistance of the earth can be measured with battery or continuous currents without making use of the system of circuits and connections usually employed in the slide-wire type of Wheatstone bridges, thereby simplifying the cost of construction and rendering this apparatus more easily understood and used and the construction of parts more readily attained than when a Wheatstone

bridge is used in connection with alternating currents or extra direct electrical impulses.

A further object is to overcome as far as possible the inaccuracies due to electrolysis and earth currents and to furnish an apparatus in the use of which this obstacle is reduced to a nominal condition, if not entirely eliminated, and wherein a telephone receiver is so constructed that when currents of equal potential flow through its differentially wound coils it will indicate the ohmic resistance of two circuits, one of which encloses a different length of the earth.

Referring to Fig. 1, the apparatus (a) will be stationed at any convenient point, preferably on a rod driven into the ground. Then a suitable conducting rod, such as (b'), of any suitable metal, preferably brass, is driven into the earth to form the second electrical contact.

The instrument (a) is a box containing a battery and slide-wire scale of high resistance and also contains the various wires connected together. This box is provided with two binding posts on one end, and on the other end is one binding post, as shown at (d'). The bottom of the box is provided with a brass socket (d^3), which is adapted to enclose and be firmly attached by a thumb-

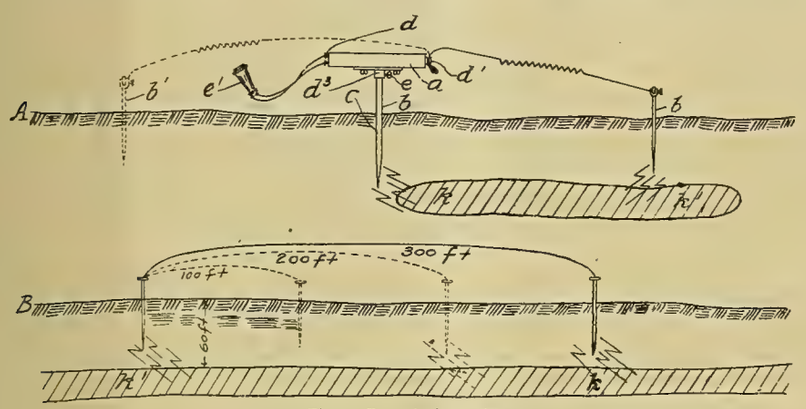


Fig. 1. Brown's Apparatus.

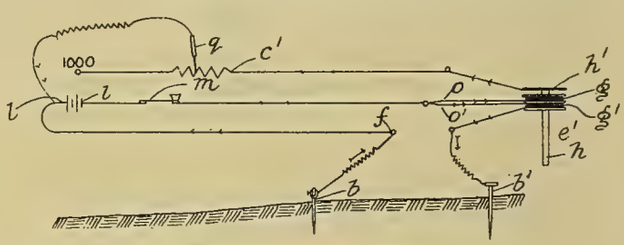


Fig. 2. Connections of Brown's Apparatus.

ELECTRICAL METHODS FOR DETERMINING LOCATION OF METALLIC ORES.

screw to the brass rod. The receiver is attached by suitable conducting cords to the two binding posts on the end of box. The rod (b) is electrically connected through the socket (d^3) to the circuit wire inside of the box.

Fig. 2 shows the connections of the apparatus. (g) and (g') are the differentially wound coils on the magnet (h), forming part of a telephone receiver; (h') is the telephone diaphragm; (i) is the battery, the current of which flows through the two circuits (1 o) and (1 o'); (q) is a stylus adapted to contact at various points with a high-resisting wire (c'), forming part of the circuit (1 o).

It is evident that when the resistance of the circuit (1 o) is equal to the resistance of the circuit (1 o') currents of equal volume of potential will pass in opposite directions through the receiver coils (g) and (g'), and no sound will then be heard in the receiver, provided the stylus point is touched to and in contact with such a point on the high-resistance wire (c') as will equalize the resistance of the two circuits (1 o) and (1 o'), the receiver in this instance performing the work of the bridge wire in the Wheatstone-bridge system of measuring resistances.

In using the apparatus one of the rods is driven into the ground at any point. The box, with the receiver attached, is then connected by the socket to the rod (b) by the thumb-screw, which firmly attaches it to the rod. Another rod (b') is driven into the ground at another point. The rod (b') is then connected by a copper wire to the binding posts. The battery current is then turned on by a suitable switch. The telephone receiver being placed to the ear, the stylus is placed in contact at various places and points on the high-resistance wire (c'). Each time a contact is made with stylus (q) on the high resisting wire (c') a sound will be caused in the telephone receiver until the stylus is placed on such point on the wire (c') which will cause the resistance of the circuit (1 o) to equal the resistance of the circuit from (1) to (o') when such point is touched. Then these two circuits, which form part of the differentially wound windings of the telephone receiver (g g')—in this condition the resistances of these two circuits—will be equal. The same volume of current will flow in opposite directions through (g g'). The effect of the current on these two circuits will be to nullify each other, and no variation of the magnetism of the receiver magnet (h) will take place, no deflection of the diaphragm (h') will be caused, and therefore no sound will be heard in the receiver. These contacts of the stylus are continued until a contact is made on the wire (c'), at which point of contact no sound will be heard in the receiver. The figure over this point of silence on the scale will indicate the resistance of the different length of earth interposed between the rods (b) and (b'). This resistance will then be recorded and the rod (b') moved and placed at other points on the circumference of a circle, including the area to be tested, measuring the resistances in the manner described at each of the points.

It is evident that when the rod (b') is placed at a point directly over the ore body the current will find a path of least resistance in the ore body lying directly underneath the line being measured and will pass through it to the rod at the station on the central point of the circle. This diminished resistance will be shown on the scale (c') and will indicate the presence and location of ore.

The device proposed by Messrs. Daft and Williams is somewhat more complicated. This invention relates to the use of apparatus which is adapted to produce from any convenient source of electricity electric impulses of a very abrupt character and to project these impulses through the crust of the earth. It also embodies apparatus which is adapted to detect the presence of those impulses at a considerable distance and to differentiate the character of their manifestations as affected by the nature of the underlying material in the immediate neighborhood.

The apparatus consists of, first, an inductor wherewith electric impulses are generated in a secondary circuit on the interruption of a primary circuit; second, a resonator or receiving instrument adapted to be tuned to respond readily to feeble electric impulses, and, third, electrodes which are adapted to facilitate the making of an earth contact and to be joined by wire conductors—two to the inductor and two to the resonator.

The method of observation adopted is as follows: Two electrodes are planted in the soil at about the center of the district which it is desired to explore, the distance apart being anything between say, five and 100 yards, depending on circumstances. The inductor before mentioned is joined up to those electrodes, with the result that lines of impulses are established in the neighboring underlying soil, which lines in the case of homogeneous soil have directions like those of the lines of magnetic force due to a magnet which has its poles at the electrodes. In proceeding along any one line of impulse there will be a steady fall of potential from the positive to the negative electrode. The line of steepest gradient of the potential will be the straight line from electrode to electrode; but on each side of that line and in the earth beneath there will be curved lines of falling potential somewhat of the shape of an ellipse having an axis along the line joining the electrodes.

One of the electrodes connected to the resonator is planted in the soil at some considerable distance from the inductor electrodes, and the operator carrying the other electrode proceeds from the first electrode along the line of impulse and touches the soil at intervals, at the same time listening at the resonator. If he is proceeding toward the mineral deposit the sounds will gradually become more intense. He then moves his first electrode in the same direction and seeks to bridge the mineral deposit with the resonator connecting wire and to plant the two electrodes, one on each side of the deposit, but outside its limits.

Supposing that done, he will find that the sound will grow in intensity as the electrodes are caused to approach the margins of the deposit, and that when the electrodes step over the margin into the soil overlying the deposit there will be an abrupt falling off of the sound, and that when both electrodes are well within the boundary there will be comparative silence. These phenomena may be explained by observing that the lines of electric impulses will be concentrated toward a medium of superior conductivity, and that medium will be the principal conducting channel of the stream of impulses from one side to the other. If the mineral deposits extended to the surface (in which case the method of discovery would be unnecessary), the electrodes would dip into the stream and the manifestation would be great; but if there is overlying material of a non-conductive character, as in the case assumed, the electrodes will be more or less entirely insulated from the current of impulses which will be coursing through the conducting mineral material below and the resonator will be more or less silent.

Much judgment and experience will be requisite to enable an operator in an entirely unknown field to reach the desired goal quickly; but the above description will indicate the nature of the operation which should be followed. Having determined the transverse limits of the deposit, the longitudinal are sought by planting the inductor electrodes in a line at right angles to the former line and repeating the observations.

Electrical Exports for May.

Electrical exports from the United States for the month of May amounted to a total value of $1,391,830, compared with $1,237,394 in May, 1905. Exports classified as electrical machinery show considerable falling off, but the increase in the amount of electrical appliances exported was sufficient to make the total figure for the month larger than that for May, 1905. Comparative figures are as follows: Electrical machinery—May, 1905, $806,702; May, 1906, $681,955. Electrical appliances (including telegraph and telephone instruments)—May, 1905, $430,692; May, 1906, $709,875.

Considering only electrical machinery, the following countries were the leading importers from the United States in the month of May. The figures given represent the value of the electrical machinery sent to them: British North America, $190,219; United Kingdom, $84,175; Mexico, $77,132; Brazil, $53,527; Japan, $52,181; Cuba, $40,527; British Australasia, $36,266; Argentina, $28,747; France, $21,518; British East Indies, $19,947; British Africa, $6,653; Germany, $5,990; Philippine Islands, $2,229; Central American states and British Honduras, $2,119; Chinese empire, $2,001; European countries not elsewhere mentioned, $50,940.

In May, 1905, Japan was at the head of the list, having in that month bought $267,834 worth of electrical machinery from the United States. It will be noted that in May this year Japan only reached $52,181, a falling off of $215,653. This item alone more than accounts for the decrease in the export of electrical machinery in May, as compared with May last year.

Profit-sharing Electric-railway.

A profit-sharing system has been adopted by the street railways of Lyons, France. J. C. Covert, United States consul at Lyons, writes of the system as follows: "The amount distributed will be $500 for each franc (19.3 cents) of dividend earned by the company over 35 francs ($6.75) per share. The shares are 500 francs. This year the company earned 40 francs per share. As a consequence $2,500 will go to the employes, two-thirds of the sum to their general relief fund and one-third to personal relief for sickness. The company also makes other stipulated contributions to the relief funds, the full details of the agreement being on file at the Bureau of Manufactures. The employes bind themselves not to ask for increase in wages for three years. Heretofore there have been frequent strikes."

The people of the Plateau Valley, Colorado, are determined that an electric railway shall connect their country with the outside world, says the Denver Republican. They are willing that outside capital shall build it, and are not at all anxious to be concerned either in its construction or management, but that it shall be built they are determined upon.

WESTERN ELECTRICIAN

EVERY SATURDAY.

PUBLICATION OFFICES:

507 Marquette Building, - CHICAGO.

TELEPHONE, MAIN 1746.

Eastern Office, 150 Nassau Street, New York.

Telephone, 8220 Beekman.

Trade Supplied by Western News Co.

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SUBSCRIPTION, in advance, postage prepaid, $3.00 for a full year of 52 numbers; in clubs of four or more, $2.50, with free extra copy for eight subscriptions; foreign countries, $5.00 a year; single copies, 10 cents. When change of address is requested, the **old address** as well as the new should be given.

CORRESPONDENCE relating to electricity or any of its practical applications is cordially invited, and the co-operation of all electrical thinkers and workers earnestly desired. Clear, concise, well written articles are especially welcome; and communications, views, news items, local newspaper clippings, or any information likely to interest electricians, will be thankfully received and cheerfully acknowledged.

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REMITTANCES.—All checks, drafts and other remittances should be made payable to the order of the publishers, the **Electrician Publishing Company,** and addressed to the offices of publication, Suite 507, Marquette Building (204 Dearborn Street), Chicago, Illinois, U. S. A.

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DATES AHEAD.

National Electrical Contractors' Association (annual convention), Hollenden Hotel, Cleveland, Ohio, July 18th to 20th.

International Association of Municipal Electricians (annual convention), New Haven, Conn., August 15th to 17th.

Ohio Electric Light Association (annual convention), Put-in-Bay, Ohio, August 21st and 23d.

Colorado Electric Light, Power and Railway Association (annual convention), Denver, September 18th to 20th.

Illinois State Electric Association (annual convention), Springfield, Ill., September 19th and 20th.

American Street and Interurban Railway Association (annual convention), Columbus, O., October 15th to 20th.

THE INDEX for Volume XXXVIII. of the Western Electrician, concluded last week, is distributed to every subscriber with this issue. It is interesting to remark that the volume just closed contains more reading pages—560—than any of its predecessors, and the Index, which has been prepared with much care, is also larger than any that preceded it, containing over 2,100 entries.

IN THIS ISSUE we begin the publication of a very practical series of articles on "The Small Central Station." The various departments and features of the station are taken up in detail, and helpful hints on construction, operation and management are given. We are confident that all readers of the Western Electrician interested in small electric-light plants will find these articles of real value.

CONSIDERABLE importance attaches to the midsummer meeting of the American Association for the Advancement of Science, just held at Ithaca, N. Y. This meeting, the fifty-sixth in the history of the society, is a return to the former custom of holding sessions in midsummer. The new plan of holding the meetings in "convocation week" in midwinter, while successful in promoting the special work of the various sections, has the disadvantage of endangering the popular work of the association. As originally intended, one of the principal functions of the association was to spread interest in science through the entire educational world. When founded, the organization was able to keep in touch for a time with all divisions of science, as the specialties now so highly developed did not exist. Of late numerous special societies have been formed, and the work has taken on more of a technical character. It is to be hoped, therefore, that the holding of a somewhat popular summer meeting and a more technical winter meeting each year will serve to render the association useful to a maximum extent. It is well that the general association be continued, as excessive specialization is apt to make scientists narrow, and only by getting together frequently can they maintain their general perspective of all science. The central body may be said to be the authoritative voice speaking for the whole body of scientists throughout the country. These ideas were clearly expressed by President Welch in his address at the opening session.

A report of the meeting will be given in the Western Electrician next week.

AMONG certain newspapers, and even among periodicals professing to follow technical lines, and which should know better, there is a marked tendency to lay the cause of fires whose origin is unknown to the door of the electrical system installed on the premises. Some of these papers very confidently asserted that the fire which broke out in San Francisco after the earthquake was the direct result of crossed electric conductors and other disturbances in the electrical system. Anyone who stops to consider the matter seriously will see the absurdity of these statements. Why pick out the most improbable of the possible causes of the fire and set up that old cry, "The wires were crossed," when there were conditions present, owing to burning gas jets, overturned coal stoves, etc., which would make it almost impossible for fire not to start in a dozen places at once? But for the doubting ones who wish to be convinced, we may call attention to the words of Charles Towe, fire marshal of the city of San Francisco, who in a letter to William McDevitt, fire inspector of Philadelphia, exonerates electricity from all blame. The substance of this communication was printed in the Western Electrician of May 26th, and in it Mr. Towe says: "The fires were no doubt caused by gas lights, as after the houses were shaken the pipes fell with the burners still lighted. Stoves in use were overturned in hotels and restaurants, the hot coals rolling on the floors; the same trouble occurred in dwellings where fires were in use, and lighted lamps burning." Under conditions such as these it is indeed curious that people with ordinary judgment should overlook the real cause and tell again the worn-out story of how electricity caused the fire.

NO DOUBT the question has arisen in the minds of many why it is that the efficiency and capacity of storage batteries are rated by most manufacturers on the ampere-hour basis rather than on the kilowatt-hour basis. The latter rating would appear to be simpler and more consistent, since the output of the station is given in kilowatt-hours. This query appeared in the recent Question Box of the National Electric Light Association, and several persons submitted answers to the question.

The capacity of a battery expressed in terms of kilowatt-hours really means more than if stated in terms of ampere-hours, for the ampere-hour capacity of an entire battery is that of a single cell, irrespective of the voltage, while the kilowatt-hour capacity is dependent not only upon the ampere-hour capacity but upon the average voltage on discharge as well. It is the energy input that governs in the storage battery, as in other apparatus, and in order to give a correct rating in ampere-hours it is necessary to modify the capacity in ampere-hours by specifying at what particular rate of discharge the readings are taken. Therefore it would seem to be more consistent to rate the battery in kilowatt-hours. In charging storage batteries it is common practice to keep the current constant, the electromotive force varying. As the cells charge the voltage rises, falling off as the charging is stopped. This, while it would count if the batteries were rated in kilowatts, has no bearing if they are rated in amperes, and the efficiency will consequently show up greater under the ampere-hour rating.

RAILROAD ACCIDENTS are undoubtedly more frequent in the United States than in Great Britain, but possibly in not much greater proportion than the greater mileage and more arduous conditions of railroading in this country would lead one to suspect. At any rate, it has been a long time since such a peculiarly distressing disaster as that at Salisbury, England, on July 1st has occurred anywhere. It was the boat train, connecting with the American steamship New York at Plymouth and bound for London on the London and Southwestern Railroad. While proceeding through the town of Salisbury at high speed, this train plunged from the track, for some reason that at present seems unknown, and in the terrible wreck that ensued 23 persons were killed and eight or nine were injured. Nearly all the dead and injured were Americans who had left the boat at Plymouth to reach London more speedily, and among those who lost their lives were three—Louis Cassier and John E. McDonald of New York and Mrs. W. W. Smith of Dayton, O.—connected more or less directly with electrical pursuits.

It would not be difficult, in commenting on this shocking accident, to return in kind some of the caustic criticism of American railroad management made by English journals on the occasions—all too numerous—of similar catastrophes in this country. But neither crimination nor recrimination will bring the dead to life or prevent a recurrence of similar calamities in the future. There must be instead a stern resolve on the part of public authorities and railroad managers that accidents must not happen, so far as human foresight can prevent them. The feverish mania for increased dividends as manifested in unsafe speed to beat the other fellow, in inadequate personnel and material and in many other ways, must be curbed. Rigid investigation should determine the responsibility for accidents, and where it is proved that neglect or carelessness of individuals is to blame, punishment should always be swift and certain, sparing neither the highest or the lowest.

These observations have no particular novelty, of course. But novel remedies are not to be looked for as the most efficient preventives of railroad accidents. Rather must we rely on deep-grained principles of the moral law; railroading must be a matter of conscience as well as of money. And the recent accident at Salisbury seems to show, by the dangerous and excessive speed adopted for purely commercial reasons, that this old-fashioned lesson has yet to be studied in England as well as America.

THE SMALL CENTRAL STATION.

Practical Hints on Its Construction and Operation.

[This series of articles is based on the popular book of Mr. W. J. Buckley, entitled "Electric Lighting Plants: Their Cost and Operation." But the material constituting the book has been completely revised and modernized with the assistance of several writers of experience, while much new matter has been added. It is to be noted that only plants using overhead construction are considered in the present work.]

CHAPTER I.

General Observations.

The prices of labor and material vary so from day to day and from one locality to another that no hard-and-fast rule can be made which may govern one contemplating entering the field of electric lighting. In estimating the cost of a plant good expert judgment should be employed, and coupled with it there should be a knowledge of all conditions peculiar to the locality in which the plant is to be installed and the service it is to meet. These conditions may be familiar to the man who knows little of engineering, but unless he possess in addition a practical knowledge of that art he can do no better than to employ at the very outset the services of a man capable along these lines. Any expense thus incurred will be more than repaid in the saving through timely consideration of matters which would not appear to the ordinary business man, but for which the engineer's experience and training have prepared him.

Where prices are given on the cost of the various items which enter into the construction and equipment of a lighting station of modest capacity, such as this work purports only to treat of, they must be accepted more as a matter of illustration than otherwise and never taken as absolute. They stand as a fair average of cost over the United States and Canada and cover a range of years which includes both good times and bad.

It is the question of proportionate returns upon the investment which must determine the prospective investor in his choice of field, and this can only be arrived at by a careful analysis of the local conditions to be met and worked out each in its own peculiar way. In general a properly managed electric-lighting station brings a good return on the investment. This is borne out by statistics. There are stations which show profits even where the management has been careless or stupid. Much depends upon this question of management—more perhaps than in any other business, for here are most unlimited chances for small leakages, which, undetected and unchecked, will soon consume all the profits and leave an undesirable balance on the deficit side of the ledger. However, the best of managers may be badly handicapped by a station of faulty design or cheap construction, and too great emphasis cannot be placed upon the advisability of consulting an experienced man on all questions of a technical or practical nature and in giving his judgment a proper valuation.

No matter how small or how large the capacity of your plant is to be, it is best economy to prepare beforehand rather full plans and specifications for your own later knowledge, as well as for submission to contractors and builders. When such plans are furnished the bidder knows just what is expected of him, and it is possible for him to name his price with a smaller margin of profit than he could employ were he asked to bid on something which was largely a matter of speculation and assumption. Furthermore, all bidders will be proposing to furnish the same thing, or as nearly so as their various productions will permit, while, if no such details are given, a wider range is gone over, with the result that none perhaps offers what is wanted, and no estimate can be made of the comparative values offered. Only too often does this happen, and then, unless the buyer makes the frequent mistake of accepting the lowest bid, he has to reject them all, make his specification anew and call again for prices, with the result that much time has been lost and that each bidder adds to his second proposal a liberal charge for the work of getting out the first. If the plant had been properly designed at first and bids asked for on the design, the cost of the designer's services would have been more than equaled by the saving in doing away with the contractor's charge for this same kind of service and with his margin for uncertainties.

The object of the present series of articles is to give the purchaser some slight knowledge of the problems which must be encountered and solved in the erection and operation of an electric-lighting plant, and to enable him to follow with a fair degree of intelligence the plans and specifications of his engineer. Or, in some cases, it may serve to guide him, by supplementing his own knowledge, to be his own engineer, requiring another's services only in the capacity of consultation on those many questions which arise and in the consideration of which two heads are found to be better than one.

CHAPTER II.

Building and Foundations.

Location.—Having chosen his locality, the exact location becomes a question of prime importance, and due consideration must be given to all questions and conditions which may arise. Chief among these are nearness to the source of power, the opportunity for future expansion and the proximity of the field to be lighted. In the case of municipal or even commercial lighting, where the plant is to supply more than a single district, the question of city ordinances must also be investigated and due regard be had for their observance.

If waterpower is to be employed, the question of location is usually determined by the necessity for selecting a site which is available, but unless there is some peculiar reason why waterpower should be employed the prospective purchaser will do well to investigate thoroughly the relative costs of power developed in other ways, always bearing in mind the questions of depreciation and of expansion.

In choosing a location with steam as a basis of power, it is essential that there be as little handling of the coal and ash as is absolutely necessary. It often proves to be a paying investment so to locate the plant that a spur of railroad may be run directly over the coal bunkers and the coal dumped into them from the cars, whence there should be but a single handling to place the fuel under the boilers. This is a feature of installation which becomes more prominent in larger plants, but it is well worth consideration in the design of a plant of any size.

With the more modern methods of distribution of electric power at high voltage the question of nearness to the market is not so vital a one as it was 10 or 12 years ago. There is, of course, always a certain cost of maintenance of electric circuits, but the chief items to consider in this connection are the first cost of installation and the bearing of the city ordinances.

The Building.—The building should always be considered merely as the housing for the boilers, engines and generators, and as such is of secondary importance, except that it must be so designed and built to furnish the greatest protection to these vital features of the plant. Care should be taken to make it fireproof, or as nearly fireproof as possible, and in addition there should be provided ample and convenient means for fighting fire. Such a building will begin to pay for its slight additional cost immediately in the lessening of insurance rates, both upon itself and upon the machinery it shelters. Loss by fire in an electric-lighting station is peculiarly hard of adjustment because of the injury done to the machinery by heat, dirt and moisture, which is not apparent at first but develops later upon putting the apparatus into daily service again. Other losses, equally as great and equally as hard to estimate, come through stoppage of revenue and loss of customers. Thus it is imperative that this matter of proofing against fire should be most thoroughly gone into.

The usual construction consists of brick walls with a steel trussed roof—supported independent of the walls is best—of fireproof construction. In the roof a dome or cupola is usually built, to or from which all lines entering or leaving the building are taken. In lieu of this a wall box of ample capacity should be furnished near the roof for caring for these wires. Where possible the engine and machine foundations should be built to a level eight to 12 feet above the ground and the floor of the room carried at this height. This provides an ample basement for carrying all steam and exhaust pipes and also takes care of the condenser, should one be used, which should always be placed below the engine, as the piping from engine to condenser must always drain away from the engine and must contain no rises to pocket water. This basement permits of leaving the pipes all thoroughly accessible, much more so than a trench would do, and also does away with the necessity for a pit for the engine flywheel, should the slow-speed type of engine be adopted.

Plenty of ventilation should be provided. Windows cost no more per square foot than does solid wall and should be used liberally in the building design. It must be borne in mind that some or all of the machinery may have to be brought into the house after it is completed, and a door of sufficient size should be provided to care for the largest piece of machinery to be used. And, again, it must be remembered that the building is to accommodate the machinery and not the machinery chosen to suit the building. So it is well to leave the final selection of building plans until after the contracts for machinery have been let, for it not infrequently happens that machinery figured upon is not available, and the installation of a substitute might change the whole arrangement so as to make an alteration in the building desirable.

Placing of Machinery.—When the local conditions do not forbid, the best arrangement of boilers and engines is to place them in the same building with a wall between them, keeping the whole bank of boilers as near the complete line of engines as possible and leaving room for further extension at one or both ends, so that additional installations may be made without carrying the steam over a longer distance than is absolutely necessary.

The boiler foundations should be at the ground level or below it to facilitate the handling of coal and to avoid pumping water to too great a height. There must be room enough in front of the boilers to permit of drawing out the flues, and the back must be accessible to a man with a barrow for the removal of ashes. The boiler-room floor is best made of cement and laid so as to drain readily to sewer connections, which should be provided for each boiler, pump and heater. The basement floor beneath the machine room should be built in a similar manner and ample provision made for draining off drips and small leakages.

All engines and generators should be upon separate foundations, save in the direct-connected type of machine, where each unit, consisting of engine and generator together, must have its separate foundation. And they must be so placed as to make each easily accessible, for there come times when it is necessary to stop a machine with the least possible delay. Plenty of room must be left for the handling of pistons and rods of the steam and water cylinders should it become necessary at any time to remove them, and all machines and engines should be so spaced as to leave ample room for a man to get at the foundation bolts.

Here, again, in the machine room the more modern practice provides a cement floor, which present-day methods have made possible to be built as strong as any floor without excessive weight and cost and with the additional recommendation that it is absolutely fireproof. This floor should have its level a few inches below the machine foundations so that it can be flushed with water without danger of doing damage to the machinery. It should drain readily to sewer connections and so dry readily.

If the station is of considerable size, a traveling crane having access to the whole engine-room floor will be found a paying investment, as it will at the very start effect a great saving in installing the machinery. Where such a crane would be a luxury, the station must be provided with lifting jacks, blocks and chain tackle that should always be available in case of a breakdown. A fixed support for the tackle is desirable, but where it cannot be provided an adjustable tripod of sufficient size and strength must be kept on hand for use in case of emergency.

Foundations.—It is not alone sufficient that the building, boiler, engine and machine foundations be well built. The nature of the soil upon which they are built must be carefully investigated and every precaution taken to insure that there shall be no settling after the machines have once been placed. The New York Building Code includes a list of various soils, giving the bearing capacity of each. This has been accepted as standard practice and can be used as such. To quote from it: "Different soils, excluding mud, at the bottom of

the footings shall be deemed to sustain safely the following loads to the superficial foot, namely: Soft clay, one ton per square foot; ordinary clay and sand together, in layers, wet and springy, two tons per square foot; loam, clay or fine sand, firm and dry, three tons per square foot; very firm, coarse sand, stiff gravel or hard clay, four tons per square foot."

Loose rock should be removed and solid rock should be dressed off in horizontal steps, so that all pressure exerted upon it shall be carried without tendency to slide. Solid rock will stand any load the foundation may impose upon it. In soil of low bearing value, piles of spruce or hemlock are usually employed to stiffen it up, and the foundation started with a bed of cement over and about the heads of the piles, which should be cut off to a uniform height at about the level of the ground water, which would tend to cause the piles to decay.

[*To be continued.*]

QUESTIONS AND ANSWERS.

Use of Telephone Without a Battery.

C. A. P. of Wright's Station, Cal., asks if two receivers connected in multiple and having no source of current can be used for voice transmission.

ANSWER.

Yes. The receiver, when spoken into forcibly, acts as a generator of electricity. Changes in its magnetic field are produced by the vibrations of the diaphragm corresponding to voice vibrations. The small coils of wire wound around the soft-iron pole pieces of the received magnet have induced in them a current varying with these changes. Such a current will not be strong enough to actuate a receiver over a distance of more than a few feet, and the arrangement is therefore not a practical one.

Note that the above combination consists of two receivers in multiple. Where a receiver and transmitter are in multiple, the combination is inoperative without a battery; because the ordinary carbon transmitter cannot generate electricity, but only causes changes in some existing current.

Three-phase Generators in Parallel with Scott Transformers.

J. J. O'D. of Aylmer, Quebec, asks if generators developing three-phase current would run satisfactorily in parallel with three-phase current of the same voltage taken from two to three-phase Scott transformers over a five-mile transmission line.

ANSWER.

This arrangement is feasible if certain governing conditions are fulfilled. The transmission-line voltage must be constant, and the engines or other sources of power running the generators must be designed to divide the load properly with each other and with the line.

The two-phase system must not be overloaded or liable to fluctuations of voltage of greater than very small percentage, because at best the two to three-phase transformation is not as steady a source of supply as a directly generated three-phase current. For this reason the capacity of the Scott transformers should be considerably larger than the demand expected from them to prevent unbalancing and consequent trouble with the generators.

It is true also that the load at the point of consumption cannot be liable to changes greater than three or four per cent. on account of the impedence drop in the five miles of transmission line. This drop in voltage at a sudden change in the load would either throw the alternators out of phase or cause heating and inefficiency, due to interchange of current between the transmission line and the generators.

The engines which run the generators must have sloping speed-load characteristic curves, i. e., they should drop in speed at a constant rate as the load is increased. This will make the regulation better and make less liability of the two sources of power getting out of synchronism.

The frequency of the existing system was not stated, but 25 cycles or lower would of course be more adaptable than higher frequencies, since there is less change in phase for a given amount of change in angular velocity for lower frequencies and the governing of the engines would not need to be so close.

The practicability of using this arrangement, as above stated, depends upon the condition of the two to three-phase system and the demands to be made upon the combined system.

National-Interstate Telephone Association.

The second annual convention of the National-Interstate Telephone Association in the Auditorium Hotel, Chicago, was closed as scheduled on June 28th. Proceedings of the first two days were printed in the Western Electrician last week. On Thursday, the last day, some important action was taken. The name of the association was changed to the International Independent Telephone Association of America, and the constitution was amended so as to enlarge the scope of the organization. At the close, Mr. J. B. Hoge of Cleveland was unanimously re-elected president. The convention proved to be a valuable meeting and as a result the growing Independent movement received an impetus which will carry it to new fields. Action was taken to determine the prospects of gaining entrance to Chicago and several other cities. Thursday's session was opened at 10 a. m. by President Hoge. The committee on standard operating rules and regulations, on account of the importance of some of the matters under consideration, was unable to complete its report. The committe was continued, and when completed the report will be printed in pamphlet form and furnished to the papers.

Charles S. Norton of Indianapolis read a paper on "Official Organs—National and State." He recommended that the association establish and maintain an official organ. The matter was referred to the executive committee.

A very interesting paper entitled "Southern Toll Line and Exchange Development" was read by L. G. Parker of Louisville, Ky. He said that the great resources of the South were not yet generally known and appreciated in other parts of the country. While Independent telephone systems have a good start in many cities and localities, the South still offers an exceptionally promising field for investment in Independent telephone development. At the present time out of 75 cities having over 7,000 inhabitants, 37 are equipped with modern Independent exchanges and are in successful earning condition. Among the cities equipped are Louisville, Lexington, Paducah, Owensboro and Frankfort in Kentucky; Memphis, Knoxville, Clarksville and Jackson in Tennessee; Savannah, Columbus and Atlanta in Georgia; Birmingham, Bessemer and Mobile in Alabama; Meridian in Mississippi; Shreveport in Louisiana; Tampa in Florida; Wheeling, Huntington, Parkersburg and Charleston in West Virginia; Norfolk, Newport News and Roanoke in Virginia, and Raleigh and Concord in North Carolina.

The Central Home Telephone Company of Louisville, said Mr. Parker, has in active operation throughout Kentucky and Southern Indiana about 700 miles of pole line connected with the New Long-distance company of Indiana. It is building in that state about 550 miles more. Its affiliated company, the Long-distance Telephone and Telegraph Company of Alabama, has in operation and is building 800 miles more, or a total of 2,050 pole-line miles, representing an expenditure of about $2,000,000, all financed and going. The company's lines will connect with the long-distance companies in Ohio, Indiana and Missouri. It will have a trunk line running straight from Louisville to Mobile, Ala., one circuit of which is made of No. 6 copper wire. It will have lines to Memphis, to Atlanta, to Florida and to such other points as seem desirable.

The committee on amendments to the constitution reported that the present constitution was inadequate. It recommended a large number of changes, all of which were adopted. The name of the association, as previously stated, will be the International Independent Telephone Association of America. Provision was made to admit the Canadian association to membership. In the future the advisory board of the International association will consist of the president of each state, territorial or provincial association, and the executive committee is to consist of four members, selected from the advisory board by the president.

Membership in the International association is no longer to be made up of individual operating companies, but is to be held by the state, territorial and provincial associations, represented at the conventions by delegates. Provision, however, is made for an associate membership, in which is included the manufacturers and dealers who asked admittance to the association. Associates can be heard at the meetings, but will have no vote, the control remaining with operating companies.

Section 2, on membership, reads as follows: "Manufacturers of Independent telephone apparatus, manufacturers of cable and other telephone equipment or material, dealers in poles, telephone supplies and material, publishers of Independent telephone magazines and journals, telephone construction companies and firms, may become associate members of this association by paying annual dues of $25 each, after formal action as provided by section 1 of this article. Additional annual assessments may be made by the executive committee, with the consent and approval of such associate members. Associate members shall not be eligible to hold office in this association, nor have votes therein."

The committee on standardization of equipment reported interesting recommendations. Samuel G. McMeen of Chicago was chairman of the committee, but in his absence Mr. Edward F. Clement of Washington, D. C., reported as follows:

"We indorse the resolution presented at the convention of 1905 by the preceding committee on standardization," recommending that a permanent equipment committee should exist and that a national association bureau of standards and engineering should be maintained.

"In our opinion the official selection of one unvarying type of telephone equipment as a standard for all companies in the association is not feasible at present, and if it were effected it would probably discourage improvement and impede progress; but we believe that there can and should now be standards officially determined to which various kinds of material and equipment can be referred.

"In connection with the fixing of standards, it is highly desirable that many details affecting maintenance costs should be determined upon, specified and recommended for adoption by all operators and manufacturers as soon as possible. Examples of such details which have been fixed in other lines of business are: Standard incandescent-lamp base, standard threads on iron pipe, the standard system of machine screws and standard fittings for railroad practice.

"A unit of carrying value for telephone circuits should be determined as soon as possible, and the knowledge of it properly disseminated throughout the association. The adoption and use of this standard unit will enable subscribers' lines, trunk circuits and long-distance lines to be designed and treated in a uniform and a definite way, and will render possible mutual understanding and co-operation in transactions involving such lines and line values, which has hitherto been impossible.

"We recommend that the association carry the foregoing suggestions into effect, and to that end that a permanent committee be authorized, to be known as the 'committee on physical standards;' that this committee be appointed immediately after the present convention to take the place of the present committee on standardization of equipment, with power to carry on the required work under the direction of the proper officers of the association. All physical determinations made by or under the direction of this committee should be recorded in the form of specifications, to be kept on file as a part of the permanent records of this association, and standard materials as they are determined should immediately be given code names and numbers for the convenience of maker, seller, purchaser and user.

"In addition to the foregoing, we further recommend that the officers of the association be authorized and empowered to receive and act upon the recommendations of the committee on physical standards, and to make the necessary business arrangements for carrying on the work of said committee, including provision for meeting expenses of the work, which, if possible, should be done without making it a charge upon the revenues of the association."

In connection with the report, Mr. Clement said there was a great deal of work to be done in the way of standardization, and the committee believed it would take a long time to do it. He said: "There are a great number of details, which, if properly standardized and properly codified, would save small maintenance costs, and it is in those little things that most of the waste occurs. There are a lot of other things that that committee ought to take up and carry on, particularly accumulating records for the members of the association, and I personally feel that a bureau carried on in that way could probably be supported and would certainly be of a great deal of value along the lines followed by such bodies as the National and other underwriters' associations, where they are in a position to render special reports to their members. Probably the expense of that, according to the plans we sketched out, could be defrayed by fees or something of that sort; but that can safely be left to the officers."

Mr. Clement also read a few remarks on the subject from Mr. McMeen, in part as follows: "Such an association as this is, and ought more and more to be, a means to enable knowledge of the best ways of doing things relative to our business to be distributed throughout the membership, for, after all, the chief end of all matters of construction, equipment, organization, rules and specifications in the business is to furnish a good commercial telephone service. It is ways of doing things to that end which are important, rather than one or another physical element."

"I do not know how far the association will find itself able to act in this direction, but I am so sure that there is much good to be done that I would urge the establishment of a permanent committee to succeed the retiring one, and that its work be assisted by all in every possible way."

The report was accepted and after some discussion was referred to the executive committee for consideration.

Charles F. Bender of Pittsburg reported for the committee on standard forms of accounting. An exhaustive report had been prepared, but was not read at the meeting, it being thought best to have

it printed and distributed among the members. The form proposed is divided into six accounts—standard forms, classification of income, classification of construction, general accounts, operating accounts and maintenance accounts. Mr. Bender said: "It cannot be expected by the members of this convention that a standard system of accounting can be formulated with the expectation that all companies will at once change their present method without a thorough investigation of the advantages of a new system. The general adoption of any uniform system of records will of necessity be effected only in time. We recommend that a permanent committee of at least five members be appointed to receive and consider suggestions from any or all of the Independent telephone companies, so that said committee can make such changes or enlarge the system as may be deemed necessary from time to time, and also to act as an advisory board. We also recommend the publication in pamphlet form by the association of this report in such manner as will enable the larger and smaller companies to appropriate such particular features as are expedient to their needs."

Upon the motion of George N. Bandy of Iowa a committee was appointed to investigate and report on the best method of getting rid of what is known as "free business." It was generally agreed that the free business which all companies are compelled to do should in some way be added to the revenue-producing business.

The papers of W. B. Woodbury of Detroit, W. P. Hemphill of Topeka, Theodore Gary of Missouri and J. B. Earle of Waco, Texas, were not read, but were ordered published. On account of lack of time, only a few of the questions in the Question Box were considered. In response to a question as to how technical schools should train the young man for the field, Mr. Albert B. Smith, instructor in telephone engineering at Purdue University, offered a few suggestions. It was decided that the association should co-operate with the technical schools in an effort to induce young men to enter the operating field after leaving school rather than the factory. Mr. Smith had followed this plan and thought it the better.

The committee appointed to make awards to the telephone companies which exhibited photographs of exchanges, reported that an excellent exhibit consisting of 50 different views of buildings, both interior and exterior, had been considered and the awards made as follows: Keystone Telephone Company, Philadelphia, first; Lincoln Telephone Company, Lincoln, Neb., second; Sioux City Telephone Company, Sioux City, Iowa, third; Louisville Home Telephone Company, Louisville, Ky., honorable mention.

A resolution was adopted urging the mayor and council of Evansville, Ind., to grant to an Independent company a franchise in Evansville. Action was also taken instructing the executive committee to investigate the Chicago situation and make known its conclusions within 60 days.

The following officers were elected upon the recommendation of the nominating committee:

President—James B. Hoge of Cleveland.

First vice-president—Theodore Gary of Macon, Mo.

Second vice-president—Charles E. Sumner of Portland, Ore.

Secretary—Charles C. Deering of Boone, Iowa.

Treasurer—J. G. Splane of Pittsburg.

The work of J. A. Harney of Cleveland, assistant secretary, was highly commended by the association, and the executive committee recommended his continuance in office at an increased salary. In an eloquent address Mr. Cyrus Huling of Columbus, Ohio, expressed the association's appreciation of the efficient work of President Hoge in directing the affairs of the association. Next year's meeting will be held some time between June 1st and July 30th, and will probably be held in St. Louis.

Notes of Exhibitors and Visitors.

C. L. Hibbard, who has just branched out as a manufacturers' agent, put in an appearance.

G. Halleck Johnston represented the interests of the Western Telephone Manufacturing Company, Chicago.

Mr. Blaisdell of the Maine Hub Manufacturing Company, West Seboois, Maine, "blew in" for a moment on Thursday.

C. A. Rolfe of Rochester attended the convention. Mr. Rolfe is at work now on some novelties in the line of protectors.

The exhibit of Frank B. Cook, Chicago, attracted much attention. Mr. Cook was assisted by a corps of energetic representatives.

President Frank G. Jones and Manager Kenny of the American Electric Fuse Company of Muskegon, Mich., were on hand as usual.

The American Conduit Company of Chicago and Los Angeles was represented by H. Lafferty, superintendent of construction, and F. C. Smith.

The Swedish-American Telephone Company came nobly to the front in Room 612. In addition to President E. B. Overshiner and A. V. Overshiner were Messrs. Macklin, Russell, Seeley, Rhods and Ferguson. A full line of the well-known Swedish-American apparatus was presented.

H. M. Powers of New York city was one of the gentlemen looking after the interests of the Gould Storage Battery Company of New York.

Messrs. Poole, Parker and Hall exhibited central-energy lockout devices and other specialties for the Mountain State Electric Company of Wheeling, W. Va.

F. A. Lundquist of the Globe Automatic Telephone Company exhibited an ingenious automatic telephone system that excited much comment at the convention.

J. M. Lenz, treasurer of the Runzel-Lenz Electric Manufacturing Company, Chicago, renewed acquaintances with many of his friends and customers and made many new friends.

A. D. Gillespie, representative of the Monarch Electric Wire Company of Indiana, is now making his headquarters at South Bend, and he found time to attend the convention.

The Sandwich Pole Changer Company, Sandwich, Ill., whose device is so well known to Independent telephone men, was represented by E. C. Hennis, A. C. Kirkpatrick and H. O. Rugh.

Godfrey H. Atkin, manager of the Chicago office of the Electric Storage Battery Company, was of course on hand. Mr. Atkin's yacht in the harbor was at the disposal of the friends of his company.

H. C. Dodge, who might be characterized as one of the pioneers in electric flashlights, represented the American Electric Sign Company and exhibited flashlight signs especially adapted to telephone use.

The Electric Appliance Company was capably represented by S. A. Dinsmore and R. S. Mitten, Elmer Brown, H. N. Remington. A full line of telephone supplies and novelties were explained in detail.

H. E. Adams and W. G. Nagel and R. G. Kendrick were on hand for the W. G. Nagel Electric Company of Toledo. These gentlemen represented Hercules guy anchors and a fine line of their construction materials.

Of course, President James S. Cuming of the Central Telephone and Electric Company of St. Louis was on hand with a handsome exhibit. Mr. Cuming was attended by Messrs. Wallace, Poertner, Becker and LeBourveau.

J. R. Wiley, Chicago manager, and E. J. Pietzcker, St. Louis, of the Standard Underground Cable Company did the honors for their company. Messrs. Davis, Anderson, O'Neill and Rogers also looked after the interests of the Standard company.

President I. J. Kusel of the American Car and Equipment Company was energetic in rendering assistance to J. L. Haas, who was presenting a full line of Black Hawk batteries for the Central Electric and Manufacturing Company, Rock Island.

Manager E. F. Kirkpatrick of the McRoy Clay Works of Brazil, Ind., and Chicago, made an exhibit of all styles of vitrified-clay conduit. Mr. Kirkpatrick was on hand day and night. It was no wonder that "Kirk" had to shake with the left hand.

E. S. Hamilton of Adrian, Mich., exhibited one of the novelties at the convention. His malleable iron cross-arm created a bit of a sensation among construction men. Everyone wondered why it had not been done before, and many were the favorable comments.

General Manager T. P. Bradley of the Duluth Log Company, Duluth, Minn., producer of cedar poles, was one of the first on the ground. This company is prepared to fill orders for cedar poles promptly, being fortunate enough to have a large stock on hand.

Advertising Manager F. R. Bryant of the Central Electric Company was on hand during the convention. The Central Electric Company made no exhibit, but a number of the company's representatives were present, and, with Mr. Bryant, did the honors in handsome style.

One of the prominent exchange managers was T. S. Lane of the Montana Independent Telephone Company of Butte, Mont. Mr. Lane is an old Chicago man, has his residence in New York, but has been much in Butte for several months engaged in business for his company.

Managing Director Homer E. Niesz called attention to the Chicago Electrical Show of 1907. Mr. Niesz was in daily attendance and considerable space was disposed of. The records of space sold up to date make it an assured fact that it will shortly be a question as to what to do with the late comers.

A. F. Knierinn was on hand to look after the interests of the F. Bissell Company, Toledo. The Bissell company exhibited a fine line of can-top terminals and Security specialties. It is making a great drive on telephone-construction specialties, in addition to its electric-light supplies. With unexcelled shipping facilities, the Bissell company commands trade from those who require extraordinary promptness in shipment as well as excellence of quality.

George Conover, who has achieved such an enviable reputation as the "old reliable" purchasing agent, is back again at 135 Adams Street, where he will continue his purchasing and forwarding work for telephone companies. His offices are now on the eighth floor of the Merchants' Loan and Trust Building, Chicago.

The Steel Gain Manufacturing Company, Chicago, exhibited its "Bull-dog" steel gain. This device is said to be meeting with favor among the electric-light, telephone and telegraph companies. Kempster B. Miller, president; E. E. Yaxley, treasurer, and W. H. Trimm, secretary, looked after the interests of the company.

Mr. Smith, secretary and treasurer of the Chicago Insulated Wire Company, found time to drop in the rotunda on Thursday. The Chicago Insulated Wire Company has a host of friends in the electrical business, and many of these are due to the liberal policy of Messrs. Turlay and Smith. The company's factory at Sycamore is now running full blast.

A feature of the exhibit made by the North Electric Company of Cleveland was a 50-line automatic self-restoring drop switchboard with visual-signal targets. The company, however, presented a comprehensive exhibit of North apparatus. Headed by President C. H. North, the company was represented by Messrs. Boyd and Pratt.

Mr. Skeel, western manager of the Crouse-Hinds Company, managed to find time to be at the convention Wednesday. Mr. Skeel has made a host of friends throughout the West, and he found it difficult to "break away." The Crouse-Hinds Company's business in the West has increased to a remarkable extent, all of which is due to Mr. Skeel's energetic and successful efforts.

The White Class Advertising Company did the honors at the telephone convention through Fred L. Martin. Mr. Martin's excellent work in advertising the products of the Stromberg-Carlson company is well known to telephone people. Mr. Martin has made his mark as an advertiser of intricate telephone apparatus, and his skill in this direction should be valuable in his present connection.

President P. C. Burns and General Manager J. G. Imhsen, assisted by Messrs. Zabel, Henderson, Hauptman, Blackledge and H. B. Hewitt, made a fine "front" for the American Electric Telephone Company. In addition to entertaining delegates with automobile rides, etc., the company exhibited eight-party selective ringing apparatus, the Burns adjustable telephone and the company's new round magnet generators.

The National Carbon Company of Cleveland, Ohio, of course came to the front with its usual army of handsome and indefatigable representatives. In addition to N. C. Cotabish and C. W. Wilkins, the latter now known throughout the West as that "Chesterfieldian Manipulator of Carbonaceous Products," were Messrs. A. V. Wood, A. V. Ward, W. O'Conner, E. J. Jenny and M. H. Moffet. The exhibit consisted largely of a full line of Columbia dry cells.

W. N. Matthews of W. N. Matthews & Bro., was on hand daily during the convention. Mr. Matthews was booming Stombaugh anchors, and reports business in his other specialties as most excellent. The Kearney cable clamp is receiving a good deal of Mr. Matthews' attention, and this specialty has been received with marked favor by construction men handling large cables. W. N. Matthews & Bro. seem to have the faculty of selecting and exploiting specialties that "fill a long-felt want."

The International Telephone Manufacturing Company's exhibit of the whistling receiver, hung overhead in the rotunda of the Auditorium, was a striking demonstration of the durability and power of the International transmitter under heavy battery tests. It was remarkable that not only was there no loss in transmission, but the sound that issued from the receiver in the rotunda was unquestionably greater than that projected into the transmitter upstairs. Henry Shafer, president of the company, and one of the best-known men in the business, was in attendance.

The Automatic Electric Company of Chicago exhibited a new type of automatic switchboard, such as will be used in San Francisco and Oakland, Cal., where the automatic system has been adopted by the Home Telephone Company. The new system is known as the "unit-type system" and marks a new departure in automatic telephony. It occupies about one-fifth the space of the previous type board made by the Automatic Electric Company, and will mean an enormous saving in outside construction. It is designed to be used in sub-station work. It has all the new features of the Automatic, including common battery. The Automatic company also exhibited a line of small magneto manual apparatus—such as is used for toll boards.

etc., in connection with its automatic system. Those representing the Automatic Electric Company at the convention were H. M. Woodworth, J. F. Crook, C. L. Fisher, E. K. Seymour, R. B. Tyler, E. A. Mollinger, E. E. Meyer, P. H. Davenport and C. G. Waggoner.

President Joseph Belden of the Belden Manufacturing Company was on hand daily. The Belden company is at the present time in a very prosperous condition. President Belden's policy of accommodation in small matters as well as large has borne good fruit.

No more indefatigable and skillful pair of advertisers appeared at the convention than Thomas G. Grier and Mr. Robbins of the Nungesser Electric Battery Company, Cleveland. These gentlemen presented a full line of Nungesser "1900" batteries. Friends of the company, too, were presented with an exceedingly handsome souvenir fob, which was initialed to suit the recipient. Messrs. Robbins and Grier likewise introduced a novelty in the line of a huge model of the "1900" battery with high-tension sparks playing between the terminals, and a talking machine "that told its own story" in a most interesting manner.

The Stromberg-Carlson Telephone Manufacturing Company of Rochester, N. Y., and Chicago, was represented by its usual large delegation, this time headed by T. R. Finucane. Accompanying Mr. Finucane were Messrs. Cracraft, Durant, Sigberg, Bowen, Sr., Bowen, Jr., Myers, Shafer, Eubanks, Lifford, Speed, Gould, Hyde, Lewis, Schafer, Mockenhaupt, Shafer, Wilms, Halbrick, Maver, Wilkinson and Fister. There was exhibited a central-energy switchboard in operation; also a model intercommunicating plant and selective party-line telephone. In addition to this, too, there was a fine line of other telephone apparatus, including mine and street-car telephones.

President Wallace L. DeWolf of the Kellogg Switchboard and Supply Company was on hand Wednesday afternoon, in company with quite a number of the Kellogg staff. Mr. DeWolf stated that competition was keen—this with a smile. But it is reported that the Kellogg company is doing a most prosperous business. The company did not make an exhibit at the convention, but prepared a special exhibit at the factory and had a number of automobiles to convey the convention delegates to and from the factory. F. J. Dommerque, secretary; H. M. Post, advertising manager; R. S. Mueller, manager Cleveland office, and Mr. Thompson, manager of the Philadelphia office, with others, represented the company.

President Ernest L. Clark of the Valentine-Clark Company, assisted by Frank L. McGillan and I. B. Eberhardt, entertained a large number of prominent telephone people with automobile parties. Mr. Clark was voted a "prince of entertainers." Incidentally it may be stated that the high-speed automobile which Mr. Clark had in service during the convention was one built by his own hands. City Electrician Ellicott and Mr. Clark are warm personal friends, and the automobile in question is the result of their last winter's work. Mr. Clark was congratulated, too, on his recent acquisition of the control of the entire Valentine-Clark business. The company has been one of the leaders in the pole business, and its success has been due largely to the broad-gauged, aggressive policy of President Clark.

The Rock Island Battery Company of Cincinnati made an interesting exhibit, successfully handled by Louis Loeb and Louis May. It was a matter of great regret that M. A. Loeb of this company was prevented from attending by a sudden illness. Mr. Loeb is at present confined to the hospital, but expected within a few weeks to be again at his business. Not only was the exhibit at the Auditorium a most excellent one from an advertising viewpoint, but it is reported that several large orders found their way through this channel to the factory. M. A. Loeb, secretary of the company, has been most aggressive in pushing the Rock Island battery. As an evidence of this stands the present large factory in Cincinnati, whence the company moved from a former factory in Rock Island, Ill.

Waterpower Development in Harz Mountains.

Consul Albert of Brunswick, Germany, writes that the Association for the Utilization of Water Power in the Harz Mountains has been organized and is about to begin work. Large dams will be built across valleys and the overflow water will not only be used for purposes of irrigation, but also for mechanical purposes, for mills, etc., and in generating electric power to be used on railroads and for manufacturing. Persons who desire to furnish machinery for this undertaking can write for information to the Vorstand der Gesellschaft zur Förderung der Wasserwirtschaft im Harze, care of Doctor Stegemann, secretary of the Handelskammer, Brunswick, Germany. It will be advantageous to have all correspondence and advertising matter in German. Further information is on file at the Bureau of Manufactures, Washington, D. C., file No. 205.

The New-Business Department for Central Stations in Cities of Moderate Size.[1]

By M. S. Seelman, Jr.

If I was to be asked what the company, awaking from its lethargy and desirous of securing the possible business within its sphere of operation, should first do toward establishing an effective commercial organization, I would say: Hire a good man, if possible one familiar with the kind of work he will be called upon to do; a man under 40, if you can; better yet, under 35. If you can secure one with a combination of technical and commercial knowledge, not necessarily an engineer, but a man who has been trained around a central station, knows something about generating and distributing methods and has tackled lighting and power problems before, so much the better. He will have the less to learn and you the less to teach.

This man should have charge of the organizing and conducting of our new department. Let us consider him as having been installed and call him the general agent.

The first step our general agent shall take is to establish a first-class and highly attractive office and show room. This should be located on the main street or principal "square" of the town. This new office and show room must be made bright and attractive. The color scheme should be a creamy white that will reflect the light to the best advantage. The electrical exhibits ought to be as varied and complete as possible. A great many exhibits can be secured at little cost from manufacturers who will be glad to co-operate with the central station for the advantageous display of their wares.

The windows of this office must be utilized to illustrate different methods of show-window lighting. Arranged on separate switches can be shown exhibits of trough incandescent lighting (as by Frinck reflectors), incandescents in combination with cone or holophane reflectors and Nernst lamps with the special Nernst reflectors. The common method of window lighting by means of projecting incandescents running around the sides of the windows, or by chandeliers, may also be shown, but in this case care must be taken to explain to customers that wherever the object of the lighting is to display the goods, then one of the three first-mentioned systems of reflected light from hidden sources is the more desirable, while the visible lamps—projecting or in chandeliers—may only be used to draw attention to the goods as to attract the eye to the window itself, as with a saloon.

In the show window itself should be placed an exhibit of electric fans and heating appliances.

If there is room in the window, a sewing machine operated by a motor should be prominently featured and kept running, as a moving object attracts more attention than a still-life exhibit.

An exhibit of various types of lamps should be installed in the office. These should include arc lamps (one showing the concentric diffuser), one, two and three-glower Nernst lamps (there is a simple but highly artistic five single-glower Nernst lamp fixture which could well be made a part of this exhibit), meridian and high-efficiency lamps, Cooper-Hewitt tubes, turndown lamps—such as the Hylo—and attractive and efficient clusters, such as the arc burst and the pagoda reflecting arc. Holophane glassware could be shown as an annex to this exhibit.

In a prominent place over the desk which canvassers are to occupy our general agent should have a sign hung, reading:

"Don't Talk Volts and Amperes; Talk Dollars and Cents."

And this brings us to the subject of canvassers. The general agent will, of course, take steps at once toward securing the aides required in his campaign for new business, the principal questions that arise being how many does he need, in what manner shall he secure them, and how much ought he to pay them?

The solution of the first question must be governed to a considerable extent by local conditions—the industrial, commercial and residential nature and status of the town. Roughly speaking, I should say that—other things being equal—a city with 50,000 population or less, which is alive and fairly prosperous, would require one canvasser to about every 12,500 population. This is an elastic rule, however, and must be freely interpreted.

To secure the men we want we must either again draft from the larger companies or advertise in technical publications. Very likely, our general agent knows one or two men of the type he wants who are working for other companies and whose services he can secure.

As to remuneration, whether straight salary or salary and commission is the best method of paying, that is a debatable question. I am a firm believer in the latter method as the one most effective for securing new business.

Now, then, let us suppose we have gathered our selling force together and have equipped our show room. We are still not quite ready for business. It is advantageous, I believe, to give the new men the run of the office for a day or two, so that they may become acquainted with the company's physical layout and its installation, metering and service methods. During this time our general agent can have divided the city into districts, one for each of his canvassers. A word about this work of districting:

There are many cities where the business district is largely concentrated in the center of the town. In places of this kind I believe it is an excellent plan—at least to start with—to district along lines starting at a common center in the business section and radiating outward. In this way you give each man a portion of business section, of residence locality and probably of power territory.

Now then, we are pretty nearly ready to canvass. Our general agent gives his men a selling talk, not only to inspire them with enthusiasm, but to give them the last word of information as to how to approach and handle various light and power propositions as they may present themselves, so that the men may be competent to advise prospective customers as to matters involved in their installation, such as wiring, selection of lamps and glassware, location of switches and outlets, painting and decoration of houses and stores to produce the best and most economical lighting effects, types of motors in general most suited for special classes of power work, ideas and methods of apportioning the units in a power installation, etc.

Now to canvass. Some might advise a preliminary canvass to secure names and addresses of prospects, but I believe in digging right in from the start, reaching out after business from the first day. The district agent begins work about 9 a. m., and is instructed to report back at 4:30 or 5 p. m. If this is not practicable on account of distances, then reports can be limited to the morning session, the district agent arriving at the office at eight instead of nine, but where practicable it is better to have the agent return late in the afternoon, so that he may report on his day's business then, giving time for the general agent to go over the reports and prepare his instructions to his men, for issue in the morning.

There are a number of systems of keeping track and record of canvassers' work. The card system is probably the best for a city of 50,000 or less. The district agent's daily report of his work he makes out in the form of a card for everyone visited, on which card is inscribed name, address, nature of business, date visited, attitude of the visitee, prospects of doing business with him, when to call again, etc. This is not a particularly arduous job for the canvasser, and he is not likely to call upon more than from 12 to 20 people a day.

The general agent must look these daily card reports over carefully before they are alphabetically filed away. He must especially note any difficulties or obstacles encountered by his men and he himself must bend his best sales efforts on these especially difficult propositions. If the canvasser reports a man as positively out of the prospective class, before the general agent accepts this classification he should either send someone else to see the recalcitrant or go himself. In this way the impossibles can be eliminated and the card catalogue list becomes a list of prospectives.

And this list of "prospects" soon assumes proportions and furnishes the very best possible list for the effective distribution of printed matter.

And this brings us to the important subject of advertising.

I am inclined to believe that newspaper advertising is likely to be more advantageous and profitable in a small city than it is in a big one. There should be more or less of it done in every city, not only because it promotes a desirable feeling of good-will between the newspapers and the corporation, but because it certainly has a very real educative value. In the average big city, however, the character of the population is such that out of a circulation of, say, 100,000 that some newspaper may have, only one or two thousand may be possible customers. In advertising, the company must pay to reach the 98,000 unprofitable ones along with the 2,000 prospects, and it is—as a general proposition—uneconomical to pay for all this surplus publicity. In the average small city conditions are different. Circulations are not so large nor mediums so numerous, advertising charges are not so heavy and a larger proportion of readers are likely to be prospects. So that, for advertising in the city of 50,000 or less, I would utilize the newspapers to a considerable extent. Take a whole page or a half page once in a while on some special occasion, such, for instance, as a reduction in rate or the inauguration of some new policy or special proposition, or a marked addition to station capacity. At other times use an advertisement each week in weekly papers and about three times a week in dailies, not all the year round, but for certain months in the year, pausing now and again to take breath and gather renewed energy for a new campaign. The size of these ads should not be fixed hard and fast, but should

1. Abstract of the paper which received the first prize of $500 awarded by the Co-operative Electrical Development Association, under the auspices of the National Electric Light Association, for the best paper on the "Organization and Conduct of a New-business Department Suitable for Central Stations in Cities of 50,000 Population and Under." Mr. Seelman is with the Edison Electric Illuminating Company of Brooklyn.

vary up from a minimum of five inches single column or four inches double, according to the particular message it is desired to convey.

I doubt if a central station in a city of 50,000 or less would support a first-class advertising man, and the other kind is of little use—liable to cost a good deal more than his salary. If your general agent can write a good ad—and a good ad does not need to be "smart" at all (it is merely the embodiment of a common-sense argument, or a special proposition in an attractive form)—so much the better.

Here is a point that should be borne in mind: Never send out a piece of advertising matter without enclosing a return post card. A fundamental law of politicial economy is that a man is a lazy animal and you want to make the path to your front door as easy and smooth as possible. Each different branch of the business should have its distinctive return post card, so if you send out a lighting circular you enclose a lighting post card; a sign circular, a sign post card, and the same with power, fans, heating and refrigeration, if you go that far. Don't make it a postal card—that is expensive—but an attractively printed post card with your address and place for a one-cent stamp on the one side and on the other a printed form referring to the matter in hand, and space for name and address of the sender. I have experimented as to the relative advertising value of the penny United States postal card and the plain post card for this return work, and find that, while the cost is as six to one, the latter is nearly as effective as the former. This return post-card method gives you a fair chance to estimate the interest your advertising is arousing and leads, if the advertising is right—other things being equal—to a continuous and often surprisingly large amount of new business.

And this brings us now to another very important feature of and factor in a new-business campaign, and that is the special propositions. And right here I want to say that if you want to get a big share of new business, you have got to be liberal, you have got to go half way to meet the customer, you have got to be willing to spend a dollar to make two.

A good many companies are ready to make extensions, even in cases where it takes quite some time to get back the original investment, not to mention a profit, yet they turn away haughtily from the proposition to supply a customer with some equipment which in a far shorter period pays for itself and gives a handsome return on the money invested.

There's a free-sign proposition, for instance; it has proven "good business" everywhere it has been tried, so far as I know. A panel signs costs you complete about $45. With overhead construction, customary in a city of 50,000 or less, to hang and connect the sign ought not to cost you more than $25. Here's an investment of $70. Take 200 per cent. of your investment—$140—divide it into 24 parts and offer your customers free signs on a two years' guarantee of $6 a month. You are sure to get back the cost of the sign and installation well within the two years, even if the customer's current bills do not run above the guarantee (which is unlikely).

The town in which this free-sign proposition will not "take," if it is properly advertised and pushed by the new-business organization, must be dead indeed.

Then there are the special lamp propositions. There are doubtless many stores in the city in which we are hustling for new business that are illuminated by gas arcs or Welsbachs, which we find it impossible to touch with the ordinary standard incandescent-lamp proposition. Here is where the Nernst lamp comes in, also the high efficiency and meridian lamps. Each has its place. The Nernst is an attractive proposition to a customer, especially a lamp about three-glower size. It is highly attractive, even decorative, in appearance, gives a beautiful pearly-white light and is in every way far superior to any gas lamp, being at the same time so efficient in wattage as to permit of free competition with gas. And from the station's standpoint, it is not nearly so expensive of maintenance as from some reports we might be led to believe.

A method of getting one class of new business which has worked well in at least one large city, but which might or might not be applicable to the city of 50,000 or less, can be utilized with the drug stores.

Here hours of burning are long, and the average drug store may not be able to afford the average rate for the average installation. Still you cannot cut rates for him and be consistent. Get up an attractive advertising bulletin stand of wood and iron, that will cost you about $15, with a frame in the top portion for a placard, and beneath this pockets for bulletins and other advertising matter. Then make an arrangement with the druggist, now using gas, that in consideration of his permitting you to keep your advertising stand in a prominent place in his store, you will pay him a sum which, subtracted from the bills at regular rates for lighting his store by electricity, will make such illumination economical for him. The placards, bulletins, circulars, etc., are changed once a month. It is good advertising for the central station, too, because, as a rule, the right kind of people deal in drug stores, and while awaiting the compounding of prescriptions have time to read your advertising, which is placed where they cannot help but see it.

One way to get at a gas-illuminated store is to offer to draw, gratis, plans for the electric illumination of the store which will provide a lighting far superior to gas.

Now as to residences and new buildings. In the average town of 50,000 there will be found about six architects, in the town of 25,000, three. One of the first acts our new general agent must do is to set himself to get acquainted with these architects, not alone in a business way, but, if possible, socially, so that a feeling of friendliness may spring up between them. Let him join their clubs, take them out to dinner, etc. After this "entente cordiale" has been established, our general agent is in a position to know from the start what is taking place in the line of erecting new structures, and he is less likely to be called upon to continually fight the installation of isolated plants. Get the architects on your side.

Then, of course, the building permits must be closely followed up. Let no guilty man escape. Every new building must be wired, and the way to do this is to see the builder the day his permit is issued (before if possible) and to follow him right up until the business is done. The same with permits for alterations. When the owner is about to make alterations in his home or store, that is the psychological moment to approach him about installing an electric illumination on the premises. These are new-business pointers that cannot be neglected.

A far stiffer proposition than the new residence is the unwired old one, and yet there are doubtless hundreds of these, even in a city of 50,000, which, if wired, would yield a fair and certain revenue. How to get them wired is the problem. Your advertising helps by bringing the householder to a realization of the many advantages and conveniences of an electric service. Then it is a good plan for your canvasser to call in the daytime, get the "lady of the house" on his side and then make an appointment for evening, after supper, when the householder is likely to be in the right frame of mind, and the canvasser can meet wife (already predisposed in his favor) and husband together. May and June are specially good months to canvass residences in, because families who are out of town in July and August can arrange to have the wiring done in their absence, saving them some inconvenience.

But there are householders who would like to have an electric illumination who do not feel that they can afford to pay out the cost of wiring in a lump sum. If these be reputable citizens, let the company help them out by financing the deal, the money to be repaid within a year in monthly installments.

In pushing electric heating and cooking devices some companies have acted in co-operation with the department stores. From personal experience I should say it is better for us to go it alone and let the department store do the same. Our standpoints and purposes are widely different. The store sells the appliances for the profit in the sale, and the profit must be a large one, for sales are necessarily limited in number. The central station's object is not to make a profit on the sale, but to get the appliance on the system where it will use current.

The method which has been most successful in placing irons is to send them out on trial, putting one in every home equipped for an electric service. In the city of 50,000 or less, I would advise either using one of your canvassers for this purpose throughout the city, or else making each canvasser take care of his own district in this respect. Load the irons in an auto, and when leaving each iron for a trial of from 30 days to three months, have the canvasser give a little selling talk and leave a neat circular calling attention to its many advantages. Also let him leave a postal card addressed to the company explaining that it is possible, though not probable, in first using the iron that some trifling trouble may be experienced, in which case tell the customer not to condemn the iron but to send the postal card, when the company's representative will call and straighten out the kinks. The iron is all right, and if followed up in this way is bound to prove a boon to the housewife and a source of revenue to the company.

Other heating and cooking devices are not so valuable to the central station as the iron, but they all have their place in popularizing current.

The use of electric fans can be increased by judicious advertising and canvassing, and if you are not afraid of complications with contractors and supply dealers, by selling them at a low figure—a price approximately cost. If you have considerable surplus supply, rent them out for the summer months.

I have purposely kept the subject of increasing the power business to the last, because it is at once—being primarily day load—of the utmost importance to the central station and at the same time, ordinarily, the most difficult to secure.

First of all, let me say that while it is possible to secure lighting business at a higher price than is paid for other illuminants, because of superiority and also because average installations are of such size that isolated generating plants are impracticable, to get any large slice of new power business your price has got to be right, for even if you can go into a factory and demonstrate how, by cutting out friction load, you can largely reduce the energy required to turn the wheels, if your rate for current is too high, there is nothing to prevent the mill owner from taking advantage of your tip, eliminating much belting and shafts, installing motors and putting in his own dynamo.

Power business is such good business that special effort to get it is well worth while. If within the limits of possibility, make your rate right to begin with.

It is more difficult to secure a good power canvasser than the other kind. If your general agent is enough of a technician and sufficiently familiar with power problems to handle this end of the business, that is a tremendous help. If not, and there is much power business in your town, then, in addition to your other canvassers, you will have to hire a power expert.

The way to get your power business is to get it. There must be energy, enterprise and indomitable tenacity on the part of your power man, backed up on the part of the company by a readiness to help and a willingness to be liberal. I know a general agent who is also a power man in a manufacturing city of 25,000 inhabitants, who has got a big load of new power business for his company by use of the qualities I have mentioned. He goes into a factory, indicates—at the company's expense—the engines in use, figures out the energy saving he can effect by the use of motors installed to the best advantage, finds out what its coal and water costs the factory, and has been enabled more than once to go in and win on a guarantee not to exceed for expense of operation these coal and water charges, getting eventually from four to six cents for the current. If the factory owners balk at the expense of motors, he offers to buy them and receive payment in installments. If installation is going to interfere with the needed operation of machinery, he agrees to install the motors at night, on Sundays and holidays. That man has got ginger, and he does the business. He is now running not so very far from that ideal condition where peak is nearly uniform for at least 12 hours per day. This man's example is a good one to follow.

As soon as the canvasser has signed up a customer the tendency is to quit him and pass by on the other side of the street. This must be avoided. The customer ought to be frequently visited by the man who took his contract, cementing an acquaintance, ascertaining and attending to his wants, and, what is of the utmost importance in more ways than one, retaining his good-will. If the customer has a complaint, it is better to relieve him of it than to let it rankle in his chest, and the complaint may be of something readily remedied. Besides, the customer may desire to add to his installation. Actually, the old customers ought to constitute one of the most fruitful fields for new business. Don't neglect them.

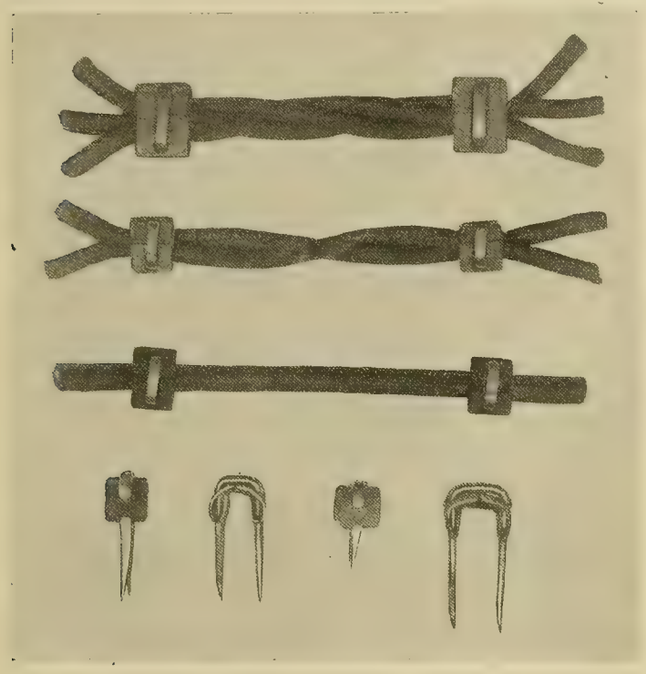
In line with this care of old customers, here is one idea which can be followed to advantage. The bills each month should be compared, either in the metering or billing department, with the bills of the previous month. Wherever any marked drop is noticed the case should be called to the attention of the general agent. In nine such cases out of 10 something is wrong, which, taken at once, may be remedied with little loss to the company. If, on the other hand, the matter escapes notice, the customer also may escape, and, at any rate, the revenue from him for many months is likely to be greatly reduced or lost altogether.

Express Cars on Illinois Traction System.

In response to requests from a number of St. Louis shippers for an express service that will enable them to make delivery of their shipments on the day their orders are received, the McKinley syndicate of Illinois is said to have placed in service an additional electric car between Venice and Hillsboro, which will leave Venice at 2 p. m. daily, except Sunday, making deliveries at Edwardsville, Hamel, Worden, DeCamp, Staunton, Mt. Olive, Litchfield and Hillsboro the same afternoon. Shipments for this car will be received at two points in St. Louis up to 11 a. m. daily. This service is in addition to that of the through car leaving Venice at 4 a. m., which will hereafter handle shipments for points north of Staunton only, including Gillespie, Carlinville, Virden, Springfield, Riverton, Decatur, Forsythe, Clinton and many other points, making delivery to all points as far east and north as Decatur on the day of shipment. Shipments for this through car are received at the St. Louis receiving stations up to 4:30 p. m. The tariffs apply from St. Louis direct and are based on the Illinois railroad and warehouse commissioners' classification and distance tariff, the rates being just the same as freight rates charged by steam railroads.

Blake Insulated Staples for Wiring.

Designed only for low-voltage wiring, such as that for telephones, telegraphs, annunciators, bells, etc., the insulated staples illustrated herewith are made by the Blake Signal and Manufacturing Company of Boston. They are standard, square-shouldered staples having good driving qualities. The manufacturer enumerates these advantages:



BLAKE INSULATED STAPLES.

"The fiber insulation on these staples cannot come off in driving. The double thickness of insulation under the head of the staple gives a large surface of contact with the wire to stand mechanical strain. The staple can be driven over two or more wires without danger of causing a cross. The insulation on these staples gives an added protection from leaks on grounds on the wiring. When used in damp places it also protects the braiding on the wire from rust or corrosion of the staple. Wiring can be done with Blake staples in one-half the time required for cleat work. The Blake insulated staples cost less than the screws alone used with porcelain cleat work. When stringing long runs of wire the end staples will hold the slack until the wire is secured at intermediate points." Large quantities of these staples are sold to telegraph and telephone companies, to bell hangers, to wirers of automobiles and motor boats, and in fact for all low-voltage circuits.

Subways Recommended for Downtown Chicago.

In a report to the local transportation committee of the Chicago City Council, Bion J. Arnold, consulting engineer for the committee, recommends a system of subways in the downtown portion of the city as the best means of improving the street-car service. For years the city has opposed overhead trolleys in the busy district and trolley cars have been drawn through the downtown district by horses, but with the abandoning of the cable cars all the lines of both companies are being equipped with overhead trollew wires.

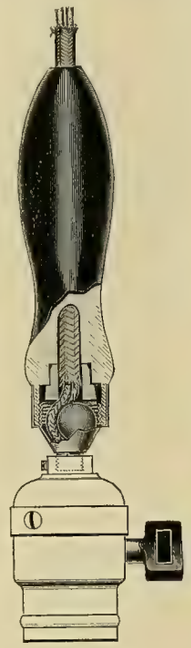
It has been suggested as a means of avoiding the overhead trolley in the downtown district that underground trolleys be installed in this district. This plan, Mr. Arnold says, would be feasible but not advisable. Underground trolleys would cost a large sum of money, and in the end they would be abandoned for a comprehensive subway system. Therefore he recommends that subways be constructed now in State, Monroe, Dearborn, Clark, Randolph, Washington, Market and Van Buren streets and Michigan avenue, at an estimated cost of $4,800,000. These subways would take from the streets all cars now passing through the La Salle street, Washington street and Van Buren street tunnels and accommodate through cars between the North and South sides.

The Chicago Union Traction Company and the Chicago City Railway Company are working night and day erecting poles and stringing trolley wires. On last Sunday for the first time the cars on the Adams Street line were taken to State Street by trolley, instead of being drawn by horses from Fifth Avenue.

Prof. M. E. Cooley of the University of Michigan has been engaged by the city as an adviser in street-railway values. The street railway companies were to furnish detailed figures this week as to the value of their properties. These figures will be considered by Professor Cooley with Mr. Arnold and Mr. Du Pont.

Keough Cord-grip Handle.

The Keough cord-grip handle, here shown, is one of the new specialties placed on the market by Keough Brothers & Co. of Boston. Inside of this handle is the Keough cord-grip, which prevents any strain on the terminals. This device is highly recommended by the underwriters, as is their regular cord-grip. The company states that



KEOUGH CORD-GRIP HANDLE.

by using this one-eighth-inch grip there can be saved the difference between that and the three-eighths-inch socket and bushing. This company has also recently placed on the market an automatic ice-chest switch which is meeting with approval.

The Lighting Situation in Baltimore.

The much-talked-of plan for consolidating the lighting properties of Baltimore has been announced. The Consolidated Gas, Electric Light and Power Company now owns about 60 per cent of the stock of the Consolidated Gas Company. The minority stockholders of the Gas company are offered 80 per cent of the new preferred stock and 50 per cent in the new common stock for their holdings, while the preferred stockholders of the Consolidated Gas, Electric Light and Power Company are offered 50 per cent in new preferred and 40 per cent in new common stock. The common stockholders of the company are offered 30 per cent in the new common. It is said that the 61 per cent approximately of the new securities exchanged for the Gas company stock, owned by the Power company, amounting to over $5,000,000 of new preferred and $3,285,000 of new common, will be cancelled when received by the Power company. The combined capital of the two companies is now over $22,000,000. The capitalization of the new consolidated company will be over $13,000,000. A syndicate has been formed by the Continental Trust Company, offering $83 per share for the stock, and will place it in the consolidation. The company likewise has formed a syndicate which has underwritten the entire common stock issue of the new company at 40 per cent of the par value, and each common stockholder has the choice of accepting the new common stock of the new company or $40 in cash per share.

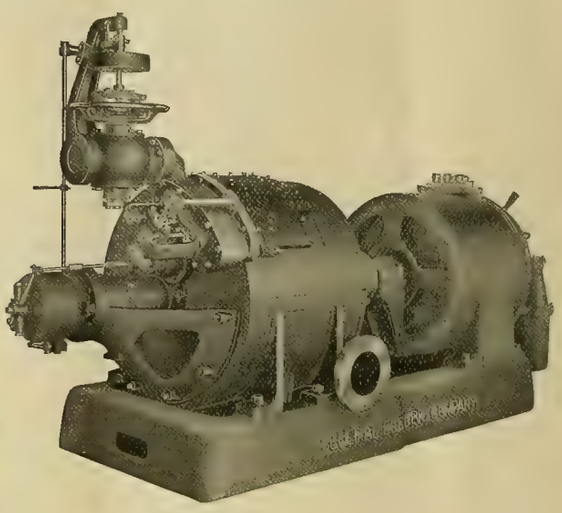
Proposed San Francisco Water Supply May Generate Electric Power.

The Eureka Lake and Water Company's extensive properties in Northern California have been taken over by E. J. McCutcheon, who is interested with W. B. Bourn, ex-president of the San Francisco Gas and Electric Company, in the Gaston Mine at Gaston, Cal. A large amount of mining water is sold to various companies in the district. French Lake and several other bodies of water, besides Eureka Lake, are included in the deal. This company may make a proposition to pipe water to San Francisco for the proposed new municipal supply. There is talk also of generating electricity at some point on the pipe line where there would be sufficient drop to generate possibly 15,000 horsepower. W. B. Bourn is also interested in the Bloomfield and Milton water systems, which are very extensive. The total area of their 11 main reservoirs is 11,600 acres.

Small Curtis Steam Turbines.

The success attending the use of small direct-current horizontal Curtis steam-turbine generating sets, made by the General Electric Company, warrants a description of this type of electrical apparatus. Not only is this machine suitable for use where reciprocating engine-driven generators have formerly been used, but on account of its compactness and simplicity of construction it has been adopted for new uses.

Perhaps the most evident reason for the advantages claimed for this type of generating apparatus is the fact that it embodies all the good points of rotary motion. Vibration and wear, which always accompany a reciprocating motion, are reduced to a minimum in the turbine. On this account the



SMALL CURTIS STEAM TURBINE.

machine may be placed on light and inexpensive foundations, and on account of the compactness of the entire set it is well adapted for train lighting, as an exciter in generating stations and for auxiliary power of all kinds where small space and quiet running as well as minimum expense for installation are of importance. Machines of this type are built for these purposes in sizes from 15 kilowatts to 300 kilowatts for operating either condensing or non-condensing at pressures ranging from 80 to 200 pounds in the smaller sizes and from 100 to 200 pounds in the larger types without reducing valve and at any degree of superheat up to about 200° F. without danger of injury.

Another important advantage of the steam-turbine generator set is the small number of bearings. In the reciprocating engine besides the main bearings are those for the cranks, cross-head, wrist pin, etc., all requiring effective lubrication. On the other hand, the turbine set has only its main shaft bearings and link between governor and valve. In the smaller sizes of turbines the bearings are supplied with oil by the usual oil rings and wells of ample proportions. In the larger sizes a closed oiling system is used, provided with an oil circulating pump. Such a pump is shown at the right of the accompanying illustration. Since the system is closed, there is no waste of oil from spattering or other causes. No internal lubrication is necessary in the Curtis steam turbine, and as a result the exhaust steam can be used in heating systems or in manufacturing processes, as it is entirely free from oil.

The speed of the turbine is held constant by a centrifugal governor which controls the steam supply entering the turbine. A uniform speed is obtained irrespective of load conditions. In addition to the regular governor an emergency governor is supplied which shuts off the steam, if for any reason the speed should rise a certain percentage above that fixed as normal. This entirely eliminates any danger of excessive speeds.

On account of the rugged construction of the Curtis turbine, it is not subject to injury in case it is by accident flooded with water.

The generators in these turbine sets gain indirectly in compactness because of the higher operating speeds as compared with generators of the engine-driven type, and the cylindrical design of the turbine suits exactly the compact, well-proportioned electrical unit.

From their compactness and absence of vibration the small Curtis steam-turbine sets have found a wide field in electrical train lighting, mounted either on the locomotive or in the baggage car, as exciter sets in power houses and for small power and lighting installations. Being easily and quickly located in an odd corner, they have been found exceptionally well adapted for auxiliary units in manufacturing establishments. In the smaller sizes the set makes an ideal unit for marine work.

The Holdrege (Neb.) Lighting Company has been incorporated with a capital stock of $75,000. Edward A. Eames is interested.

Indiana Telephone Items.

The Cedar Line Telephone Company of Waupecong, Ind., has been incorporated, capitalized at $1,000. The declared object of the company is to construct and operate a telephone exchange and system in Waupecong and vicinity. John Christie, Isaac Myers and Walter Shiveley are directors.

The Long-Distance Telephone Manufacturing Company of South Bend has filed articles of incorporation with the secretary of state. The capital stock is $100,000. The company proposes to establish a large plant for the manufacture of telephones and telephone electric apparatus, electrical appliance and supplies, and all equipments necessary for an exchange or electrical plants. Charles K. Seibert, M. L. Seibert and Stanley A. Duvall are directors.

The Central Union Telephone Company is installing a new switchboard at Columbus. The board will accommodate 800 drops with capacity for 400 drops additional, if the business demands.

The city council of Princeton, Ind., and the Cumberland Telephone Company have agreed on the terms of a new franchise for the company to continue operation in Princeton. The city has the choice of receiving $1,000 for a 30-year franchise or $2,000 for a 35-year franchise. The company must bind itself to install an up-to-date central exchange before July 1, 1907. The franchise provides a sliding scale of rates to the maximum charge, being dependent on the number of telephones in actual operation on the local boards.

The Bell Telephone Company has purchased what is known as the McCarthy telephone exchanges in Rome City and Albion in Northern Indiana. This system has but 400 telephones, but was prolific in long-distance business and therefore of great importance to the Bell Company.

The Bell Company has also purchased and taken over the New Home Telephone Company at Linton, Ind. This company has many telephone in the coal offices and in the coal mines that abound in the vicinity. Upward of $25,000 was paid for this plant.

Plans have been perfected to connect the great system of Independent companies in Indiana and Kentucky. This will give Indiana telephone users connection as far south as Memphis and Mobile. The new service will make it possible for the Indiana telephone patrons to get connection with 150,000 telephone users in the south.

The United States Government is putting in a private telephone exchange at the Army Post, (Ft. Benjamin Harrison) which will connect all the regimental quarters with the office of the command, and the commissary quartermaster's depot, etc. Connection is also being made with the city, and long-distance service will be established. The encampment soon to be held will find the duties of the camp less irksome because of the use of the telephone.

The Home Telephone Company of Wabash has begun the construction of an $8,000 exchange building in which the company will install a multiple system, the whole improvement to cost about $40,000.

Whether a telephone company has the power to charge a higher rate for service to an incessant user is to be determined by a suit filed by Charles Faucett, a stock buyer of Greenfield. The Fortville Company increased the price of service to Faucett on account of his using the line oftener than other subscribers and refused to connect him with a person desiring to talk with him. Faucett has paid for service at the rate charged others and refuses to pay more and asks for $600 damages for being refused connection. S.

Canadian Telephone Items.

The Canadian Senate has passed the bill of the Bell Telephone Company of Canada, which authorizes the company to increase its capital stock to $30,000,000, without amendment.

The special committee of the City Council of Ottawa has recommended that the Bell Telephone Company be granted an extension of its exclusive franchise in the city for a period of two years only.

Owing to the early prorogation of the Dominion Parliament, the bill promoted by the government of Manitoba to empower that province to carry out its scheme of a provincial telephone system could not be put through this session.

By an amendment to the railway act of Canada it is provided that where a telephone company is given the right of entry to a railway station it shall not be compelled to pay damages where this service upsets a monopoly that any other company hitherto enjoyed in these premises. It was also provided that all telephone tolls shall be subject to the approval of the Board of Railway Commissioners of Canada, and the board may order telephone companies to make connections with municipal telephone systems.

Landsowne, Ont., is being equipped with an Independent telephone line. The service is controlled by the Landsowne Rural Telephone Company, which was recently organized. This service has a radius of 10 miles and will prove a great convenience. Shares in the company are $50 each, payable in five years at the rate of $10 per annum. Each subscriber is a shareholder, so that the cost of using a telephone each year of the five will not be more than $10. The promoters say that at the end of five years they expect to operate at a cost of $2 to $5 per year per telephone to each shareholder. Long-distance connections have been secured over the Bell Telephone and the North American Telegraph companies' lines. W.

Telephone News from the Northwest.

The council of Thief River Falls, Minn., has again refused permission to the Northwestern Telephone Exchange Company to use the streets. The company now threatens legal proceedings.

P. I. Muri, secretary of the Twin Lake and Butte Telephone Company, is taking bids at York, N. D., for the construction of a telephone line 22 miles long.

The Strout Telephone Company has been organized and will construct a rural line to connect with the Litchfield (Minn.) Telephone Exchange Company's system.

The Western Mutual Telephone Company of Leola, S. D., will extend its line to Aberdeen, where it will connect with the Dakota Central telephone system.

S. K. Groth was appointed chairman of a committee of business men at Thor, Iowa, to investigate the advisability of building a telephone system.

Work on the new People's Mutual Telephone system at Sidney, Iowa, is to be started immediately.

Albert Johnstad of Henden, S. D., has received the contract to build 30 miles of rural telephone line in Howard County, South Dakota.

An ordinance will be passed by the council at Crookston, Minn., giving the Northwestern Telephone Exchange Company permission to put in a conduit system. R.

Michigan Telephone Matters.

The Marquette Construction Company has been organized at Detroit to build the new plant for the Home Telephone Company. Articles of incorporation have been filed. C. M. Foster and T. H. Wagner of St. Louis, and W. B. Woodbury and Thomas A. E. Weadock of Detroit each hold one share, and Max Koehler of St. Louis holds 246 shares as trustee. The capital stock is fixed at $25,000, half paid in. The articles of the Home Telephone Company have been amended to make the amount paid in $3,096,000 of the $6,000,000 capitalization, $100,000 in cash and the balance in property. There is evidently a high valuation placed on the franchise, for which the company fought so hard.

Village authorities of Otisville object to poles being placed in the streets and are making trouble for the Michigan State Telephone Company, which is attempting to extend its lines in the village. The same trouble has been experienced at McBain by the Citizens' Telephone Company.

Stockholders of the Wexford County Independent Telephone Company have increased the capital stock from $1,000 to $2,000. G. A. Gilbert was elected secretary and E. Gilbert treasurer of the company. O. Litchard has resigned as manager. Lines are being built and the system will soon be ready for the installing of telephones. B.

GENERAL TELEPHONE NEWS.

The Gothard Telephone Company of Beresford, S. D., has been incorporated with a capital stock of $25,000.

The Barnum Telephone Company has been granted a franchise for an exchange at Moose Lake, Minn.

The Montana Independent Telephone Company has been granted a franchise for a local system in Great Falls, Mont.

Plans have been filed by the Independent Telephone Company of Seattle, Wash., for a two-story brick veneer building, 36 by 62 feet, to be used as an exchange. The building will cost about $10,000.

The capital stock of the Suburban Telephone Company of Clayton, Mo., has been increased from $100,000 to $6,000,000. H. W. Karrenbrock is president of the company and Joseph B. Greensfelder is secretary.

F. W. Anderson of Wheatland, Cal., has applied to the supervisors of Marysville, Cal., for a telephone franchise. Mr. Anderson has connections with Lincoln, Nicolaus and Auburn, and wants to enter Marysville. Bids are to be advertised for, the life of the franchise to be 25 years.

Thaddeus S. Lane, representing the Montana Independent Telephone Company, has been in Great Falls, Mont., asking permission to erect poles and string cables for a new telephone system in Great Falls. A modern building to accommodate the plant will be erected later. The company expects to spend $2,000,000 in the state.

Among the telephone companies recently incorporated are the following: Day County Telephone Company, Grant, Okla.; Albana Central Telephone Company, St. John, Kan.; Moline Telephone Company, Moline, Kan.; Moorland Mutual Telephone Company, Moorland, Iowa; Farmers' Mutual Telephone Company, Stella, Neb.

CORRESPONDENCE.

Great Britain.

London, June 20.—Reference has already been made in these notes to the feeling that is fast becoming general in England that with the present government in power, private enterprise, so far as new parliamentary promotions are concerned, has come to a dead stop. This has been instanced by the proceedings in connection with the supply of electric power for London, but nothing could be calculated to facilitate the existing methods adopted by so many of the local authorities as a speech which was made by Mr. John Burns a few days ago, on the occasion of the opening of the new Brighton electricity works. Mr. Burns is president of the Local Government Board, which authority has to sanction all loans asked for by local authorities. He advised local authorities to go on and spend money upon matters such as an electricity undertaking, and not to bother about making a loss for a few years of a thousand pounds or so. It is a pity that such unqualified expressions should be used by a gentleman in the position of a cabinet minister.

It is noteworthy that in Great Britain recently a considerably greater amount of attention has been paid to lamps and illumination than was formerly the case. Hence it is not surprising that a proposal is being made to form an illuminating engineering society whose function it shall be to discuss upon a scientific basis the merits and faults of the different illuminants now used for public and other lighting purposes, and to define the sphere of useful application for each of them. The annual expenditure for lighting purposes is estimated to exceed $175,000,000 in the United Kingdom, so that only a small increase in the efficiency of the systems used will amount to a considerable saving per annum. The gentleman who is moving in the matter is Mr. Leon Gaster.

An international colliery exhibition is now being held in London, and it is remarkable for the very large show made of electrical appliances, and for the fact that several firms are to be found here who were not exhibiting at the big electrical exhibition at Olympia last autumn. The chief features are electrical coal-cutting appliances and electric winding machinery, the latter being a subject to which particular attention is now being paid. The Westinghouse company, for instance, shows winding gear for both alternating and continuous current, while other details worthy of mention are a depth indicator and retardation indicator, shown by the Lahmeyer Electrical Company, for indicating to the man working the winding gear the exact position of the cages, the other being an instrument which automatically prevents overwinding. This firm has also evolved a signaling system which indicates to the attendant, by means of colored incandescent lamps, whether the load is to be men or material, or whether the journey is to be made for testing purposes. The main feature of the show, from the electrical point of view, is that the design of the various machines goes with the motor that is to drive them, and not independently, as was always the case until recently. The last three years have seen vast strides in these matters.

The proposal of the consulting engineer and resident engineer to the Edinburgh Corporation that greater importance should be paid in the future to the building up of the reserve fund, has not met with the approval of the council, as a whole. The electric-lighting committee recommended that, in accordance with the report of the two gentlemen above referred to—and which was discussed in these notes—the reserve fund of the electricity department should be brought up to its maximum at the earliest possible date, and that afterward it should be maintained at five per cent. of the capital expenditure. This recommendation was lost in council by six votes. The Edinburgh council is also considering the question of electric traction. This city is remarkable in Great Britain for having a most complete and satisfactory cable system of tramways, which is in the hands of a company. The question of electric traction, however, is under discussion, and a deputation has been appointed to visit various towns where surface-contact and conduit systems are in use.

At the annual convention of the Municipal Electrical Association, which is being held this week, the burden of the presidential address, which was delivered by Mr. J. H. Edgecombe, the chief electrical engineer at Kingston-on-Thames, was that a central bureau should be established having for its raison d'etre the collection and tabulation of statistical information relating to the electrical undertakings of the United Kingdom. Complaints are being made on all hands by municipal engineers as to the number of inquiries which they are continually receiving for information relating to their works, and the suggestion is that this should be sent, at certain periods, to the central bureau, to which all inquirers would be referred. It would be interesting to know what those technical journals which publish annually such statistics as those referred to think of the proposition.

An interesting lawsuit is now in progress between the Westinghouse company and a man who

claims that certain improvements in the design of electrical machinery which he submitted to the company—and which were rejected—have since been embodied in the machines made by the Westinghouse people. The hearing has extended over several days, and is not yet completed.

The Southwark (London) Borough Council is placing itself in an invidious position by refusing to discuss an offer by an electric supply company to give a supply of energy for street lighting at a price cheaper than the council is supplying from its own station.

Considerable feeling is being displayed both by Lloyds and the Marconi company in connection with the government's wireless-telegraph bill, which extends their control for another two years. Lloyds argue that in effect it confers a monopoly upon the Marconi company, whereas the latter, of course, contends that it does not. As the bill is in the last stage, it is not likely that its course will now be stayed. G.

New York.

New York city, June 30.—Delegates to the convention of the Street Railway Association of the states of New York visited Schenectady yesterday at the invitation of the General Electric and American Locomotive companies. The party included some 50 members of the association and was in charge of Manager E. F. Peck of the Schenectady Railway Company, chairman of the entertainment committee, and other officials. Special cars furnished by the local railway company brought the guests to the city where they were received by officials of the American Locomotive Company. After viewing the works, the party proceeded to the factories of the General Electric Company, where an informal lunch was served in the new firemen's headquarters building. The reception committee at the works of the General Electric Company included J. G. Barry, C. P. Haskins, G. H. Hill, E. D. Priest, Theo. Beran, manager of the New York office; F. H. Gale and others. After lunch the party spent the afternoon in viewing the works, leaving about 4 o'clock.

Yesterday morning John Miller drove his horse to a watering trough in Eighty-sixth street. When the horse touched his nose to the water he flew back with a snort and fell over dead. There had been a thunder storm in the morning, and it was discovered that an electric-light wire had been blown down and one end fell to the trough, forming a connection. The water and tank were heavily charged and the horse received the shock when he touched the water.

Considerable interest was shown by officials of the New York Edison Company in the news that the Chicago Edison and Commonwealth Electric Companies had voluntarily reduced the rates for lighting current. Arthur Williams said the reduction is in line with the policy of all the big electric companies. "The new Chicago price will average about the same as we get here," said Mr. Williams. "New York, Chicago, Boston and Philadelphia are getting cheaper electricity than any four of the big cities on the other side of the world. Ten cents for electricity is the equivalent for dollar gas, and these big cities in America enjoy that rate approximately. London, Paris, Berlin and Vienna pay a great deal more."

The charge of eight cents fare made by the new Interborough electric lines in the Bronx, for a transfer to the Subway, has aroused those who are compelled to pay it daily. The Heights Taxpayers' Association has decided to combine with other organizations in the Bronx and on Washington Heights to compel the company to issue transfers to the Subway for one five-cent fare. This, the association says, is provided for in the franchise.

Wells driven in the bottom of the Subway and filing a series of tanks with cold water, through which air is to be forced, is the latest plan for cooling the subway submitted to the Rapid Transit commissioners by Chief Engineer Rice. From Mr. Rice's report it appears that none of the plans which were expected to cool the Subway has been successful. Mr. Rice's plan is that used in the Metropolitan Subway in Paris. Mr. Rice proposed to drive four eight-inch wells through the bottom of the Subway to a depth sufficient to obtain 400 gallons of water per minute. This water will be carried into shallow tanks by pumps. Four huge fans will be installed to force air through these tanks, thus cooling it. The water in the tanks, according to Mr. Rice, will be about 52 degrees, and he believes that the air forced through it would bring the temperature in the Subway down to 64 degrees.

The proposal to add third tracks to the Second and Third Avenue elevated roads was killed by unanimous vote of the Rapid Transit Commissioners yesterday. Now the corporation counsel will seek an injunction to forbid the Interborough company from operating the present third track on Third avenue, and the track may be removed. The Interborough company asked the commission for a perpetual franchise for the third tracks. The perpetuity clause was what led to the rejection of the application. The Interborough company, it is said, may amend its application and present it again, offering the city better terms. The Rapid Transit commissioners, however, are understood to be irrevocably opposed to any extension of the elevated roads. C. I. C.

New England.

Boston, June 30.—Mayor Dwyer of Medford, Mass., has vetoed the ordinance granting a location for an elevated structure on Mystic Avenue to the Boston and Lowell Interurban Company. The Medford City Council has sustained the mayor's veto.

The negotiations for the New York, New Haven and Hartford Railroad Company's purchase of the Rhode Island street railway and the Connecticut Railway and Lighting Company's systems from the United Gas Improvement Company of Philadelphia, Pa., have ended in a disagreement.

The village of Morrisville, Vt., has contracted for the construction of a dam at Cady's Falls, the dam to be part of the village plant to furnish electric light and power. The village will sell power to manufacturers.

The Consolidated Railway Company has completed its survey for the proposed electric railway between Rockville and Stafford Springs, Conn. This will be a section of the Hartford and Worcester road. The route was over private land most of the distance.

In accordance with the recent Connecticut Supreme Court's permanent injunction against the use of the third rail in the city of New Britain, the New York, New Haven and Hartford Railroad Company has given orders to change the power from electricity to steam as soon as possible. The company has until August 1st to abolish the third rail. Steam will be used until an overhead trolley system has been constructed.

In behalf of A. B. Leach & Co. and a number of Maine capitalists, Carl P. Dennett has completed negotiations for the purchase of all the Consolidated Electric Company's stock (50,000 shares) and bonds. Mr. Dennett will pay $500,000 for the bonds. The new owners will build a modern power plant on the Saco River within 18 miles of Portland, Me., at a cost of $500,000. They propose to furnish additional electric power in Portland, amounting to 3,000 horsepower.

The Consolidated Railway Company is preparing plans for an addition to its New Haven (Conn.) power plant. It will erect a one-story brick building 60 by 70 feet and will install three 500-horsepower boilers, a large generator set and condensers. The company will also enlarge its Branford (Conn.) power plant.

The Boston aldermen, sitting as committee of the whole, have given a hearing to the Metropolitan Home Telephone Company, which wishes a Boston franchise. Alfred S. Hayes, the company's counsel, was the only person who appeared. He said that the company would furnish 200 free telephones to the city. The committee will later consider a motion inviting the New England Telephone and Telegraph Company to appear before it and argue against competition.

The Bennington and Hoosac Valley Electric Railroad Company has decided to extend its electric railway from Bennington, Vt., to Troy, N. Y.

The Consolidated Railway Company has bought the control of the Torrington and Winchester Railway Company, which owns an electric railway between Torrington and Winsted, Conn., a distance of 14 miles. B.

Southeastern States.

Charlotte, N. C., June 30.—The Athens (Ga.) Electric Company has been granted the right to increase its capital stock from $125,000 to $275,000. The company at an early date proposes to make a number of improvements.

The appointment in the federal court of a temporary receiver for the Cape Fear Power Company at Fayetteville, N. C., has caused considerable disappointment among the cotton mills and manufacturing plants, who were awaiting the arrival of the electric current to supply their motive power, and it is hoped that matters will soon be adjusted so that work can proceed with little delay.

The Rockingham (N. C.) Power Company has let the contract to W. R. Bonsal & Co. of Hamlet, N. C., for erection of a dam across the Pee Dee River at Bluitt's Falls, where, it is said, 28,000 horsepower will be developed. Transmission lines will be built to Wadesboro, Rockingham and other points.

It is now likely that the plan for municipal ownership of a lighting plant in Richmond, Va., is dead. The committees on electricity and finance have tabled the matter and asked the council to advertise for bids for lighting the city for three years.

The secretary of state has this week granted a commission to the South Carolina Public Service Corporation, with an initial capital of $500,000, to build an electric railway from Orangeburg, S. C., to the sawmill town of Ferguson, on the Santee River, 65 miles distant. The incorporators include J. T. Timmes of Brooklyn and J. A. Graig of Orangeburg.

The Lynchburg (Va.) Traction Company has been granted the right to extend its lines out to the fair grounds over the Salem turnpike.

Indications point to a test of an act of the South Carolina Legislature in granting rights to a number of power companies, including the Portman Shoals development near Anderson, on the ground that the rivers on which plants were to be erected are under federal jurisdiction. A complaint has already been forwarded to Washington from South Carolina dealing with the subject, and the authorities at Washington have asked the governor for a copy of the law on the matter, and for his opinion.

The town of Cartersville, Ga., has voted a bond issue for the improvement of the gas plants and to build a municipal electric-light plant.

The first spike was driven on June 22d for the interurban electric railway to connect Anderson, S. C., with Belton and other points.

Plans are on foot in Atlanta, Ga., for the incorporation of two of the biggest electrical houses in the South within three months. One company proposes to deal in electrical supplies, construction and equipment, and the second, with about the same stockholders as the first, will handle some other line of the electrical supply business. The names of the promoters have not yet been made public. L.

Ohio.

Cleveland, June 30.—Rumors have been afloat here for several days to the effect that most of the electric roads centering in Cleveland will be merged under the management of one large corporation. This was the idea of the old Everett-Moore syndicate, it is said, and it is being renewed with Henry A. Everett as one of the leading figures. A few days ago it was announced that the Cleveland Electric would probably be taken over by an eastern syndicate on a lease. The others are the Lake Shore Electric; the Detroit United; Toledo Railways and Light; Northern Ohio Traction and Light; Cleveland, Painesville and Eastern; Cleveland, Painesville and Ashtabula; Cleveland and Southwestern, and the extensions of these roads.

The greater part of the double-track work on the Lake Shore electric road between Cleveland and Lorain will be completed by August 1st.

It is said that the management of the Cleveland Electric Railway Company is willing to put the settlement of the fare controversy before the people to vote upon this fall, if Mayor Johnson will also submit his leasing plan.

The Marion Town Council has granted a franchise to the Marion-Findlay railway, being promoted by G. W. Meeker and others.

Employes of the Cleveland Electric Railway Company held their annual outing at Shadduck's Grove Wednesday, about 800 persons being present. After the race contests and other sporting events presents were made to the three oldest employes of the company in point of service, as follows: Patrick Campbell, 39 years; Frank Richter, 36 years, and Christ Hendrickson, 31 years. The affair was one of the most pleasant ever held by the association of railway men.

The Indiana, Columbus and Eastern Traction Company has filed a mortgage for $18,500,000 in each of the 18 counties of this state through which the lines it has acquired pass. Attorney George Warrington of Cincinnati has just returned from Philadelphia, where the deal for financing the company was completed. The roads included under this head by purchase or lease are as follows: Dayton, Springfield and Urbana; Urbana, Bellefontaine and Northern; Columbus, London and Springfield; Columbus, Grove City and Southwestern; Columbus, Buckeye Lake and Newark; Columbus, Newark and Zanesville; Columbus and Lake Michigan; Dayton and Western; Dayton and Northern; Dayton and Muncie, and the Zanesville Light and Power Company.

The Union Gas and Electric Company has deposited $5,000,000 in New York banks, of which $2,000,000 is to be used for betterments of the gas and electric plants at Cincinnati and $3,000,000 will be allowed to remain as a guarantee of the payment of dividends of the Cincinnati Gas and Electric Company. A few days ago the directors of the latter met and completed the details of the deal whereby the company leases all its property to the new incorporation, which will take charge on July 1st.

A general passenger and freight office has been opened by the Schoepf people in the McCune Block at Columbus, Walter Hurd being the general passenger and freight agent. He will have jurisdiction over all the lines of the syndicate in Ohio.

An advance has been made in the wages of the men employed on the old Appleyard roads that will average about seven cents an hour. All who have been in the employment of the roads three years will receive 21 cents an hour; those who have served four years will get 22 cents; five years, 23 cents, and six years, 25 cents.

The Fisk Electric Company of Toledo has been incorporated with a capital stock of $10,000 by J. B. Fisk, Jr., and others.

The Forest City Railway Company has issued a prospectus to investors. It shows that an issue of $2,000,000 cumulative six per cent. preferred stock will be issued, but under its contract with the Municipal Traction Company, no bonds are to be is-

sued. A statement of Mayor Johnson accompanies the prospectus, in which he says that he will favor these two companies in every way possible and recommends this stock to investors.

In the case of Anna Holzencamp against the Cincinnati Traction Company, the supreme court has decided that a person standing at a regular stopping place awaiting to board a car and injured by a falling trolley pole, raises the presumption of negligence on the part of the railroad company and the person may recover damages, unless the proof is rebutted.

Officers of the Indiana, Columbus and Eastern are as follows: President, J. B. Foraker, Jr.; vice-president, W. H. McAlister; secretary and treasurer, Thomas Fitzgerald. In addition to these men the directors are W. Kelsey Schoepf and John C. Gallagher.

A syndicate headed by J. R. Nutt has offered $6.25 per share for all the stock of the Toledo and Western. It is said that the officers and directors are willing to accept the bid and are endeavoring to get the stockholders to do so.

Mayor Thomas L. Johnson of Cleveland has been asked to act as sole arbitrator in a strike of the employes of the Lehigh Valley Transit Company at Allentown, Pa. This request is unique from the fact that this road is controlled by the estate of the mayor's brother, of which he is administrator.

The Sandusky, Fremont and Southern has sold $500,000 first mortgage bonds, guaranteed by the Lake Shore Electric, the proceeds to be used in beginning the construction of the line.

Interested persons have agreed to dismiss the suit of the Gamewell Fire Alarm people against the city of Cleveland. This suit was filed in 1901, and the allegations were that the city did not carry out its part of the contract. The dismissal of the suit will put the city in position to install any system it desires, and it is probable that one designed by a local man will be used. O. M. C.

Indiana.

Indianapolis, June 30.—The Gary & Hammond Traction Company has filed articles of incorporation with the secretary of state with a capital stock of $10,000. The company proposes to construct a system of street and interurban railways in and connecting Hammond, East Chicago and Gary in Calumet township and in other intermediate or nearby towns and cities of Indiana. The company also proposes to produce and supply electricity and steam for light, heat and power to the towns and cities of that vicinity. The principal office will be in Gary. K. K. Knoff, W. D. Hayne, William Beepe and G. R. Call are incorporators.

The Evansville, Princeton and Vincennes Interurban Railway Company has incorporated and capitalized at $1,600,000. The purposes of the corporation are to construct, operate, purchase and lease street and interurban railways in and between the cities of Evansville, Princeton, Vincennes and intervening towns, and from Vincennes to Washington and Petersburg. The company also proposes to supply electricity and steam for light, heat and power in the cities and towns through which the road runs. The men backing this scheme are Samuel T. Murdock, Henry Marshall, William V. Stuart of Lafayette and Robert L. Todd of Evansville.

The deal which has been on for some time between the Indiana Union Traction Company and the Anderson City Council, whereby the franchise of the traction company is extended to 1952 and the traction company in return agrees to build its main shops here by July 7, 1907, has been closed. The company announces that it will spend $125,000 on its shops. The company also agrees to have in operation by December, 1909, a line from this city to Elwood, via Frankton, also a line from this city to Newcastle via Middletown.

That part of the new line of the Terre Haute and Sullivan Traction Company, between Shelburn and Sullivan, was opened for regular traffic June 25th.

It is announced that the traction syndicate represented in Indiana by Hugh J. McGowan and in Ohio by W. Kelsey Schoepf will take over the Dayton and Northern and Dayton and Muncie lines July 2d. It is also believed official announcement of the leasing of the Dayton and Western will be made at that time.

The Akron Light, Heat and Power Company of Akron, Ind., has been incorporated and capitalized at $10,000 to build and operate an electric light, heat and power plant in Akron, and to supply the citizens with light, heat and power. O. O. Russell, A. A. Gast and R. R. Carr are the incorporators.

In order to meet the demand for electricity the Exansville Gas and Electric Light Company has decided to install two additional turbine engines in its plant in Evansville. The two turbines to be installed will be of 1,000 and 1,500 kilowatts capacity respectively. The company managers say this unexpected demand for electricity comes from the interurban traction lines and the city parks. The managers of the plant say they can furnish the traction companies with power cheaper than they can make it themselves. In proof of this claim the Mt. Vernon and the Newburg traction lines are now supplied with power from this plant. The second demand comes from parks and summer resorts.

Charles E. Rugger has been appointed receiver for the Muncie Gas Light and Fuel Company of Muncie. This plant will likely change hands soon and will then be improved and made profitable. S. S.

Michigan.

Grand Rapids, June 30.—The work of connecting the sub-station of the Grand Rapids-Muskegon Power Company is nearly completed, and within 20 days the company will be ready to furnish power to Grand Rapids consumers. The two biggest concerns to be supplied are the Grand Rapids, Holland and Chicago Railroad and the Eagle Plaster Mills, the two consuming 4,000 horsepower daily. This will utilize all of the power available from the one dam at Big Rapids. No more power will be contracted until other dams are completed, requiring another year of work. It is said that negotiations are still pending for a combination of the power company with the Grand Rapids Edison Company. The Muskegon interurban road and two big Muskegon concerns are using the power. The big plant of the Brunswick-Balke-Collender Company, now being constructed in Muskegon, will also use the power.

The taxpayers of Paw Paw have voted $50,000 bonds for electric lights and waterworks.

The business of the Grand Rapids, Grand Haven and Muskegon Railway shows a gain of 20 per cent. over that of a year ago. This road is operated by the third-rail system.

To meet a 90-cent gas rate the Jackson Light and Power Company of Jackson has announced that after July 1st the charge for electric lighting will be reduced 25 per cent.

The city of Marquette is to install a second power and lighting plant on Dead River at a cost of $60,000. The new plant will be half again as large as the one now in commission and the two will have a capacity of 2,500 horsepower. The work will be spread over three years.

The annual report of the financial condition of the Lansing electric light plant shows that the plant received from the city for the fiscal year $5,000, while in the preceding year it received $15,000. From private consumers it received nearly $58,000, a gain of nearly $16,000 for the year. During the last year $32,000 was spent for construction work, against $35,000 the previous year, and operating expenses were $38,000, against $34,000 the previous year.

The Detroit United Railway has inaugurated a through service between Mt. Clemens and Toledo. A through service from Detroit to Cleveland is planned.

The People's Railway Company of Detroit has filed articles of association, having incorporated with a nominal capital of $100,000. The Detroit Trust Company is named as fiscal agent, and Detroiters who are interested in the corporation are Henry Blackwell and Will A. Waite. L. W. B.

Dominion of Canada.

Ottawa, June 30.—Government statistics show that the growth of electric railways in the Dominion during the last five years has not kept pace with the general growth of the country or with the expansion in steam roads. In 1901 the total electric-railway mileage in Canada was 674 miles and in 1905 it had only increased to 793 miles, or by an average of 24 miles a year.

An injunction has been granted restraining the town of Kenora from continuing the erection, on the east branch of the Winnipeg River, of a municipal power plant. The town is erecting a dam on the river, half of the bed of which is now claimed by the Keewatin Power Company and half by the Hudson Bay Company.

The application of the International Railway Company to be allowed to develop additional power at its plant on the Canadian side of Niagara Falls and transmit energy to the American side to operate its railways there was considered by the new Ontario hydro-electric power commission at its first meeting held recently. The application had been transferred from the Niagara Park commission to the new tribunal for decision.

The initial report of the city of Ottawa Electric Commission has been issued. On July 17, 1905, in order to prevent the amalgamation of electric companies, which proposed to put up the rates, the city expropriated, by virtue of its charter, the Consumers' Electric Company. The civic plant has ended the first 10½ months of its existence since it took over the plant with a balance of $826. The number of customers has increased 40 per cent. For months past the plant practically ran itself while the City Council fought over the best method of management.

A movement has been on foot among members of the Dominion Parliament to make all electric railways holding a federal charter carry the Parliament members free of charge. The railway act of 1903 states in its interpretation clause that a railway means any railway which a company has power to construct. Many railway and legal experts are of the opinion that electric railways come under this definition and that those operating under federal charters must comply with the clause which states that: "The company shall furnish free transportation upon any of its trains for members of the Senate or of the House of Commons of Canada with their baggage." W.

Illinois.

Peoria, June 30.—The Camp Point Electric Light and Power Company has been incorporated to operate an electric-light and power plant. Incorporators are Ed E. Hollister, Frank H. Whitney and George C. Gid.

The Cameron Electric Company of Chicago has been incorporated, with a capital stock of $5,000, to manufacture electric machinery and supplies. Harry E. Cameron, Ed R. Liver and Joseph A. Granger are the incorporators.

The Chillicothe Water, Light and Power Company has succeeded to the business of J. G. Daily. The new company is capitalized at $50,000, the principal stockholders being W. H. Foctor of Chicago and F. N. Earl of Plano.

The Keokuk and Western Illinois Electric Company announces that it is now ready to begin the construction of the interurban line between Keokuk and Carthage. It is stated that this line is the nucleus of an extensive interurban system whose eastern terminal will be Galesburg.

The McKinley syndicate now has a fast through service in operation between Springfield and St. Louis. The Corn Belt Limited, as they have styled the new train service, consists of three new cars that are complete in every detail, even to smoking room, cafe and observation compartments. While at present the southern terminus is Granite City, the passenger can take a terminal into St. Louis. It is only a short time until the cars will run into St. Louis. The company has purchased land extending clear down to the river. A ferry service will be used and the cars will be taken across the river and go into the heart of the city.

The Central Railway of this city, which is a part of the McKinley system, will build a line to East Peoria at once, using the bridge now being built by the syndicate, but after that using its own track and furnish an independent service to East Peoria.

Sample books of interurban mileage have been issued by the Illinois Traction Company. The books will be sold in various sizes, and besides being good on the traction company lines will also be honored by the Aurora, Elgin and Southern, Joliet, Plainfield and Aurora, Chicago and Joliet Electric Company, and the Chicago and Desplaines Valley Company.

At Monmouth a proposal to light the city by gas instead of electricity is being considered. V. N.

Pacific Slope.

San Francisco, June 28.—The light and power situation in San Francisco is still slowly improving. A number of the manufacturing plants in the districts south of Market Street have been supplied with direct current for the operation of machinery, although a number of manufacturers got tired of waiting for proper facilities in the city and located on the larger sites offered them across the Bay and in other parts of the state, instead of rebuilding their old plants.

The underground distribution is not yet perfect on the San Francisco Gas and Electric circuits, and there are the usual complaints of temporary interruptions of lighting service in some quarters and of inferior lights in others. The old Edison three-wire underground system is again in use over the greater part of the district east of Van Ness Avenue and it bids fair to continue its usefulness to future generations. Several motor-generator sets feeding into this system are again in operation in what is left of the burned Jessie Street station.

The United Railroads is rapidly completing the electrical equipping of the Sutter Street cable road, and when it starts up in a few days it will be of great service to the community which now depends upon the Ellis and Eddy Street cars for transportation between the ferries and the new retail business centers on Fillmore Street and Van Ness Avenue. The company finds difficulty in securing enough workmen.

It is reported that there is a strong possibility that the 20-year contract under which the California Gas and Electric Corporation was to furnish the United Railroads of San Francisco with all of the power needed to operate its cars, beginning with June 1st, will be abrogated without strong opposition on the part of either company. The corporation, now a part of the new Pacific Gas and Electric, has almost completed a 16,000-horsepower gas-engine plant near the city as a reserve generating station to enable that contract to be filled, but it is said that the United Railroads has plans for another source of electric power.

C. P. Baird, who is connected with the Valley Electric Company of Santa Maria, is in Lompoc, Cal., for the purpose of looking over the ground with a view to putting in an electric plant at that place.

The small damage to the Geary Street Railroad, San Francisco, has been repaired. The cars are well patronized and a four-minute headway is in force on the line. The cable was uninjured by the fire.

On June 24th a fire destroyed the Reno Light, Power and Water Company's plant, situated on the Truckee River. The plant will be rebuilt. A.

PERSONAL.

Bertram T. Holdeman has resigned as electrical inspector at Evansville, Ind., to become electrical and general inspector for Burrows, Marsh & McLennan in Chicago.

C. J. H. Woodbury of Boston, a member of the American Telephone and Telegraph Company's engineering staff, has been given the degree of doctor of science by Union College.

Louis A. Ferguson, second vice-president; Peter Junkersfeld, electrical engineer, and R. C. P. Holmes, purchasing agent of the Chicago Edison Company, returned from their European trip on June 30th.

Dr. A. E. Kennelly and Howard A. Carson have been given the honorary degree of master of arts by Harvard College. Dr. Kennelly is one of the foremost electrical engineers of the country. Since 1902 he has been professor of electrical engineering at Harvard, and he is a past-president of the American Institute of Electrical Engineers. Mr. Carson is the engineer of the Boston rapid-transit tunnels.

Mrs. W. W. Smith, her daughter Eleanor, aged 25, and son Gerard, aged 21, were killed, it is reported, in the railroad horror at Salisbury, England, on July 1st. Mrs. Smith was the widow of the Mr. Smith of the Smith-Vaile Company, afterward the Stillwell-Bierce & Smith-Vaile Company, and now the Platt Iron Works Company of Dayton, Ohio, manufacturer of waterwheels. The members of the family were making a holiday tour abroad, and in death they were not divided. The son would have graduated from Yale next year.

Louis Cassier of New York, publisher of Cassier's Magazine and the Electrical Age, was, according to the list in the daily newspapers, one of those killed in the frightful railroad accident at Salisbury, England, on July 1st. Mr. Cassier was about 44 years of age and a native of Boston. He was a man of great energy and well known in the mechanical and electrical industries. He attended the Atlantic City convention of the National Electric Light Association a month ago. Mrs. Cassier will have the sympathy of many friends in her sudden and shocking bereavement.

Clarence A. Ross, who has for the last 10 years been identified with the Westighouse Electric and Manufacturing Company, has resigned his position, taking effect July 1st, in order to accept the vice-presidency of the Engineering, Construction and Securities Company of Chicago. Mr. Ross carries into his new position experience in central-station construction and management, having built and managed the Ardmore (I. T.) Electric Company, the Holton (Kan.) Electric Company and the Eldorado Springs (Mo.) Electric Company, being still owner and manager of the plants at Holton and Eldorado Springs.

John E. McDonald of New York took, at the last moment, Mayor McClellan's reservation on the ill-fated boat train from Plymouth to London, and was killed in the railroad disaster at Salisbury, England, on July 1st. He was about 35 years old and for five or six years past had been interested in telephone and real-estate enterprises. He was president of the Boston and New York Telephone and Telegraph Company, president of the Knickerbocker Telephone and Telegraph Company, treasurer of the Massachusetts Telephone and Telegraph Company, treasurer of the Telephone, Telegraph and Cable Company of America, and president of the Thomson Hill Land and Improvement Company.

Electric-light men generally will be interested in the Ajax Line Material Company of Chicago, as organized by Albert Scheible, to make the class of devices for whose improvement Mr. Scheible has been so largely responsible—outdoor lighting specialties. Associated with him, as secretary and treasurer of the new company, is Mr. John F. Turner, who brings with him a fine business record as president and treasurer of the Sanitary Feather Company. The president of the new company, Albert Scheible, graduated at the head of the original class at the Chicago Manual Training School, took honors at Purdue, and added another degree at Cornell, where he was a classmate of Bion J. Arnold, George G. Shepadson and L. B. Marks. He then spent a year at Cleveland as assistant to the superintendent of the Swan Lamp Manufacturing Company, during which year he began his oft-repeated contributions to the electrical journals. Returning to Chicago in May, 1890, he immediately joined Mr. George Cutter, and a month later was attending to the advertising which ever since has reflected Mr. Scheible's individuality. This advertising included a few devices for outdoor lighting, the prospects of which so impressed Mr. Schieble that he made this part of the general line his hobby, and today thousands of users can testify to the practicability of the types designed by him. When the George Cutter Company was organized Mr. Scheible was made secretary and treasurer, which position he held until he sold out his interest a few months ago. During the last few years the added duties of buyer and sales manager left no time for designing, but the number of types now being developed by his new company implies that he may make up for lost time. The Ajax Line Material Company has leased the entire floor of the building at 12 and 14 South Jefferson Street, Chicago, where it will manufacture improved forms of the outdoor lighting specialties originally designed by Mr. Scheible, together with the new types just being brought out under his own patents.

ALBERT SCHEIBLE.

David M. Hyland, for about 35 years connected with the electrical department of the city of Chicago, died at St. Anthony's Hospital in Chicago on June 30th. His health began to fail last January and he had not been well since. Mr. Hyland was born in Lowell, Mass., 58 years ago. He received his education at Notre Dame University. About 35 years ago he entered the fire alarm office of Chicago as lineman in the repair department. Here he learned telegraphy and soon after was made chief operator. For the last six years he was acting assistant city electrician. Last January, when his health began to fail, Mr. Hyland resigned his position. He was well known about the City Hall, where he had many friends. It is said of him that he took but one vacation in nearly 40 years. The funeral services were held at the home of his brother and sister, 1009 Park avenue, who are his only surviving relatives. A number of city officials and employes of the electrical department attended the funeral.

ELECTRIC LIGHTING.

The Alpine Light and Power Company of Alpine, Utah, has recently been incorporated.

John G. Vogel has been granted a franchise for an electric-light and power plant in Argenta, Ark.

S. M. Hexter of Cleveland, Ohio, contemplates putting in an electric-light and power plant in Moberly, Mo.

F. A. Heinze has applied for a franchise to establish an electric-light, power and heating plant in Butte, Mont.

The question of erecting a plant for the lighting and heating of the county jail in Milwaukee, Wis., is being considered by the county commissioners.

Thomas L. Loftis has been granted a franchise to erect an electric-light and power plant for the distribution of electricity throughout the city of Durango, Colo.

The Huntsville (Mo.) Electric Light and Power Company has received a new dynamo, two new boilers and other machinery to fully equip its plant. The company has dismantled the old power-house building and is enlarging and rebuilding it.

City Electrician David Keith and Superintendent Oscar Kleinstuber of Milwaukee are considering the establishing of a small municipal lighting plant on Jones Island in connection with the pumping station. If the council grants permission, a number of arc lights will be placed on the island, and South Water Street may be lighted for a number of blocks by current from the proposed plant. The electrical department is putting in underground cables for the fire-alarm service.

ELECTRIC RAILWAYS.

The La Crosse City Railway Company has been granted a franchise by the City Council to extend its lines to certain streets in La Crosse, Wis.

Dean & Co. of Grand Rapids have purchased the electric-light plant and street railway in Sedalia, Mo., and will make it the center of a system of suburban lines.

The Iowa City (Iowa), Montezuma and Western Railway Company has been incorporated for the purpose of operating an electric railway between Montezuma and Iowa City.

Arrangements have been perfected for the consolidation of the various traction lines entering Meadville, Pa., under the charter of the Meadville Traction Company, with an increase in the capital of the company from $500,000 to $1,250,000. The project also includes the building of an interurban line to reach Conneaut Lake and Linesville, thereby connecting with all railroads.

During the fiscal year ended June 30, 1906, the Northwestern elevated railway in Chicago carried 20,132,871 passengers, an increase of 2,320,046 over 1905. The daily average was 79,816. The revenue from the traffic was $1,456,643. The South Side elevated carried an average daily of 101,770 passengers last month, making a new traffic record. The opening of the Englewood branch has caused the business of this road to increase rapidly. The Metropolitan's gain was the smallest in over a year, the daily average traffic only increasing 7.5 per cent.

Consul Harry A. Conant of Windsor, Ont., writes that the Windsor, Essex and Lake Shore Rapid Railway Company is to be operated by the single-phase alternating-current system. He says the management has found, after comparison with steam and the direct-current system of electric traction, that the cost of equipment and the operating expenses would be less, and a higher speed could be attained.

The control and management of various electric-railway and lighting interests in Schuylkill County, Pennsylvania, have been acquired by J. G. White & Co. In the combination are 15 companies supplying practically all the existing railway and lighting services of Schuylkill County and vicinity. The companies have 57 miles of electric railroad, and about 20 miles of additional track will be constructed. About $1,500,000 will be spent, it is said.

It is now within the range of probability that the first single-phase electric train will run on the New York, New Haven and Hartford Railroad between New York city and Stamford, Conn., before the summer is over. The latest reports from Coscob, where the electric-power station is now being erected by Westinghouse, Church, Kerr & Co., who have charge of the construction of that building, are to the effect that everything is now about ready for the reception of the first instalment of electrical machinery. It was learned that the initial installation of apparatus will have a capacity of 13,000 horsepower, consisting of Westinghouse-Parsons steam turbines and Westinghouse alternating-current single-phase generators. Of the 35 locomotives, which will be operated on the road to begin with, the first are now undergoing practical tests.

POWER TRANSMISSION.

The Pennington Power Company of Tishomingo, I. T., is developing the waterpower of the Pennington and Blue rivers. Electricity will be transmitted to nearby points. W. C. Wells is president, C. B. Burrows treasurer and Stephen C. Treadwell secretary.

Joseph J. Cannon of Salt Lake City has filed applications for permission to appropriate water of creeks in Juab County for power purposes. He proposes to establish two waterpower electric plants and will distribute current for light and power purposes in the vicinity.

PUBLICATIONS.

Allis-Chalmers alternating-current generators of the belted type are fully described in a bulletin just issued by that company. The bulletin describes in detail all the features of these machines, illustrating each part. While direct-current alternators have largely displaced belted machines in modern power stations, still there are many places, particularly in comparatively small installations, where belted units are desired.

The Westinghouse Electric and Manufacturing Company has issued two new bulletins, treating, respectively, of Westinghouse No. 119 railway motors for direct-current service, and electrical and mechanical brakes for Westinghouse type K motors. The former contain the latest improvements in motor construction and combine excellent operating characteristics with sound mechanical construction. The brakes for type K motors have had marked success, especially in the field of electric-crane, hoist, conveyor and similar work.

More than passing notice is to be taken of the new general catalogue of the Cutter Company of Philadelphia, devoted to circuit-breakers. The catalogue is in book form, nine by 11 inches, substantially bound in cloth. It is provided with a thumb index so that the reader may turn with the least delay to any of several different types of circuit-breakers made by this company. Descriptions are given of each type, and on the opposite page is an illustration of the device or diagrams as the case may be. The latter are unusually bold and distinct, owing to the large size of the pages, which has made large cuts possible. Carefully prepared tables give the code word, ratings, calibration and prices of the circuit-breakers. This catalogue will be sent to consulting engineers and users of I. T. E. circuit-breakers without charge.

MISCELLANEOUS.

An electric power plant is to be erected by the Anheuser-Busch Brewing Association. It will be two stories in height and occupy a space 57 by 89 feet at 3000 South Second Street, St. Louis. The estimated cost is $30,000.

It appears that after carefully watching for three years a kilometer's length of telegraph wire in a district not overpopulated with birds, an interested observer has proved that 1½ head of game, such as partridges, pheasants, quail, and so on, are impaled yearly on every wire of this length in France, which means a total all over the country of 40,000 annually. Many of the victims, especially

of the migratory kind, lose their lives through nocturnal flights. In view of these conditions sportsmen in France are strongly in favor of space telegraphy and are advocating its adoption as one of the most valuable game laws. The London Chronicle adds that it would be interesting to find out if in England, also, bird intelligence is still of the pre-telegraphic period.

More than $4,000,000 worth of automobiles were brought into this country during the fiscal year ended June 30, 1906, and more than $3,000,000 worth were exported during the same time. The rapid increase in the use of automobiles is shown in a marked degree both by the figures of the Bureau of Statistics and those of the Bureau of the Census. The value of automobiles manufactured in 1900 is given by the census figures at only $4,748,011 and in 1905 at $26,645,064. The Bureau of Statistic figures will show approximately $4,000,000 worth of automobiles imported in the fiscal year 1906. Reports from United States consuls and others have shown the practical application of automatically propelled vehicles in many of the comparatively undeveloped countries, especially in the tropics, including Mexico, the West India Islands, South America, Africa, India, the Malay peninsula, Java, China, Japan and the Philippine Islands, all of them sections in which animal power for transportation is extremely scarce and development delayed by reason of that scarcity. The proportionately large exportation of automobiles to sections of this character is a suggestion of the practical uses apparently being made in those countries of this class of vehicles.

TRADE NEWS.

The E. M. Reed Electrical Company of Kansas City, Mo., has been incorporated with a capital stock of $20,000.

The Urbana Electric Supply Company of Urbana, Ill., has secured the contract for the electric work to be put in the farm-mechanics building at Illinois University.

The Pacific Electric and Manufacturing Company of Napa, Cal., has been organized to manufacture and sell high-tension switches for indoor and outdoor use, and all high-tension line appliances. The company announces that arrangements have been made with Mr. F. G. Baum for the right to manufacture the oil switches and outdoor switches designed by him and which have been remarkably satisfactory. A bulletin describing the switches and appliances is being gotten out; in the meantime blue prints and prices will be mailed to those requesting.

The Salt Lake City district office of the Westinghouse Electric and Manufacturing Company was removed on July 2, 1906, to 212-214 South West Temple Street, Salt Lake City, Utah. The Dallas district office was also removed on the same date to 418 Main Street, Dallas, Texas.

A Canadian wishes to open correspondence with persons in the United States with a view to selling magnetite (magnetic iron ore), to be shipped from a port on either Lake Ontario or the Bay of Quinte. Information may be obtained by writing to the Bureau of Manufactures, Washington, D. C., and referring to file No. 201.

Exports of manufactures from the United States in May, 1906, were larger than in any preceding month in the history of our export trade, aggregating over $56,000,000, an average of more than $2,000,000 for each business day of the month. This is the showing made by the returns received in the Bureau of Statistics of the Department of Commerce and Labor. For the 11 months ended with May, exports of manufactures aggregated $531,000,000.

In the United States Circuit Court of Appeals for the third circuit, sitting in Philadelphia, Pa., a patent decision was handed down on June 11th in favor of the General Electric Company, which had brought suit against the Garrett Coal Company on the charge that the defendant company had been using series-parallel controllers, manufactured by the Morgan-Gardner Electric Company of Chicago. These controllers, it was alleged, are an infringement upon the plaintiff's patents No. 587,441 and 587,442 of August 3, 1897. This is declared to be an important decision, as it covers a form of controller of which it is said that more than 86,000 have been sold, and which is generally known as the "K" controller.

BUSINESS.

At York, Pa., a few days ago the Heany Fireproof Wire Company purchased the plant of the Norway Iron and Steel Company for a consideration of $366,000. T. A. W. Shock will be the general manager of the new firm, which now has a capitalization of $50,000. The capitalization will be increased to $1,500,000 in the near future. Wire insulating machines will be built in the present machine shop. The foundry shop will be equipped with wire machines. The officers of the new company are: President, W. F. Bay Stewart; treasurer, C. C. Frick; secretary, A. R. Brodbeck, Hanover; directors, R. H. Shindle and D. F. Lafean.

Business of the Stanley-G. I. Electric Manufacturing Company in the territory immediately connected with the Chicago office has been very gratifying, and in order to take care of the increase it has been necessary for the company to establish an office at Omaha, Neb., in addition to the Detroit, Minneapolis, St. Louis and Kansas City offices.

The American Publicity Company, operator of the W. B. Worthy system of automatic railroad advertising, has made Edgar P. Hazazre manager of the electrical department, with offices and shops at 272 South Wood Street, Chicago. Mr. Hazazre would be pleased to receive catalogues and data on construction supplies, time switches, automatic switches, meters, railroad signal devices and general electrical supplies.

The Derby Gas Company of Derby, Conn., has retained W. S. Barstow & Co., 56 Pine Street, New York, as engineers in making extensive additions to its electric power plant and distributing system. The present plant will be remodeled to conform with the new installation. When the plant is completed it will be one of the most modern of its kind and will include some interesting departures from current practice.

As the present equipment of the Foos Gas Engine Company of Springfield, Ohio, is not sufficient to turn out enough engines to meet the increasing demand it has just purchased $20,000 worth of machine tools, consisting of lathes, planers, boring mills, drill presses, grinders, etc. This company has made a steady gain since 1887 and it manufactures high-grade gas and gasoline engines in all sizes and types. With this additional equipment it expects to make prompt delivery of all orders.

The Illinois Steel Company, Chicago, now has on order an aggregate of 8,000 kilowatts in Allis-Chalmers gas-engine generating units, intended for installation in the central power plant at the South Works, South Chicago, to operate on blast-furnace gas. The original order for two engine-generator units was placed some time ago, calling for prime movers of the horizontal, twin-tandem type, 3,000 boiler horsepower, for direct connection to generators of 2,000-kilowatt capacity each, 25 cycles, 6,600 volts, three-phase. The two additional engines and generators recently ordered are to be exact duplicates of the former units.

ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued (United States Patent Office) June 26, 1906.

824,098. Water-level Indicator. John T. Dawes, Liverpool, England. Application filed June 23, 1905.

Various heights of the water level are indicated by circuits which are automatically closed by the rising water and which actuate an annunciator.

824,153. Carbon Holder for Electric Furnaces. George O. Seward, Holcombs Rock, Va., assignor to the Willson Aluminum Company, New York, N. Y. Application filed May 3, 1904.

A bushing screwed on the head of the electrode has a tapered surface, a suspending rod being attached to the bushing and supporting it and the electrode. A ring has a tapered surface by which it is supported upon the bushing, being connected to the latter and to the line.

824,159. Microphone. Franz Treyer, Zurich, Switzerland, assignor to Johann Caspar Ryf, Zurich, Switzerland. Application filed October 3, 1905.

A microphone comprises a vibratory diaphragm, a ring and a disk between which the diaphragm is arranged, an insulated support for the ring provided with antivibratory perforations and loose contact material interposed between the diaphragm and the ring and disk.

824,194. Bearing for Electrical Measuring Instruments. Walter E. McCoy, New York, N. Y., assignor to the Westinghouse Electric and Manufacturing Company, Pittsburg, Pa. Application filed April 18, 1903.

A bearing for an electrical measuring instrument shaft or spindle comprises two jewels having opposing concave bearing surfaces of single uniform curvature and an interposed polished steel ball, the radius of curvature of which is less than that of the bearing surfaces.

824,201. Trolley for Railway Vehicles. John D. Paton, Edgewood Park, Pa., assignor to the Westinghouse Electric and Manufacturing Company, Pittsburg, Pa. Application filed June 28, 1905.

A new form of sliding-contact trolley embodies a contact shoe and a supporting frame, upon which the shoe is pivotally mounted. Links are provided having sliding connections with the frame and pivotal connections with the sides of the shoe, springs opposing movement of the links.

824,206. Selective System. Sylvanus A. Reed, New York, N. Y. Application filed January 23, 1905.

A signaling system comprises a circuit and two oppositely biased electromagnetic annunciators connected in multiple relation therein and each in series with a condenser. Means are provided for impressing current upon the circuit to charge and discharge the condenser surfaces abruptly and gradually, the current in the annunciators due to the abrupt charging or discharging being effectual to overcome the bias tension, and that due to the gradual charging or discharging being ineffectual for that purpose. Means reverse the direction through the annunciators of the current due to the abrupt charging or discharging.

824,213. Brush Holder for Electrical Machines. Robert Siegfried and Norman W. Storer, Pittsburg, Pa., assignors to the Westinghouse Electric and Manufacturing Company, Pittsburg, Pa. Application filed February 12, 1904.

Features of mechanical construction are described, embodying a frame and a brush mounted to slide therein, a spring, one end of which rests upon the brush and the other end of which is attached to the frame, and a steadying arm rigidly fastened to the spring and pivotally attached to the frame.

824,222. Line-connecting Device. Joseph H. Warren, Chicago, Ill., assignor to the Western Electric Company, Chicago, Ill. Application filed June 18, 1904.

A device for connecting a portable telephone to a line consists of a hollow pole comprising a number of removable sections, conductors within the sections, a clip carried by the top section adapted to make electrical connection with an overhead wire, the clip being connected with the conductor within the top section, and metal ferrules for uniting the sections and connecting the conductors.

824,223. Warning Signal for Electric Motor Controllers. William H. Warren, Brooklyn, N. Y., assignor to the Western Electric Company, Chicago, Ill. Application filed October 25, 1905.

Combined with the switching mechanism of a motor controller are a circuit including a signal for indicating safe and unsafe positions of the controller mechanism, and additional switching machanism, which moves with each movement of the controller, to control the signal circuit.

824,225. Voltage Regulator. Ragnar Wikander, Edgewood Park, Pa., assignor to the Westinghouse Electric and Manufacturing Company, Pittsburg, Pa. Application filed June 19, 1905.

Associated with a distributing circuit and a transformer winding having leads from several points therein is a voltage regulator having primary and secondary windings, the inductive relations of which are variable. Means are provided for successively connecting the respective terminals of the secondary winding of the regulator to consecutive leads. (See cut on next page.)

824,237. Controller for Electric Motors. Henry E. Dubois, Grand Rapids, Mich. Application filed January 20, 1906.

The operating shaft of a rheostat carries a wheel rotative on the shaft. A bolt is slidable in the wheel and engages an opening in the shaft, reversing mechanism, a wheel attached thereto. A slide operated by the wheel and means for detachably connecting the slide and bolt are further provided.

824,245. Sparking Igniter. Charles M. Huey, Cleveland, Ohio, assignor of two-thirds to Webster F. Traves, Cleveland, Ohio. Application filed June 24, 1904.

Details are described.

824,251. Telephone System with Centrally Arranged Microphone Battery. Gustaf P. Lambert, Charlottenburg, Germany. Application filed February 14, 1902.

Combined with a central microphone battery are several pairs of jack springs connected to each subscriber's line and in parallel to one pole of the central microphone battery, test rings or sleeves corresponding to each pair of jack springs being connected in parallel to the same pole of the central battery. A plug for the test sleeves of each subscriber's line is provided with a cord having three strands or conductors, two of which are capable of connecting respectively with each pair of jack springs, the third conductor being connected to the other pole of the central battery and to earth. Testing telephones are bridged across the two other cord conductors, induction coils being connected to one pole of the central battery and in parallel to one of the last-mentioned cord conductors. A polarization battery bridges the induction coils and a polarization battery is in one branch of the testing-telephone circuits. (See cut on next page.)

824,262. Electric Time Signal. John M. Powell, Potecasi, N. C. Application filed August 31, 1905.

An electric incandescent lamp is provided with a clockwork mechanism for switching it into circuit at a predetermined time.

824,291. Automatic Telephone Key. Ernest A. Faller and Oscar A. Danielson, New York, N. Y. Application filed October 6, 1904.

In an automatic switch are a spring-controlled switch lever, a detent pivoted thereto, contact springs adapted to be operated by the detent and an electromagnet to disengage the detent from the contact springs.

824,314. Electric Locomotive and Means for Controlling the Same. Frank L. Sessions, Columbus, Ohio, assignor to Joseph A. Jeffrey, Columbus, Ohio. Application filed August 6, 1903.

In an electric haulage system are a motor on the car having a reversible rotary member, a stationary conductor for supplying current to the motor, a cut-out for the conductor, means for establishing a short-circuit through the motor arranged at a point remote from the car and having a circuit through the rotary motor element and a circuit through the stationary motor element. Means are supplied in the circuit through one of the elements for reversing its terminals.

824,320. Process for Refining and Cleansing Coffee. Niels J. H. Weitzmann, Malmoe, Sweden. Application filed December 9, 1904.

A process of refining and cleansing coffee consists in producing a powerful magnetic field, passing the coffee through the field and agitating the coffee during its passage.

824,335. Stop Mechanism for Looms. John W. Bridge, Methuen, Mass., assignor to Arlington Mills, Lawrence, Mass. Application filed May 13, 1905.

A series of magnets are connected in multiple with the electrical source, one magnet of the series for each loom to be controlled. An armature for each magnet is connected with and adapted to control the operative relation of one part of the stop mechanism to the other in that loom.

824,339. Process of Removing Static Electricity. William H. Chapman, Portland, Maine, assignor to the Chapman Electric Neutralizer Company, Portland, Maine. Application filed November 7, 1904.

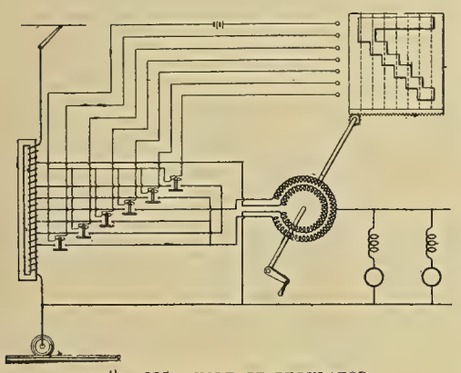
Neutralizing static electricity on a given surface is done by charging a pair of wires, one with a charge of positive and the other with a charge of negative electricity of high voltage and constant polarity, and located so that a given point on the surface to be treated may be brought within the range of convective discharge of both wires at the same time and sufficiently far apart to maintain opposing charges and bringing the surface to be neutralized simultaneously within the active influence of both wires.

824,348. Storage Battery. George A. Ford, Cleveland, Ohio. Application filed July 20, 1904.

An element for a storage battery consists of a plate member having a series of spaced vanes and an auxiliary plate member provided with fins projecting into the spaces between the vanes.

824,351. Telephone Switch Hook. William A. Fricke, Chicago, Ill., assignor of one-half to McMeen & Miller, Chicago, Ill. Application filed November 6, 1905.

Mechanical details are described.



NO. 824,225.—VOLTAGE REGULATOR.

824,364. Electrical Recording Apparatus. James A. Kenny and Chester H. Thordarson, Chicago, Ill. Application filed February 24, 1903.

A registering device upon which individual registrations are severally set up and from which they are collectively transmitted comprises denomination members, which are given a step-by-step movement as the registrations are set up, and an electric make-and-break device which is operated to send out recording impulses as the counting members are restored to zero.

824,376. Telephone System. Wilhelm Ohnesorge, Wilmersdorf, near Berlin, Germany. Application filed February 9, 1906.

A novel feature of the system is that one pole of the central battery being grounded and the other connected to the central station, taken together with the connections to two substations, form the four arms of Wheatstone bridge.

824,397. Electric Gong. William F. Word, Helena, Mont. Application filed March 8, 1905.

A solenoid actuates an arm carrying a hammer for sounding the gong, the return movement of the arm being derived from a spring.

824,430. Signal Apparatus. Frederick Muschenheim, New York, N. Y. Application filed April 2, 1906.

In a signaling system for hotels are a socket in a hall on the exterior of a room, an electric-light bulb adapted to removably engage the same and an annunciator in circuit with the socket.

824,431. Telephone Switchboard. William E. McCormick, Chicago, Ill., assignor to the International Telephone Manufacturing Company, Chicago, Ill. Application filed August 26, 1901.

In a telephone switchboard are a frame, consisting of a front plate having an opening and of a block having a socket, line contacts in the socket and an electromagnet having a sleeve and a tip electrically connected with its coil and adapted to enter the socket and engage with the contacts.

824,439. Automatic Safety Cut-out. Robert Richardson, Allegheny, Pa. Application filed August 25, 1905.

An automatic safety cut-out for electric igniter circuits of gas-engine systems embodies a housing, one of the wires of the igniter circuit passing into the housing and being broken therein, the ends of the broken portions of the wire being provided with stationary contact members and a movable contact member journaled in bearings in the housing. Means hold the contact member in position to close the igniter circuit, and electrical means in circuit with the generator from which the igniter system is fed are adapted to actuate the movable contact member when the degree of voltage of the current passing through the electrical actuating means shall have exceeded a predetermined amount.

824,494. Electric Sign. George R. Macomber, Baltimore, Md. Application filed December 22, 1905.

A lamp in front and in the center of a circular sign bearing curved letters throws the light equally on all the letters. The light is hidden by the reflector, which casts the rays toward the sign only.

824,522. Coin-freed Electric Meter. James Allan, Chiselhurst Common, England. Application filed September 14, 1904.

An attachment to electric meters for regulating the supply of current by prepayment comprises a setting spindle, means controlled by the insertion of a coin enabling the spindle to be rotated, a differential spur-and-pinion gear, gearing respectively with the setting spindle and the meter to be controlled, a pivoted tripping shoe moving with the pinion of the differential gear, an electric switch and a lever actuated by the tripping shoe to close the switch when the setting spindle is rotated.

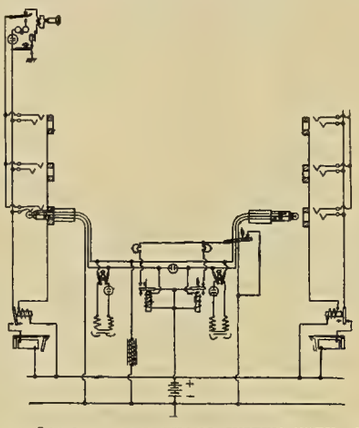
824,580. Signaling Device. Charles C. Phillips, Owensboro, Ky., assignor of one-half to James R. Tennelly, Owensboro, Ky. Application filed March 29, 1906.

A signaling system comprises a normally open circuit, including a lamp and a movable contact member for completing the circuit to light the lamp, and a latch arranged for holding the contact member in normal position with the circuit open.

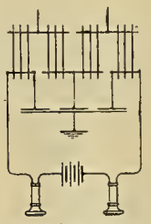
824,611. Trolley Keeper. Benjamin C. Bartlebaugh, Benwood, W. Va., assignor of one-half to Joseph Mahood, Charles A. Barlow and Paul Riedel, Benwood, W. Va. Application filed September 12, 1905.

A trolley keeper comprises a keeper plate, an arm carried thereby and adapted to extend over the trolley wire and to associate with the trolley wheel, means for normally retaining the arm over the wire, means carried by the plate for shifting the arm and an adjustable weight carried by the plate.

824,625. Rail Bond. John P. Clark, Ypsilanti, Mich. Application filed October 23, 1905.



NO. 824,251.—TELEPHONE SYSTEM WITH CENTRAL MICROPHONE BATTERY.



NO. 824,676.—SPACE-TELEGRAPH SYSTEM.

The rail bond has a terminal provided with a piece of wire cloth on its under side, which is extended laterally beyond the sides of the terminals.

824,629. System of Control for Electric Motors. William T. Dean and Rudolph Tschentscher, Chicago, Ill., assignors to the Electric Controller and Supply Company, Cleveland, Ohio. Application filed November 2, 1905.

A system for controlling an electric motor consists of a master controller connected to the apparatus of the system by but two wires, a motor-reversing switch including main and auxiliary contacts governed by the controller, a motor-controlling switch or switches having an actuating coil or coils in circuit with certain of the auxiliary contacts, and means for preventing the current flowing to the auxiliary contacts until after the circuit of the main contacts has been completed at the reversing switch.

824,637. Oscillation Responsive Device. Lee De Forest, New York, N. Y. Application filed January 18, 1906.

Features of the device are a partially exhausted receptacle, two separated electrodes sealed in the receptacle and each forming part of a separate electric circuit, a separate source of electric current for each circuit and means whereby electrical oscillations may be impressed upon the gaseous medium intervening between the electrodes.

824,643. Electric Heating Device. Ingebrigt Grettum and Oscar L. Young, Duluth, Minn. Application filed August 31, 1905.

Combined with a boiler provided with suitable flues are carbon conductors within the flues, insulating tubes surrounding the conductors, covering plates on the ends of the conductors and terminal lugs having threaded ends engaging the conductors and provided with longitudinal slots and set-screws to secure the wire therein, the lugs serving to secure the cover plates in position.

824,646. Elevator Safety Mechanism. George Hail, Providence, R. I. Application filed September 6, 1904.

In combination with an elevator car and an oscillatory controller are an electrical circuit, door-controlled switches in the circuit, a movable segmental locking-member extending along the path of movement of the controller and an electromagnet on the car and in the circuit and adapted to move the locking member to lock the controller.

824,658. Governing-valve Mechanism for Turbines. Oscar Junggren, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Original application filed August 26, 1902. Divided and this application filed April 29, 1903. Renewed March 23, 1906.

A casing with a valve mounted therein has a mass of magnetic material secured to the valve and located within the casing. A magnet having poles is mounted on the outside of the casing, which acts on the mass, and a transversely extending plate of non-magnetic material is located between the ends of the magnet poles and the mass, which prevents the escape of fluid.

824,676. Wireless-telegraph System. Harry Shoemaker, Philadelphia, Pa., assignor to Marie V. Gehring, Philadelphia, Pa., and International Wireless Telegraph Company. Application filed February 16, 1903.

In a wireless signaling system are an aerial conductor, an earth connection, wave-responsive devices connected in parallel with each other and connected to separate condensers between the aerial conductor and earth connection, and a local circuit including the wave-responsive devices connected in series with each other. (See cut.)

824,682. Method of Practicing Wireless Telegraphy. André Blondel, Paris, France. Original application filed December 3, 1900. Divided and this application filed February 7, 1905.

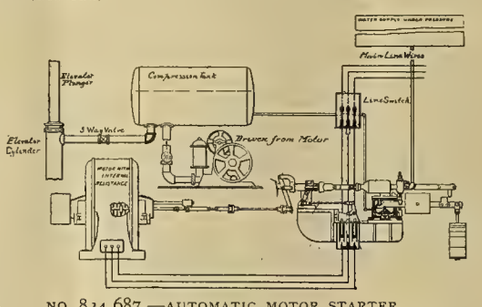
The method of wireless telegraphy consists in producing at one or more transmitting stations electromagnetic waves in groups of different predetermined frequencies and actuating at one or more receiving stations signal-receiving instruments each selectively with one of the different transmitted group frequencies.

824,684. Thermo-electric Battery and Apparatus. George H. Cove, Roxbury, Mass., assignor of one-half to Charles M. Bunker and one-half to Frank R. Kimball, Boston, Mass. Application filed February 15, 1905.

A thermo-electric battery and appurtenances comprises a block of incombustible, non-conductive material, a series of pairs of elements comprising elements formed of an alloy of antimony and zinc and elements connecting the antimony and zinc elements, the elements connecting the first-mentioned elements being alternately of copper and of an alloy of nickel, copper and zinc.

824,687. Automatic Starter for Motors. Arthur W. Darby, Holyoke, Mass. Application filed November 21, 1903.

An electric motor for actuating a device to supply pressure to a tank is provided with resistance, resistance-controlling mechanism, a mechanically operated valve-operating device, a valve connected therewith, an actuator, a piston connected with the actuator and operated by fluid admitted by the valve, means for supplying pressure to the piston through the valve mechanism, a switch connected with the actuator to be operated before movement of the resistance mechanism and connections between the actuator and resistance-operating mechanism. (See cut.)



NO. 824,687.—AUTOMATIC MOTOR STARTER.

824,696. Alternating-current Electrical Measuring Instrument. Edwin E. Lehr, Wilkinsburg, Pa., assignor to the Westinghouse Electric and Manufacturing Company, Pittsburg, Pa. Application filed November 21, 1903. Original application filed June 24, 1904.

An electric measuring instrument comprises a laminated magnetizable core, composed of two approximately annular portions, one within the other and joined by means of a substantially radial portion, a stationary winding on a portion of the core and a movable coil in series with the stationary winding and surrounding one of the annular portions of the core.

PATENTS THAT HAVE EXPIRED.

Following is a list of electrical patents (issued by the United States Patent Office) that expired on July 2, 1906:

406,041. Insulator for Electric Wires. J. C. Gill, Covington, Ky.
406,057. Electric Signaling Device. J. C. O'Neil, Cleveland, Ohio.
406,068. Wire Cable. D. Tufts, Pittsburg, Pa.
406,130. Manufacture of Incandescent Electric Lamps. T. A. Edison, Llewellyn Park, N. J.
406,168. Electric Battery. C. A. Hussey, New York, N. Y.
406,169. Electric Battery. C. A. Hussey, New York, N. Y.
406,172. Electric Registering Apparatus. J. A. Lannert, Cleveland, Ohio.
406,223. Galvanic Battery. J. E. Lee, Conshohocken, Pa.
406,231. Device for Automatically Manipulating the Valves of High-vacuum Pumps. E. B. Nicolaus, Cleveland, Ohio.
406,267. Insulating Plate for Secondary Batteries. S. C. C. Currie, Philadelphia, Pa.
406,284. Insulated Electric Wire. H. W. Jones, Jr., New York, N. Y.
406,291. Electrical Type-writing Machine. J. F. McLaughlin, Philadelphia, Pa.
406,292. Type-writing Machine. J. F. McLaughlin, Philadelphia, Pa.
406,293. Combined Electric Bell and Annunciator. J. F. McLaughlin, Philadelphia, Pa.
406,294. Electric Trembler Bell. J. F. McLaughlin, Philadelphia, Pa.
406,299. Electric Photographic Light Apparatus. L. C. Overpeck, Hamilton, Ohio.
406,300. Cable Grip. J. H. Pendleton, Brooklyn, and A. Bryson, Jr., and C. Tiers, New York, N. Y.
406,301. Cable Railway Grip. J. H. Pendleton, Brooklyn, N. Y., and A. Bryson, Jr., New York, N. Y.
406,302. Cable Railway Structure. J. H. Pendleton, Brooklyn, and Andrew Bryson, Jr., New York, N. Y.
406,303. Cable Railway. J. H. Pendleton, Brooklyn, and A. Bryson, Jr., New York, N. Y.
406,331. Electric Coupling and Circuit-closer. W. H. Baker, Chicago, Ill.
406,341. Electrical Fire Extinguisher. T. R. Douse, Chatham, county of Kent, England.
406,354. System for Charging and Discharging Storage Batteries. William P. Kookogey, Brooklyn, N. Y.
406,377. Annunciator. A. A. Vanderpool, Newark, N. J.
406,390. Electrical Typewriter. M. W. Dewey, Syracuse, N. Y.
406,406. Telegraph Pole. C. M. Russell, Bowling Green, Ky.

WESTERN ELECTRICIAN

EVERY SATURDAY

Vol. XXXIX. CHICAGO, JULY 14, 1906 No. 2

The New Belfast Municipal Power Plant.

By Frank C. Perkins.

The accompanying illustrations show the details of construction and arrangement of the boilers, engines, electrical generators and auxiliary apparatus of the new power station of the Belfast (Ireland) electric-railway system.

The power house is constructed of steel and brick and was built by McLaughlin & Harvey of Belfast at an expense of about $100,000, being constructed on 1,750 piles driven through 30 feet of river mud down to bed rock as a foundation. The building has a frontage of 180 feet and extends 138 feet on Allagan Bank Road. It is equipped with a coal-conveying plant, as shown in Fig. 2, installed by Babcock & Wilcox, Limited, from designs of the city electrical engineer, Victor A. H. McCowan. The fuel is brought in barges up the river and is discharged by a grab, operated by electric crane, the coal being deposited in the hopper of an Ingray automatic weighing machine, which discharges it into a hopper below. From this hopper it passes into an automatic filler, through a chute, which fills the buckets of the conveyor. The fuel is then elevated and is carried across the Lagan Bank road by the conveyor, through the covered way shown in the illustration, to the power house.

The fuel is carried above the level of the coal bunkers, each of which is provided with a pair of dumping cams, so that the fuel is deposited where desired. The coal bunkers are construction of steel and have a capacity of 1,000 tons. The conveyor runs above the coal bunkers the whole length of the boiler house and above the boilers, descending at the end wall. The conveyor then passes through the basement and conveys the ashes from below the boilers, rising at the other end of the boiler house and crossing the road again through the covered way, depositing the ashes at the river side into the ash hopper. The ashes may be discharged into barges or carts by means of regulating valves in the chute. This conveyor is of the endless-chain type and has gravity buckets operating at a speed of 50 feet a minute and capable of handling 50 tons of coal an hour. The conveyor is driven by an electric motor by a special frictionless drive, with pawls, which engage in the chain on both sides of the bucket, the total length of the conveyor being only 1,000 feet.

On the bank of the River Lagan a cofferdam, 130 feet long, has been constructed, and the pump house is located at this point. It is built of red brick, with stone dressings of the same type as the power house, and measures 16½ feet wide and 68 feet long. This pump house, in which are the condensing-water pumps, cost about $30,000, and was built by Courtney & Co. of Belfast. The condensing plant is of the counter-current surface type, with three-throw Edwards air pumps.

Condensed steam is piped into a common main and flows by gravity into a collecting tank, while a small motor-driven centrifugal pump delivers the water from this tank into the feed-water tank at a higher level, the speed of this centrifugal pump being regulated by means of a float in the collecting tank.

There are three exhaust-steam oil separators, each capable of handling 18,000 pounds of exhaust steam an hour from the triple-expansion engines. These separators are 3½ feet wide, 6½ feet long and eight feet high, and were constructed by the Worthington Pump Company, Limited, with 18-inch outlets and exhaust inlet.

The boiler room for the extension of the power station, which is shown in section in Fig. 3, is equipped with four new water-tube boilers, with natural draft, and capable of evaporating 20,000 pounds of water per hour each, with a working pressure of 200 pounds a square inch. These boilers are arranged in two batteries, each boiler being provided with an economizer behind it of 128 tubes opening directly into the main flue, and a superheater having a heating surface of 900 square feet and capable of superheating 150° F. The boilers each have a grate area of 100 square feet and are provided with chain-grate stokers driven by an electrically operated line shaft below the floor. The boilers have each a heating surface of 5,764 square feet, and they are all lagged with non-conducting material. The economizers are equipped with motor-driven scrapers. The motor-driven variable-stroke triple-barrel pumps of the Sinclair type which have been provided are each capable of delivering to the boiler 8,000 gallons of water an hour against the boiler pressure. The feed-pump equipment also includes a vertical compound direct-acting steam pump capable of delivering 8,000 gallons an hour.

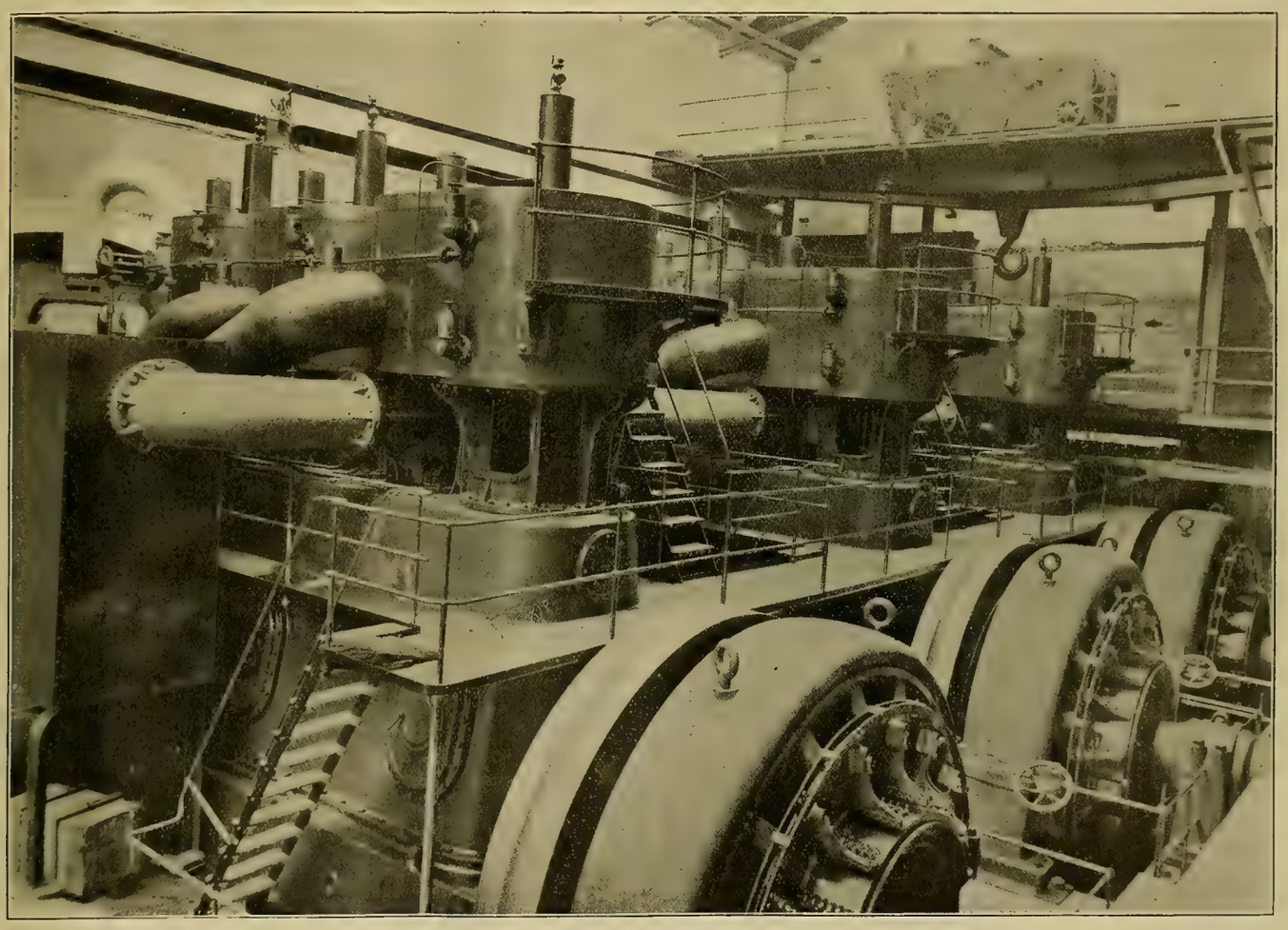


FIG. I. INTERIOR OF ENGINE ROOM OF NEW BELFAST RAILWAY POWER PLANT.

The steam from one boiler and one economizer is delivered through an eight-inch steam pipe, this outfit forming a single unit, with a 10-inch steam main acting as an equalizer between the several units. The steam is delivered to the 1,500-horse-power enclosed high-speed engines, shown in Fig. 1. Space has been provided for six such units. Each engine is directly coupled to a 1,000-kilowatt compound-wound continuous-current generator, three of which are seen in the illustration as at present installed.

These inverted vertical triple-expansion engines were constructed by Combe & Barbour of Belfast and have a stroke of 24 inches, with high and low-pressure cylinders measuring 22 inches and 50 inches in diameter, respectively, and the intermediate cylinder 33 inches in diameter. The steam is delivered at 160° F. superheat and a pressure of 170 pounds a square inch, driving the engine at a speed of 180 revolutions a minute. These engines are designed to carry an overload of 50 per cent. for short periods, the normal output at full load being 1,550 horsepower. Each engine is provided

with a flywheel, which, together with the armature of the dynamo, has an energy of 2,560 foot-tons when running at normal speed. The generators are driven by these high-speed engines at 180 revolutions a minute, and the regulation is said to be excellent, the governor being adjusted to permit of a momentary variation of speed of not more than four per cent., which is well within the specified limit of six per cent. when the load is suddenly thrown off, and a permanent variation of not more than 2½ per cent.

The multipolar railway generators of the direct-current type installed in the Belfast plant are of the slotted-armature type constructed by the British Westinghouse Company, and capable of withstanding an overload of 25 per cent. for a quarter of an hour, the normal output being 1,000 kilowatts. These machines may be operated as shunt or compound-wound generators, and at a speed of 180 revolutions a minute deliver a continuous current at 450 volts, 500 volts or 550 volts, according to their operation as shunt or compound-wound machines.

A sub-station has been installed at the Fort William depot with two motor-generators of the Westinghouse three-phase type, each having a capacity of 250 kilowatts. These machines each consist of a three-phase synchronous motor and a direct-current generator. The sub-station may be operated with continuous current from the traction or lighting switchboards at a pressure of 500 to 550 volts, and generate three-phase current direct at 6,000 volts, 50 cycles, when running at 500 revolutions a minute. The alternating-current three-phase generators are of the revolving-field 12-pole type, and the direct-current motors are of the six-pole type. They are mounted on a common bedplate. On one end of the shaft an exciter is provided for supplying the alternator field current.

In the sub-station there is three-phase synchronous motor-generator of 125 kilowatts, similar to the above, except that the set is provided with a small three-phase induction motor for starting, mounted on the opposite end of the shaft to the exciter. Current is supplied from the power station at 6,000 volts by a large alternator unit and is transformed down to a working pressure by this equipment. A storage-battery installation is soon be added for regulating purposes.

Recently the Belfast street-railway system has been electrified, the entire equipment having been changed within the period from January, 1905, to November of the same year, which is a notable engineering feat, when it is considered that the system comprises 80 miles, measured as single track.

Double lines were constructed on all the routes to a gauge of four feet nine inches, and the new rails laid are in 45-foot lengths and weigh 105 pounds a yard on the straight and 111 pounds a yard on the curves. The rails are required to withstand a test of tensile strength not less than 40 tons to the square inch.

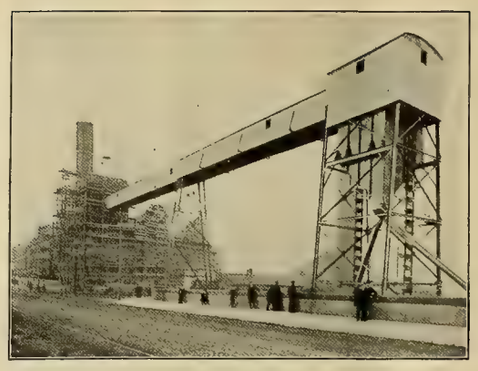


FIG. 2. COAL AND ASH CONVEYOR OF NEW BELFAST POWER PLANT.

In this line there are 170 cars in operation, constructed by the Brush Electrical Engineering Company, Limited, of Loughborough, England. They are of the single-truck double-decked type, having a length over all of 28 feet, a width of seven feet and a height of a trifle over 13 feet. They are designed to carry 22 passengers inside and 32 outside, and have a wheel base of six feet six inches. The diameter of the wheels is a trifle less than 32 inches. The motors are of the Westinghouse type, and are manipulated by series-parallel controllers.

The entire installation of the Belfast corporation electric tramways was carried out by J. G. White & Co., Limited, of London, and the power station is one of the most complete and entirely up-to-date plants in Europe of its type.

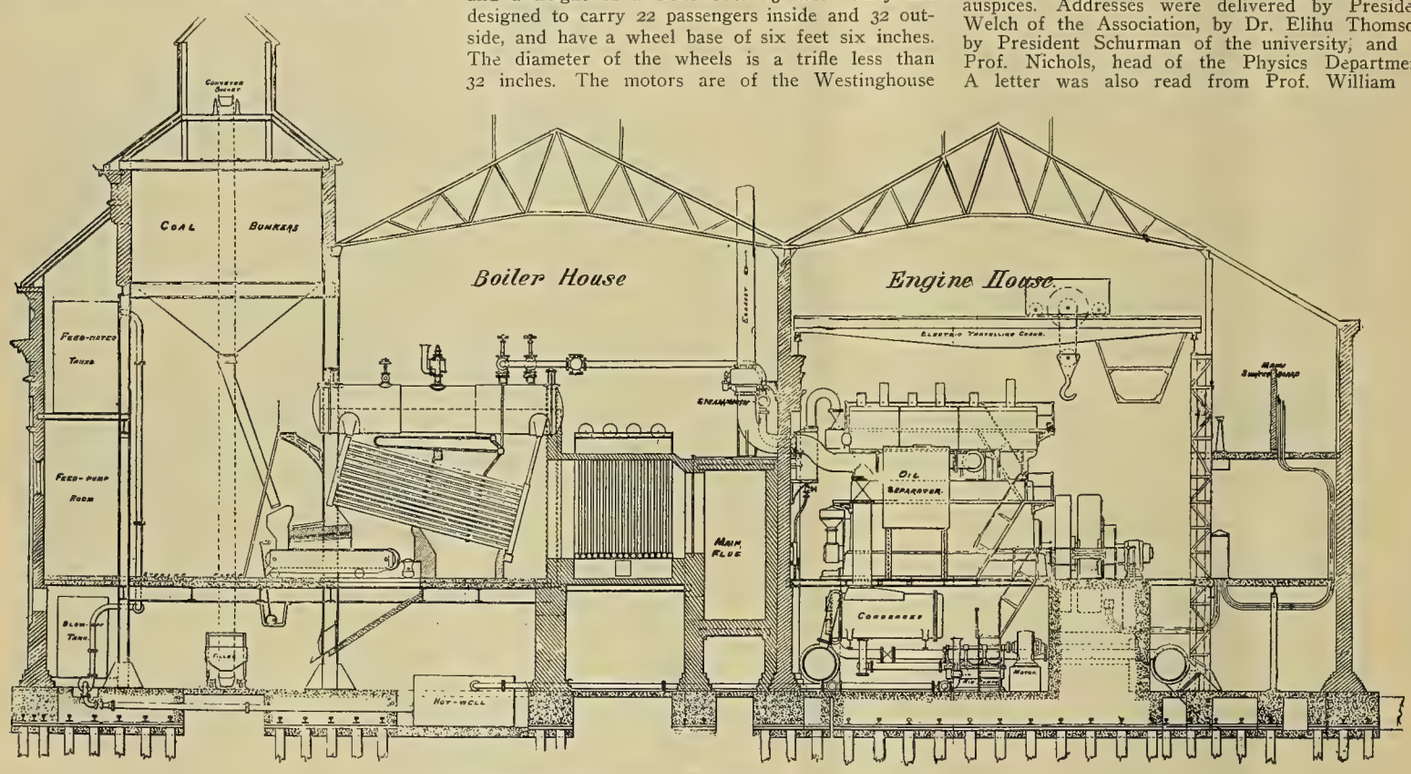


FIG. 3. CROSS-SECTION OF THE NEW BELFAST RAILWAY POWER HOUSE.

Stanislaus River Power Scheme in California to Be Completed.

The Stanislaus Electric Power Company, which is again occupying its San Francisco offices on the ninth floor of the Kohl Building, is now in the market for electric and hydraulic machinery for its 40,000-horsepower hydro-electric plant on the Stanislaus River, near Vallecito, where engineer's headquarters have been established on a large scale. Sanderson & Porter of New York are among the company's consulting engineers, and a large staff of Pacific Coast and Eastern engineers has been retained in various capacities. It will take about two years to complete the 128-mile transmission system to San Francisco, although some power may be supplied to mining plants in the mountains a little earlier. The initial installation will consist of three three-phase generators of about 5,000 kilowatts each, direct-connected to three water-wheels operating under a 1,500-foot head. The Stanislaus Electric Power Company has no direct connection with the San Francisco Coke and Gas Company, but certain prominent capitalists are interested in both companies, and the Knickerbocker Trust Company of New York is trustee for both. When electric power is ready to be delivered in San Francisco it is more than likely that the two concerns will work harmoniously together in supplying light and power. The San Francisco Coke and Gas Company lost most of its customers by the fire, but has extended its mains into the unburned district and has resumed the furnishing of gas from its plant at North Beach.

The Dedication of Rockefeller Hall of Physics, Cornell University.

An important feature of the midsummer meeting of the American Association for the Advancement of Science was the dedication of Rockefeller Hall of Physics at Cornell University, Ithaca, N. Y. This building is said to be the largest in the country for college-laboratory work, having a floor space of 20,000 square meters. The building has facilities for routine instruction of large numbers of students, and it also supplies ample quarters for purposes of research. The cost of the building, including the new equipment which will be installed, will be nearly $300,000.

The university was most fortunate in arranging for the dedication at the time of the meeting of the American Association, as it made possible the opening of the building under the most desirable auspices. Addresses were delivered by President Welch of the Association, by Dr. Elihu Thomson, by President Schurman of the university, and by Prof. Nichols, head of the Physics Department. A letter was also read from Prof. William A. Anthony, who preceded Prof. Nichols as director of the Physical Laboratory. The information brought out by these various speakers is so interesting that brief synopses of the addresses are given.

Prof. Nichols, in expressing his appreciation of the increased facilities offered for the study of physics, traced briefly the growth of the work of this department. When laboratory instruction was first given the teaching force comprised Professors Anthony and Moler, and Franklin Hall, which was built in 1883 to accommodate both physics and chemistry, was supposed to be ample for all time. It contained a physics lecture room with a seating capacity of 150 and a corresponding laboratory which would accommodate 80 students. Next year the teaching force will consist of 26 men, and the new building, with several acres of floor space, will be none too large for the 2,000 students who will receive instruction in physics. The entire ground floor of this building will be used for the purpose of investigation, while the larger part of the remainder will be occupied by students in regular courses.

Prof. Anthony implanted in the minds of his students, some of whom have succeeded him in the work of instruction, a real love for science. The spirit of Prof. Anthony still permeates the department, just as the spirit of such leaders as Gauss and Weber remained at Göttingen 25 years after their death. There are several tangible evidences of the work of the early days which form important historical relics. The old Gramme machine, the first dynamo built in America (1875), has been exhibited at several expositions and is still in good order. This machine furnished arc lights on the campus and current for experimentation long before commercial electric lighting was

a reality. These lights were supplied with current over hand-made underground cables of crude but electrically perfect design. An electrolytic gas generator was also constructed, and a great tangent galvanometer attracted universal attention. Prof. Anthony also was among the first to recommend and to put into operation a course in electrical engineering. He was always interested in the new departures in physics, and consequetly was attracted by the possibilities of electric lighting and other applications of the electric current. The electrical engineering course, therefore, is another feature of Prof. Anthony's work.

Prof. Anthony was detained from the exercises on account of ill health, but sent a letter which is of such historical value that it is here given in full.

Prof. Anthony on the Beginning of Physics at Cornell.

"I can best give an account of 'The Beginning of Physics at Cornell' by giving a brief history of my own connection with the Physical Department.

"I was called to the chair of physics in the summer of 1872. I was unable to assume the duties of the department until December of that year. When I arrived at Ithaca in November I found the physics and chemical departments had been housed in a large barn-like wooden building and that physics had been taught only by lectures without any attempt at laboratory work. I found that the McGraw Building had just been completed and that a lecture room for physics had been provided for in the south end of that building. The seats in that lecture room had been so much raised toward the back as to leave a very considerable space under them, sufficient to provide for a small apparatus room.

"My first duty was to move the belongings of the physical department into the new quarters provided for it. This I did during the Christmas vacation of 1872. For 11 years this was the home of the physical department at Cornell. It has always been a hobby of mine to establish a physical laboratory where students should themselves perform the physical experiments and become familiar with the manipulation of physical apparatus.

"In 1861, in an academy in Delaware County, New York, where I was instructor in natural sciences, I had a class of about a dozen students in physics, and instead of performing the illustrative experiments myself, at the regular session of the class during the week, I arranged with the students to devote the whole of Saturday morning to the performance of these illustrative experiments with their own hands. When I left that institution to perform similar work at Antioch College, I adopted the same plan and extended the work somewhat in the direction of the performance of quantitative experiments. Later, at the Iowa State Agricultural College, I extended this physical laboratory still further, and to the end.

"When I came to Cornell in 1872 it was with the idea that there I should find opportunity to extend the physical-laboratory work and make it a more prominent feature of the physical instruction. The space at command, however, and the apparatus available, did not permit of the organization of any regular physical-laboratory course. I did, however, make use of the physical lecture room during the afternoons and of the space under the seats in the back of the room, and also of two or thre erooms that were assigned to me in the south building for some physical-laboratory work, and a number of students availed themselves of the opportunity to become familiar with physical manipulation. Your present head of the physical department was one of these, and I think he will remember some of the work which he did in the little rooms on the second floor of the south building. I have always flattered myself that there he obtained the taste for physical work which led him to Germany immediately after his graduation, to take up the work there, where it could be carried out on a larger scale, with better facilities, and under more favorable auspices.

"In 1875 the old Gramme machine, which has become a historical piece of apparatus, was constructed, Professor Moler and mystelf doing much of the actual work of construction during the summer vacation. Two rooms in the basement of the south building were assigned to the physical department for the installation of this machine and an oil engine to drive it, together with a quantity of apparatus which was designed and constructed at the university for the purpose of making tests of the performance of this machine. From that time on to the time I left the university in 1887 the machine was used almost continuously by the students and furnished the means for a large amount of new physical experimentation. It also furnished lights for the electric lanterns used in the physical lectures, as well as current for numerous lecture experiments in electricity. It also for some years furnished arc lights for the university campus.

"During all those years, from 1872 to 1880, I was continually agitating the subject of larger quarters for the department of physics, with especial provision for physical-laboratory work, especially of a quantitative nature. In 1880, I think it was, the trustees made an appropriation of $50,000 for a new physical building, and I immediately began to devise plans for such a building as I thought would meet the demands for physical instruction at Cornell for a great many years to come. But no sooner had it been noised about that an appropriation had been made for a new building for the physical department than the chemical department began to agitate the question of putting up a building for both chemistry and physics, and so permitting the removal of the chemical department from the old wooden barn which had been its home for 15 years. It was finally decided to build such a building. Plans were drawn for it and the work actually commenced in 1881. This was the beginning of Franklin Hall.

"It was arranged that the physical department should occupy the basement and first floor and the chemical department the second and third floors. A physical lecture room seating between 140 and 150 students was provided for, and this, at that time, was deemed extravagantly large. This building was completed in 1883, and in the summer of that year the physical department was moved into it. A regular physical-laboratory course, consisting largely of quantitative experiments, was then laid out, and the work was carried on in the basement and first floor of the building for four or five years. The number of students at Cornell, however, rapidly increased, and before I left the university in 1887 the quarters for the physical department had become too small.

"Not long after this a new building was erected for the chemical department, and when that was completed the entire space that had been occupied by the chemical department in Franklin Hall was turned over to the department of physics, and the physical laboratory extended to occupy the whole building. The lectures in general physics, however, had to be given in the physical lecture room, and to accommodate the increasing number of students the lectures had to be repeated. For the last two or three years, I am told, it has been necessary to give the lectures five or six times over in order to reach all students, who are required to take the course in a lecture room which at the time the building was planned was considered to be extravagantly large.

"Such were the 'Beginnings of Physics' and the development of the physical department during the first 20 years of the existence of Cornell Univirsity.

"Now, after nearly 40 years of continued growth, the department is enabled to move into the magnificent new quarters provided in Rockefeller Hall, where a lecture room capable of seating 600 students and having facilities for every type of physical demonstration has been provided, and where provision has been made for every line of physical experimentation and investigation on a scale that I could hardly have conceived of when Franklin Hall was planned. I congratulate the faculty of physics upon the means they now have at their disposal of carrying on the work of the physical department, and I especially congratulate the students of Cornell University, not only those now here, but those to come, upon the opportunities that they will find here for pursuing the subject which treats of those matters with which all of us have to deal in the course of everyday life."

NEW ROCKEFELLER HALL OF PHYSICS, CORNELL UNIVERSITY.

Elihu Thomson's Address.

The address of Prof. Elihu Thomson on "Physical Research in Relation to the Industrial Arts" was a most timely contribution bearing upon the intimate connection which must exist between science and industry, while at the same time emphasis was laid upon the necessity for research in pure science. Investigations made without immediate applicability in the industries are of prime importance, but it is also true that when the result are found to benefit the industries the research acquires an added importance and commands wide attention. Often a discovery which when made was without apparent utility has later become the basis of a great industry. All research is useful; all acquired knowledge is essentially utilitarian.

It has come to be recognized that the usefulness of ascertained truth may be safely left to take care of itself. As an example may be taken the work of Faraday, undertaken in the spirit of pure science, and yet it now forms the basis of the almost unlimited applications of electricity. From Davy's experiment has sprung the entire industry of electric lighting. From the model dynamo built by the Italian professor, Paccinotti, has developed the modern continuous-current dynamo.

The necessity for scientific basis in the industries is shown by the research laboratories, which are now used in connection with the large manufacturing organizations. These laboratories must, however, produce commercial results, so that there is still a large and separate field for the laboratory devoted to research in pure science. Students in the laboratory should realize that scientific investigation does not consist merely of a collection of data, a tabulation of information, accurate and useful as they may be. Such work is the bookkeeping of science, and the ideal is to obtain from these facts a guiding principle, the imagination of possible truth, an attempt at generalization, a working hypothesis.

The technician is in great need of a scientific foundation for his work. So many new developments are arising in engineering that these require most careful scientific investigation to see their underlying principles. Such work as this is now being illustrated in the development of the steam-turbine engine, which has led to extended research into the many problems connected with steam at various pressures and temperatures and the conditions for the most economical utilization of the contained energy. Again, work carried on in the scientific spirit promises to more than double the efficiency of the incandescent lamp. These are but illustrations of the principle.

Finally, the object of science is the attainment of truth, regardless of opinion or precedent. It can well dispense with impressive ceremony in the dedication of its temples, the laboratories. It has no misgivings as to future value of its work in the affairs of men. Its temple must always be that of humanity in the face of many mysteries and unsolved problems of the physical universe. The work can never reach a limit, for each advance discloses new paths and raises new questions to be answered if possible by future research. We may be assured that in the future, as it has been in the past, the results will often directly inure in the improvement of existing industrial arts and give rise to new practical work. Let research be unrestricted by any utilitarian idea; let knowledge be sought out for its own sake; but let us also rejoice when knowledge can be made useful to humanity.

Grading on the traction line between Versailles and Frankfort, a continuation of the line from Lexington to Versailles, Ky., has been commenced. Work will be finished within 10 months. A large power house to furnish power for all the Central Kentucky traction lines will be built at some point on the Kentucky River. The plant will cost $500,000.

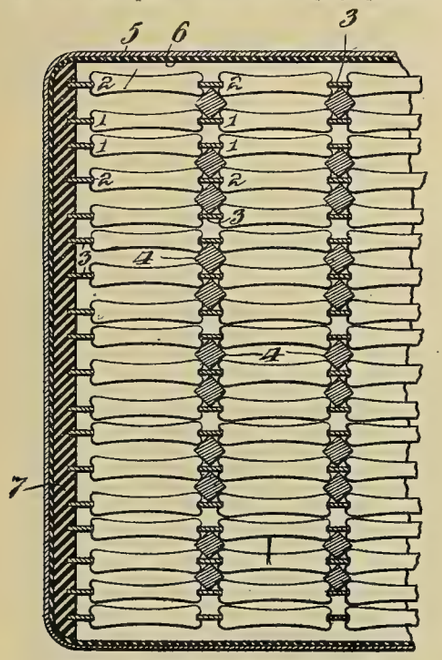
Edison Iron-nickel Storage Battery.

Mention was made in the Western Electrician of June 2d of the issuance of a patent to Thomas A. Edison for a form of iron-nickel storage battery. So much has been said concerning the Edison storage battery and its possibilities that the opportunity is here taken to give a brief description of the battery, as improved by this later patent.

The invention relates to improvements in storage batteries of the type wherein the active materials containing, respectively, nickel and iron, are maintained under pressure in small pockets or receptacles made of perforated sheet metal and held in position in suitable grids.

In practice Mr. Edison found that, bulk for bulk, finely divided iron obtained by reducing ferric oxide is much more active electrolytically than the nickel hydroxide that he has so far been able to obtain commercially. Consequently to present the best combination for practical use the bulk of iron used need be only half that of the nickel.

If the attempt is made to employ pockets of



EDISON IRON-NICKEL STORAGE BATTERY.

nickel of twice the capacity of the iron pockets the surface in contact with the metal walls is not large enough to provide for the proper discharge rate. Furthermore, such an arrangement would be undesirable commercially, for the reason that it would necessitate the employment of widely different machines for manufacturing and assembling the nickel and iron grids and also because the great bulk of nickel used would necessitate pockets of prohibitively thick metal in order to accommodate the swelling, and, finally, because with a thick mass of nickel the proper circulation of the electrolyte could not be secured.

By making the pockets for the nickel of substantially the same size as those for the iron and by using twice as many nickel grids as iron grids a practically useful combination is secured. Furthermore, the space between the adjacent nickel pockets provides for opportunity for any swelling to take place. Heretofore in the construction of the battery Mr. Edison has employed insulating separators between the several grids; but he finds that these separators are not necessary between the adjacent nickel grids, which may therefore be allowed to swell, so as to touch each other without affecting the circulation of the electrolyte or the general operation of the battery. A saving is thus effected in lateral space, and the objections due to swelling of the active materials, and particularly the nickel hydroxide, are reduced.

The accompanying illustration is a cross-sectional view through one of the improved storage batteries embodying the invention and showing the preferred form of separators.

In the diagram, (11) represent nickel pockets, and (22) iron pockets, the former being arranged in pairs, as shown. The several pockets contain the active material in pulverized form and are secured in position within suitable grids (3) in the usual way. Insulating separators are employed between the iron pockets and the adjacent nickel pockets to prevent the pockets from contacting under the effect of swelling of the active materials; but, preferably, separators are not employed between the adjacent nickel pockets, which may swell, so as to actually touch, without objection. By dispensing with separators between the nickel pockets space enough is obtained in which the entire expansion may take place. The separators preferably used are diamond-shaped in cross-section. These separators are made of hard rubber, preferably by cutting a sheet into sections. The separators are so proportioned that each engages the rounded corners of four of the pockets, while at the same time the adjacent grids are spaced a distance determined by the length of one of the diagonals of each separator. With this arrangement the adjacent pockets will be always effectively separated.

The several electrodes are assembled in any suitable can or receptacle (5), lined with a sheet of hard rubber (6) or other insulating material, and are spaced at their ends by slotted separating bars (7) in the usual way.

Lamme Induction Motor.

It is generally understood that a polyphase motor requires a higher secondary resistance when starting than when running in order to insure a large starting torque. In a single-phase motor it is still more important that the secondary winding have a relatively low resistance when running, since the maximum torque or "pull-out" torque of the motor is dependent upon the amount of resistance in the secondary circuit, while in a polyphase motor the pull-out torque is independent of such resistance.

Since such a single-phase motor is a polyphase motor at the start, it should have for economical starting a secondary winding of relatively high resistance and for running a secondary winding of comparatively low resistance in order to obtain the desired pull-out torque. It follows, therefore, that if a secondary winding can be so designed that it will have a high resistance under starting conditions and a low resistance when the motor is running, without the employment of variable resistance or short-circuiting devices, it will furnish an ideal construction for induction motors. This condition cannot readily be obtained if the same number of primary magnetic poles is used in starting as in running; but if the number of poles in starting is different from that when running an arrangement of secondary winding can be adopted which will give circuits having different resistances for starting and running, due to the fact that the secondary circuits are different for different numbers of magnetic poles in the primary member.

A motor designed along these lines was recently patented by B. G. Lamme of Pittsburg, Pa., and assigned by him to the Westinghouse Electric and Manufacturing Company. Following is a description of the machine:

In Fig. 1 the primary windings (A A′), (B B′) and (C C′) of the motor are connected by means of a three-pole double-throw switch (2) for starting conditions of the motor. Single-phase energy is supplied to the main primary winding by means of the circuit from the line conductor (L′), through the switch blade (3), windings (A A′) and (B B′), switch blade (4) to line conductor (L^2) and to the auxiliary winding by means of the circuit from line conductor (L′), switch blade (3), windings (C C′), resistance (R), switch blade (5) to the line conductor (L^2). 2X poles are induced by this arrangement of windings; but if the switch is thrown in its other position the current is reversed in the portion (B B′) of the main winding, and X poles are then induced by the main primary winding, the auxiliary winding (C C′), and its connected resistance (R) being thrown out of circuit.

The secondary member (6) (Fig. 2) comprises a core (7), having slots (8), bar conductors (9), having ends projecting beyond the ends of the core, and relatively high resistance end rings (10), connected, respectively, to the ends of all of the conducting bars. For starting conditions of the motor or for the larger number of magnetic poles the secondary circuits have comparatively high resistance, due to the resistance of the end rings.

At points (11), corresponding approximately to the polar pitch when the primary winding is con-

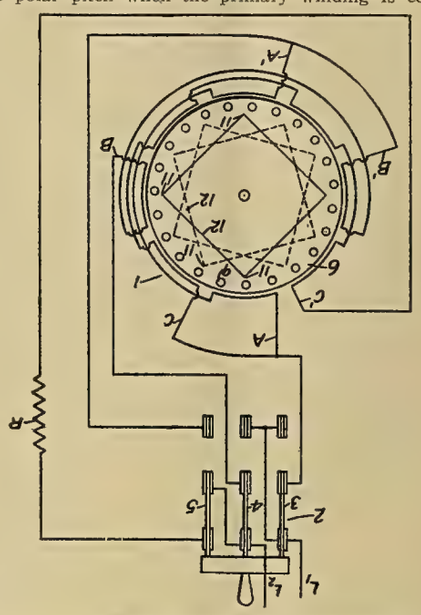


FIG. 1. LAMME INDUCTION MOTOR.—WINDINGS AND SWITCH CONNECTIONS.

nected for the smaller number of poles or for running conditions of the motor, low-resistance connectors (12) are attached. The secondary circuits for running conditions of the motor are then through the bars to the end rings (10) and through the nearest low-resistance connectors (12). By this simple means low-resistance secondary circuits are provided for the motor under running conditions and relatively high-resistance secondary circuits for starting conditions.

The secondary member may be designed for use with either single-phase or polyphase windings on the primary member, and as many low-resistance connectors (12) may be employed as are desired. The low-resistance connectors may be attached to the high-resistance end rings, or they may be attached directly to the bar conductors, though it will generally be found most expedient to connect them to the high-resistance end rings, the increased resistance introduced in the secondary circuits by so doing being relatively small, as the length of this high-resistance path is short. The greater the number of low-resistance connectors or end rings the shorter will be the high-resistance part of the path.

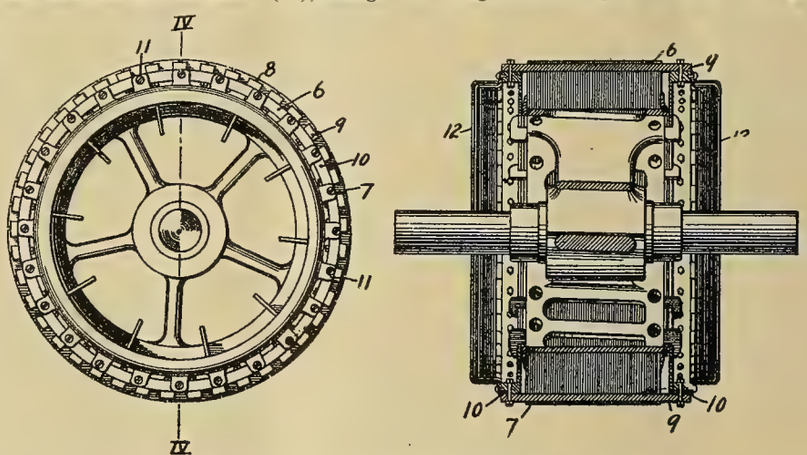


FIG. 2. END ELEVATION AND SECTION OF LAMME INDUCTION MOTOR.

Muncie, Ind., Wants Lighting Bids.

The city of Muncie, Ind., having definitely decided to abandon its municipal street-lighting plant and to enter into a contract with a private company to furnish lights for the streets, is now asking for bids from electric-light companies. Only one bid has so far been received, and the rate is $57.50 per light per year. Jerome Herf of Peru recently proposed to put in an electric-light plant in Muncie, but he has not yet presented a bid. The City Council of Muncie admits that municipal ownership of this utility proved a failure.

New "Elektra" German Steam Turbine.

There has recently been designed and constructed at Carlsruhe, in Baden, Germany, a new type of steam turbine for operating electrical generators, pumps and ventilators, as well as for marine service. The accompanying drawing (Fig. 1) shows this, the "Elektra" turbine, with single casing, and designed for working with condensation, while Fig. 2 shows the reversible "Elektra" steam turbine, with single casing, designed to work either with or without a condenser plant. The rotating wheel of this turbine, as constructed by the Gesellschaft für Elektrische Industrie, is shown in Fig. 3, while a compound steam turbine of this type is illustrated in Fig. 4. This turbine is constructed to operate with a jet condenser and has a capacity of 150 horsepower.

These turbines have been utilized extensively for operating alternating-current generators, the three-phase alternator, turbine and exciting dynamo, all being mounted on the same base. One of these units of 300 horsepower capacity occupies a floor space of 1,000 by 2,600 millimeters and has a total height of 1,250 millimeters. The exciter is mounted on the same shaft as the alter-

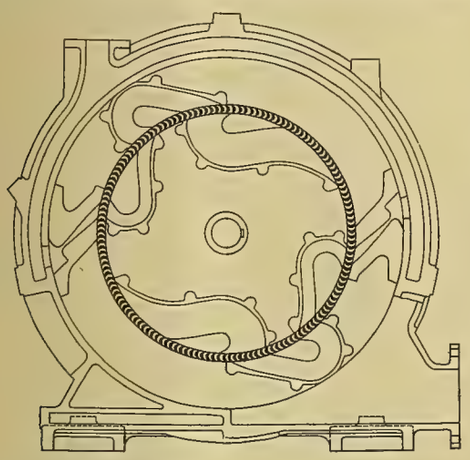


FIG. 1. NEW "ELEKTRA" STEAM TURBINE TO WORK WITH CONDENSER.

nator and turbine. The alternator, of 200 kilowatts capacity, operates at a speed of 3,000 revolutions per minute and supplies a polyphase current at a pressure of 2,000 volts.

For direct-current generation the "Elektra" turbine has also been employed with success, it is said. The accompanying illustration (Fig. 5) shows a 200-horsepower compound steam turbine of this type, operating at a speed of 2,200 revolutions per minute, with a steam pressure of nine atmospheres. It is directly coupled to a continuous-current generator of 140 kilowatts capacity, supplying current of 110 volts pressure.

This type of turbine has also been employed successfully as a boat turbine, a 35-horsepower unit having been constructed with arrow-wheel

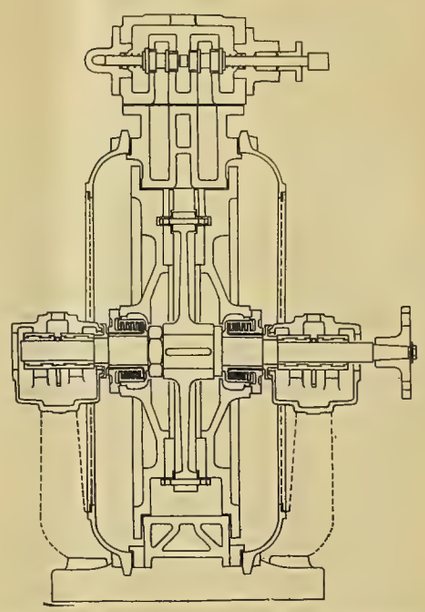


FIG. 2. REVERSIBLE TURBINE TO OPERATE WITH OR WITHOUT CONDENSER.

gearing, directly coupled for reducing the speed from 3,000 revolutions per minute to 500 revolutions per minute, the speed of the propeller, and arranged so as to be reversed instantaneously. This turbine occupies a floor space in the boat of 800 by 1,450 millimeters and has a total height of 1,100 millimeters. For pumping service and also for the operation of ventilators it is maintained that this form of turbine is particularly well suited. A five-horsepower air-pressure turbine with ventilator has been constructed, which supplies 40 cubic meters of air per minute under a water pressure of 180 millimeters and occupies a floor space of 500 by 830 millimeters, the total height being 600 millimeters and the total weight of the outfit 300 kilograms.

P.

Rapid Telegraph Sending.

The International Telegraph Tourney of the Telegraphers' Tournament Association was held in Tremont Temple, Boston, on June 29th. Richard C. Banley of the Pennsylvania Railroad's Philadelphia force broke the world's record by sending 20 ordinary railroad messages in nine minutes 36 seconds. The previous record of 11 minutes 12 seconds was made by him in 1903. The following were the winners: Railroad, class A—Richard C. Banley, James F. Beegan. Railroad, class B—William F. Bannester, James W. Harrison. Broker class—David J. Ellington, Harvey Williams, F. M. McClintic.

The team match was won by David J. Ellington, New York, and H. J. Finn, Boston, both Postal employes; Edward Dougherty and Joseph Gallagher, New York, second; Charles F. Edney and John J. Bell, Boston, third. A silver cup was awarded to each of the first and second contestants. The cups are valued at $60 each, contributed by Clarence H. Mackay, president of the Postal Telegraph Company.

Other prize winners were: Press, class A, sending 350 words of press, unabbreviated, won by David J. Ellington; Charles F. Edney, second; F. M. McClintic, third. Press, class B, receiving 350 words of unabbreviated press, wo by Charles F. Edney; F. E. Howe, New York, second; P. J. Faulkner, New York, third. Press, class C, receiving 500 words of press matter in code, won by Edward J. Coleman, Providence, R. I.; Willard E. Brown, Boston, second; F. M. McClintic, third.

Mr. Ellington received the greatest number of points and was awarded the Carnegie world's championship cup, valued at $50.

New Bids Required for Congressional Power Plant.

All bids for the proposed central heat and power plant for the Capitol, Congressional Library and the Senate and House office buildings in Washington, D. C., have been rejected as unsatisfactory. As related in the Western Electrician of October 7, 1905, it is proposed to erect such a plant, in a separate building, capable of an electrical output of perhaps 8,000 kilowatts. Very general specifications were prepared last year, and under them bids were received. On July 2d last Speaker Cannon, Mr. Hepburn of Iowa and a former member of the House, J. D. Richardson of Tennessee, constituting the commission in charge of the matter, met to pass upon the bids. After carefully considering the bids, the commission decided to reject all as unsatisfactory. The architect of the capitol was instructed to prepare new plans and specifications and invite proposals under them. It is proposed to erect a modern, high-class plant, and it is hoped that the new specifications will present comprehensive and explicit data to this end.

FIG. 3. ROTATING WHEEL OF "ELEKTRA" TURBINE.

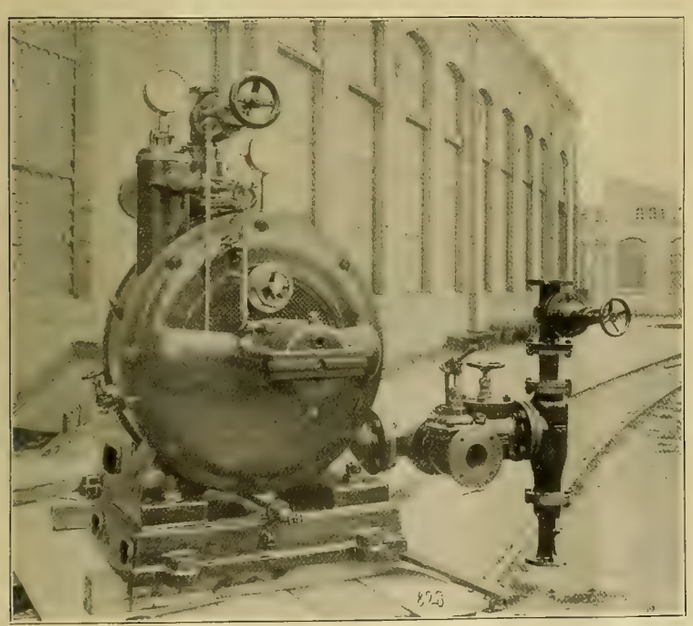


Fig. 4. Turbine of 150 Horsepower to be Operated with Jet Condenser.

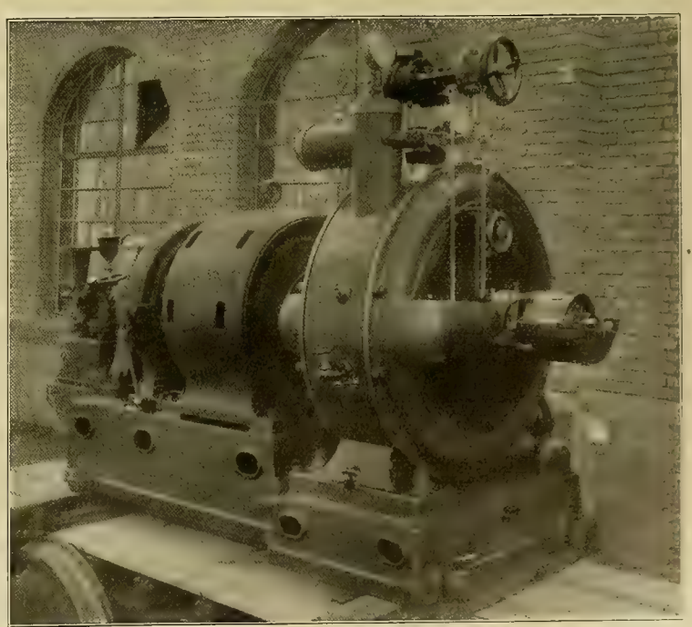


Fig. 5. Turbine of 200 Horsepower Direct-connected to Direct-current Dynamo.

NEW "ELEKTRA" GERMAN STEAM TURBINE.

WESTERN ELECTRICIAN

EVERY SATURDAY.

PUBLICATION OFFICES:

507 Marquette Building, - CHICAGO.

TELEPHONE, MAIN 1746.

Eastern Office, 150 Nassau Street, New York.

Telephone, 5220 Beekman.

Trade Supplied by Western News Co.

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DATES AHEAD.

National Electrical Contractors' Association (annual convention), Hollenden Hotel, Cleveland, Ohio, July 18th to 20th.

International Association of Municipal Electricians (annual convention), New Haven, Conn., August 15th to 17th.

Ohio Electric Light Association (annual convention), Put-in-Bay, Ohio. August 21st and 23d.

Colorado Electric Light, Power and Railway Association (annual convention), Denver, September 18th to 20th.

Illinois State Electric Association (annual convention), Springfield, Ill., September 19th and 20th.

American Street and Interurban Railway Association (annual convention), Columbus, O., October 15th to 20th.

CO-OPERATION between ordinary and wireless telegraphy is indicated by the matter-of-fact way in which official journals of the great telegraph companies bulletin the names of steamships that have been equipped with wireless apparatus. Thus the steamship Tagus is so listed for locations at sea "beyond" New York, Atlantic City, N. J., Hatteras, N. C., Guantanamo, Cuba, or Colon, Panama, and the rate established is $1.50 for the first 10 words and eight cents for each succeeding word. Similarly, the rate to the Prince George, when off Mobile, Ala., Key West, Fla., or Havana, is $1 as the base rate and seven cents a word thereafter. And so on, a fairly long list of seagoing ships being now so listed. To this extent space telegraphy now appears to have reached a "commercial" stage, but so far it appears to supplement existing telegraph circuits merely, rather than to supersede them. But it is to be noted also that "wireless" has brought relief to a few land localities without other electrical communication.

MINGLED FEELINGS will influence the old Chicagoan as he gazes on the poles and overhead wires now being erected in the principal central business streets of the city for electric-railway service. Of course he hails with glad relief the prospect of a great improvement over the wretched cable-railway service, but on the other hand he will recall the successful fight of some years ago to keep the "downtown" district free from the disfiguring overhead wires, and he will hope that the trolley-wire construction now being placed will actually prove, as now supposed, only temporary. The Arnold plan for subway loops seems to be comprehensive and desirable, if it be decided that underground-conduit railways, such as are in use in New York and Washington, are not feasible. But whether the conduit or the subway system prevail, it is to be hoped that the overhead wires, in the central business portion of the city, prove to be only a valued but temporary expedient and not a permanent fixture.

FIRE-ALARM headquarters should, of all buildings, be fireproof; but it is feared that this is not always the case. The chief of the Chicago Fire Department said recently: "The San Francisco department might have been able to prevent such a disastrous conflagration had not the fire-alarm station been among the first buildings wrecked. What good are water mains or fire apparatus if the fire department doesn't know where the fire is located? I would advocate erecting on the Lake Front in Chicago an ornamental station, fireproof in every respect, where might be located the central station of the fire-alarm telegraphs. Situated there it would be practically safe from danger of any sort. I am not saying that this building [referring to the City Hall] is going to tumble in and wreck our fire-alarm system, but if it should—well, then it would be too late to remedy the evil." It is obvious that not alone in Chicago, but in all cities, careful attention should be paid to the location, construction and fireproofing of the central fire-alarm station.

A MEASURE of considerable general significance and of particular importance to the proposed Mississippi River waterpower development at Keokuk, Iowa, was passed by Congress on June 23d. This act provides that whenever any person, company or corporation undertakes to secure land needed in river or harbor improvements, duly authorized by Congress, in which it is proposed to construct and maintain dry docks, locks or similar work, to be conveyed to the United States government free of charge, these persons or corporations shall have the right to acquire by condemnation land needed for the purpose which the property owners will not peaceably give up at fair compensation. The company back of the proposed development at Keokuk and Hamilton, Ill., as has been explained previously in the Western Electrician, purposes to dam the Mississippi River and develop a large amount of valuable waterpower. This work would involve the construction of locks, which would be turned over to the government free of charge; thus the development comes under the law just passed by Congress. Heretofore, one of the hindrances to the promotion of the scheme has been the difficulty in obtaining the adjacent land which would be inundated. The passage of the bill will naturally be of great assistance to the company in obtaining the needed property.

CHICAGO'S telephone situation presents some interesting and unusual features. To begin with, there is the Chicago Telephone Company, with its large and efficient system, giving long-distance connection to the greater part of the country. This is the well-established Bell company, which gives, on the whole, excellent service, but which has been harshly criticized for its rates and systems of charging. This company's franchise expires in about three years, and one of its adversaries, the Illinois Manufacturers' Association—an influential organization of business men—declares that a franchise may be asked for the Manufacturers' Telephone Company, recently incorporated.

Another factor in the situation is the competing automatic telephone system operated in the Loop district of Chicago by the Illinois Telephone and Telegraph Company. The cables of this system are carried through the tunnels of the Illinois Tunnel Company. The system is well built and the service, though limited, is good. The company, however, has been slow in extending its service, and its plans for the future are hard to ascertain. The Independent telephone interests throughout the country have repeatedly called upon the Illinois company with the view of arranging for the entrance of the Independent toll lines into Chicago through connection with the automatic system. But this has never been arranged, and the Independents seem to have given up hope in this direction. But they have not given up the idea of getting their lines into Chicago.

One result of the recent Independent telephone convention in Chicago was the revival of interest in the Independent movement among representatives of Chicago's business interests. On May 27th, by invitation, a committee from the Independent association appeared before a committee of the Chicago Commercial Association and laid before it the importance of giving Chicago enlarged communication with the surrounding states through the Independent telephone lines. C. B. Cheadle of Joliet, secretary of the Illinois Independent Telephone Association, presented the case for the Independents, and the statistics he offered are said to have been a revelation to the Commercial association. E. R. Conklin said that the Interstate Telephone and Telegraph Company, with 18,000 subscribers in Northern and Central Illinois, was ready to connect with a Chicago system at the first opportunity. Mr. Cheadle placed a conservative estimate upon the cost of telephone properties in Illinois alone, outside of those owned by the Bell company, at $16,000,000.

In answer to the objection to the expense of maintaining two telephones, Mr. Cheadle said: "From my office in Joliet I call up Aurora, 22 miles away, and for this service I pay 10 cents. Six years ago a single company charged 25 cents for the same service. Six years ago you paid 25 cents to talk to Joliet. Today you still pay 25 cents; there is but one company's lines to use. Six years ago I paid $60 a year for 600 connections, or at the rate of 10 cents per connection. Today I pay $75 for two telephones with Independent lines and get 4,000 connections, or at the rate of 1.8 cents for each connection. Six years ago I could call any one of 10 toll stations, pay 25 cents toll charge and 10 cents messenger fee, and talk to any one of a few people in that county. Today I can talk to any one of 3,500 people in Will County in his home or place of business for a nickel, and from one single telephone."

The situation is thus one in which four interests—the local Bell company, the automatic company, Chicago business men and outside Independent telephone enterprises—are deeply concerned. So far as known, none of these interests coincides with any of the others, although the Independents and the local business men are taking notice of each other. It will be interesting to observe the outcome and whether it will result in that long-discussed possibility—real telephone competition in Chicago.

The Visiting Electrical Engineers in England.

[From the London correspondent of the Western Electrician.]

London, June 27.—Our foreign engineering visitors have commenced their travels through the United Kingdom, the send-off function, naturally, being a dinner, which is so peculiarly dear to the heart of the English. Yesterday was the first day of official business, and in the afternoon a large number of the "foreigners," as they are being familiarly referred to, betook themselves to Teddington, where is situated the National Physical Laboratory, where the minister for war, Mr. Haldane, opened the new electrical laboratories. Mr. Haldane made a most appropriate speech upon the brotherhood of science, which brought together in common cause men of so many countries and different temperaments.

The grand banquet was held at the Hotel Cecil, nearly 500 persons being present. Mr. John Gavey, engineer in chief to the General Postoffice (president), was in the chair, and among the invited guests was the Right Hon. Sydney Buxton, the postmaster-general. Enthusiasm seems to be the foundation of our visitors' characters, and the good feeling prevailing was intensified enormously by a little episode which took place at the instance of the Italian members of the tour. Taking but few people into their confidence on the banquet evening and allowing nothing of their intentions to leak out previously, a covered object was placed by them in the dining hall. Mr. Semenza rose in the natural order of things to make a speech as one of the Italians, and at the conclusion he somewhat dramatically removed the covering and revealed a very fine bronze bust of Volta, mounted on a marble base, which, he said, had been brought over as a gift to the Institution of Electrical Engineers.

The whole of Tuesday was devoted to visiting engineering works in London, and the evening was spent at the annual conversazione of the Institution of Electrical Engineers. The headquarters of the Postoffice Telegraph and Telephone department and the London Wall exchange of the National Telephone Company were visited by one party. The latter exchange is the latest equipment of the National Telephone Company, and it is also famous in that it has been burned down twice in about 18 months or two years. The Greenwich generating station of the London County Council, the Bow works of the Charing Cross Electric Supply Company, the Chelsea power house, originated by Mr. Yerkes, and the Shepherd's Bush generating station of the Central London Railway have also been inspected. The two latter have been designed by American engineers and should provide some points of interest. The present stay in London terminates today with a trip up the River Thames to Windsor, the official home of King Edward. On Thursday an early start will be made for Birmingham. G.

Later advices are that the party visited Birmingham on June 28th and arrived in Manchester on the evening of that day. The 29th and a part of the 30th were devoted to the latter city, where the Manchester Corporation's Stuart Street power station, the works of the British Westinghouse Company and the Manchester University were inspected. Luncheon was served in the Town Hall, the lord mayor of Manchester presidig. Dr. S. S. Wheeler, president of the American Institute, responded to the toast "The Visitors." Liverpool was reached on June 30th, and on July 1st the party traveled to Glasgow. During the 10 days of the provincial tour a thousand miles of country is to be covered.

Among the visitors are Prof. S. Pagliani and G. Semenza of Italy, Prof. J. L. Farny and K. P. Täuber of Switzerland, E. Hospitalier and Paul Boucherot of France, G. Dettmar, L. Brandes, Dr. E. Budde, Dr. A. Berliner and W. von Siemens of Germany, and the folowing-named from Canada and the United States:

L. A. Herdt, R. B. Owens, F. G. Bolles, H. M. Brooks, Morgan Brooks, James Burke, W. C. Burton, F. J. Chisholm, J. R. Crawford, F. B. Crocker, T. Dwight, C. L. Edgar, F. H. Gale, K. Hedin, R. O. Heinrich, W. S. Hunt, J. P. Jackson, Dr. A. E. Kennelly, P. Letheule, J. W. Lieb, J. W. McCrosky, C. O. Mailloux, W. W. Miller, C. H. Mitchell, E. J. Murphy, C. A. Perkins, R. W. Pope, E. S. Rein, E. F. Schnuck, C. H. Sharp, J. H. Siegfried, A. Simon, Harrison W. Smith, E. W. Stevenson, F. H. Taylor, S. S. Wheeler, R. Wickander, W. H. Wiley, C. T. Wilkinson, A. E. Winchester.

THE SMALL CENTRAL STATION.

Practical Hints on Its Construction and Operation.

CHAPTER III.

FUEL AND WATERPOWER.

Fuel.—The average cost of fuel is 30 per cent. of the total maintenance account, and is equivalent to a fair quality of coal at about $2.35 per ton delivered at the station.

There is no grade of coal that can be taken as a standard, as not only do the different mines vary in the steaming qualities of the coal, but the output from any one mine usually varies in the different veins; but for the purpose of enabling the purchaser to estimate the cost of the item of fuel for his particular station, we have deduced the average fuel accounts, as reported from over 800 stations throughout the United States, and find its equivalent to be as stated, in coal of an evaporative capacity of seven pounds of water per pound of coal. Knowing the amount of steam to be generated, these figures will enable one to make a rough approximation of the cost of his fuel. But it is another of those cases where the average cost is an unsatisfactory estimate. The local cost and conditions are not difficult of investigation, and such investigation gives much more satisfactory and reliable results than any approximation can possibly do.

Of the fuels coal is by far the most important. Wood is used in very exceptional cases, and less and less as population increases and timber is more in demand for structural purposes. Under very favorable local conditions fuel oils and gases enter the field and are found to be cheaper than coal, but their field of profitable use is restricted. Also some plants, run in connection with a manufacturing business, may have a source of fuel in the refuse from the factory; but these cases are so entirely special that they fall outside the scope of this work.

Coal.—The classification which Nature has made of coals by producing them of various properties are as follows: Anthracite, consisting almost entirely of free carbon; semi-bituminous coal, a class which contains what are undeniably the best steaming coals mined in this country, and bituminous coals—a broad class which comprises all the lower grade coals and lignites, and the properties of which are varied. Of these the caking varieties are found mostly through Indiana, Illinois and Missouri and are coals which become pasty on firing and need to be broken up on the grate, as they will otherwise cut off the flow of air and impede combustion.

In the subjoined table are given the theoretical evaporative power of several coals and the actual evaporative power they have shown in good practice under regular conditions of daily service, the pounds of steam being given from and at 212 degrees.

EVAPORATIVE POWER OF VARIOUS COALS.

	Theoretical Evaporation.	Actual Evaporation.
Highland, Ind.	10.3	5.4
Turkey Hill, Ill.	11.6	6.8
Gillespie, Ill.	10.0	6.9
Collinsville, Ill.	10.5	7.2
Carbon Hill, Wash.	12.8	7.2
Big Muddy, Ill.	11.8	7.3
Kanawah, Ky.	13.4	7.7
Hocking Valley, O.	13.7	8.2
Pittsburg, Pa.	13.4	8.3
Youghiogheny, Pa.	13.3	9.2
Pocahontas, W. Va.	13.6	9.5
Cumberland, Md.	13.7	10.3

Wood.—A small percentage, very small indeed, of the stations in operation today burn wood under their boilers, and these few are mainly of that class mentioned as special, where the fuel is a by-product from some manufacturing establishment and consists of shavings, short ends or trimmings from lumber. For the benefit of those who contemplate establishing a plant so far from a coal supply as to bring wood into the field of fuel as a competitor the following approximate figures are given:

Hickory, maple, oak, beech, poplar, elm, chestnut and pine vary greatly in weight, but their steaming powers per pound are about equal, if air dried, and about 2½ pounds of one of them is required to equal one pound of average coal. One cord of hickory or hard maple is equivalent to one ton of coal; one cord of white oak, 1,700 pounds of coal; one cord of beech, red or black oak, 1,450 pounds of coal; one cord of poplar, chestnut or elm, 1,050 pounds of coal; one cord of pine, 900 pounds of coal.

Oil.—There are many advantages found in the use of oil over other more bulky fuels, but it has been found by experience that these advantages are more than paid for in the higher price which oil commands in the market. Its use has shown an evaporative power per pound of 14 to 15 pounds of water, which makes 3.4 barrels of oil, of 42 gallons each, the equivalent of a ton of coal of a quality that will evaporate about seven pounds of water per pound of coal.

The reduced cost of labor of attendance is great, and, the piping line once in, there is small cost of handling this fuel, but even these economies have failed to make oil at present market prices to compete favorably with coal.

With proper appliances for burning, however, crude oil lessens the wear and tear on the boiler, the heat produced being more uniform than that from coal or wood, and there being no necessity for opening the furnace doors and letting in cold air. The fire may be started instantly and is easy of regulation. One man can easily tend to the firing of as many as eight or 10 boilers. There are no ashes to clean out or coal to be handled, and only where there is much scale deposited from the water, necessitating frequent cleaning, does the work get beyond the abilities of one man. Combustion is practically complete, so that the fire side of the heating surfaces seldom if ever requires cleaning.

On the other hand, besides the question of cost and the lack of competition, which makes it impossible to obtain a time contract for the delivery of oil, the main objections to its use are the increased risk of fire and explosion, which bring about an increase in insurance rates, and the offensive odor of the oil, which has caused neighbors to obtain injunctions against its use.

Gas and Gas Engines.—The use of natural gas indicated the ideal fuel, and now that the gas fields are practically exhausted there has been a demand for an artificial gas which could compete with coal. No economy has been shown, however, in the generation of gas from coal or oil and its subsequent burning under steam boilers. Of more recent years, though, gas, gasoline and naphtha have been used in explosive engines and a good economy shown. So rapid have been the strides made in the utility and efficiency of the gas engine that it must today be recognized as a factor well worth consideration in the planning of a station for the development of power. While the units from which the most satisfactory results have been obtained are of a size greater than is demanded by the average sized station, which we are dealing with, the engine of moderate power has in many cases shown an economy over steam. And the next few years promise to place still better engines of this type upon the market.

The smaller units have consisted mainly in explosive engines using gasoline or naphtha and have given a very satisfactory and reliable power and at low cost when consideration is given to the items of first cost of installation, room that would otherwise be occupied by boilers, labor for handling coal and ash and the amount of capital invested. On the other hand, there are drawbacks to this type of fuel, chief among them that cited as an objection to crude oil—the lack of competition among dealers and the consequent inability of the purchaser to contract for his fuel for any length of time. There is also to be considered the necessity for carrying a quantity on hand and its explosive nature when mixed with air as well as the accompanying noise and disagreeable odor.

Waterpower.—Though waterpower is not properly a fuel—although an ingenious Frenchman has, indeed, styled it "white coal"—it is considered as such in figuring the maintenance cost of power stations. Its economy is usually overestimated, although it does show a saving in operating over steam in cases where the natural conditions are favorable. The cost of dam, properly flooded, of flume, wheelpit and tailrace, is large at installation and an ever uncertain quantity in maintaining, while the depreciation is rapid. A fair estimate of the cost of a completed waterpower plant, not including electrical machinery, is in the neighborhood of $80 per horsepower, the conditions named above being favorable. Frequently the rights of other property owners and the power required by other establishments taking water from the same source limit the extent of power available, and future extension may mean the installation of an auxiliary steam plant at a location unfavorable to the handling of coal.

As for the natural conditions mentioned, consideration must be given to the question of frosts

and ice in a region where the winters are at all severe and also to the damage done during spring freshets, which last includes loss of power by water backing up in the tailrace and the possibility of lawsuits over the flooding of land at times of extreme high water. Where such contingencies are to be met with it is necessary to have some other source of power available for the emergency, for the lighting station must be prepared to furnish light each night of the year without fail, or it loses the confidence and support of its patrons.

After giving all these points proper consideration it may still appear that waterpower will be the cheapest and best that can be employed, or there may be local conditions or questions of the purchaser's property already acquired which make it the choice of powers.

The size of units is small on the average, as is shown by an analysis of the reports, although the practice of later years has had a marked tendency toward increasing the size, the average figure having increased from 22.1 horsepower in 1880 to 44.1 horsepower in 1900. This last figure is much lower than the average of the later installations, being kept down by the continued use of wheels of small power which were installed years ago. The power developed, however, is due largely to the height of fall of water and so is entirely dependent upon the special conditions of the separate plants.

[*To be continued.*]

Electricity Wrongfully Accused in Port Huron.

Insurance companies have been considerably worked up over the numerous fires at Port Huron, Mich., which have been attributed to defective electrical equipments. However, an investigation does not bear out this theory. J. H. Montgomery, electrical inspector of the Michigan Inspection Bureau, has made the following report on the situation:

"Our attention having been called to the electrical conditions in Port Huron, and particularly to the number of fires attributed to defective wiring, it was decided to make an investigation. A visit to the city was made, and after conversation with the fire marshal, the city inspector and others, it was found that, in most cases, there seemed to be no good reason for supposing the fire to have an electrical origin. As is very often the case, where the cause was unknown, the newspaper reports have laid the blame on defective wiring. The general impression seemed to be that a considerable number of the fires were of incendiary origin. Inspections were made of several risks, including one new building, and one in which the equipment was very old. The new work was found to be in a very satisfactory condition. The other building, which was a multiple occupancy, mainly offices, was wired about 15 or 18 years ago, and was in a very poor condition. The city inspector has ordered the old wiring disconnected and a new set of mains installed. This has been done, and wherever service is required, new molding work is used. The great difficulty seems to be that there is no systematic reinspection of old work, which is a common condition in all of our cities. Companies having buildings in which they suspect defective conditions can easily secure the proper information, and, if necessary, correction of these conditions by enforcing the requirements of the clause permitting the use of electric wiring and requiring a certificate from the city inspector. It is suggested that this certificate, when obtained, should bear a reasonably recent date."

Metric System in England.

The Manchester (England) Chamber of Commerce, like some other representative English bodies, has unanimously adopted a resolution with regard to the compulsory use of the metric system of weights and measures, which is intended to embody its policy henceforth with regard to this proposed legislation. The resolution is to the following effect: "That, while continuing to support the enforced adoption of the metric system of weights and measures for general purposes in this country, the chamber shall always maintain, in any future action taken in support of legislation to bring this about, that the cotton-yarn trade and the engineering trades ought to be expressly exempt from such legislation." The chamber declared that any legislation which failed to recognize the exceptions desired should be met by strenuous opposition from the great industries concerned.

Car shops estimated to cost $125,000 will be built by the Indiana Union Traction Company in Anderson, Ind. The City Council has passed an ordinance extending the life of the Indiana Union Traction Company's local franchise to 1952. In consideration of such an extension the traction company agreed to build its main car and repair shops in Anderson.

American Association at Ithaca.

A successful summer meeting of the American Association for the Advancement of Science was held in Ithaca, N. Y., during the last few days of June and the first week of July. The attendance was large and much interest was manifest. An interesting feature was the dedication of Rockefeller Hall of Physics of Cornell University, reported elsewhere.

The programme for the summer meeting was not as full as for the other meetings, but it contained, among others, a number of interesting papers dealing with the scientific side of electrical engineering. The most technical paper was one presented by Mr. W. W. Churchill on "The Electrolytic Corrosion of Condenser Tubes." Mr. Churchill showed that in the Long Island Railroad power house the plan for overcoming electrolytis corrosion consisting of the production of a counter-electromotive force between the condenser tubes and the sea water (see Wstern Electrician of April 14, 1906, page 294) had been entirely successful. The counter-electromotive force is supplied by an auxiliary motor-generator and the plant has now been in operation 14 months. Mr. Churchill's idea in bringing this matter before the association was to restate the fundamental laws of electrolytic conduction, in order to show that the process has a sound scientific basis. The paper emphasizes the fact that the protection to the tubes does not depend upon the flow of current but upon the maintenance of a proper counter-electromotive force in the condenser.

Prof. B. B. Brackett of Potsdam, N. Y., presented several papers dealing with devices for instruction for convenient use in connection with electrical engineering instruction. An ingenious incandescent lamp resistance consists of a light wood framework similar in size to a Wernicke bookcase unit. On the inside of this the lamps are mounted and they are thus protected from mechanical injury. On one side of the frame is a series of switches so arranged that the 12 16-candlepower lamps can be arranged in series or parallel, giving a range of resistance from 16 to 2,400 ohms. From the form of these units they can be piled up like a bookcase and a great deal of resistance can be contained in a small space. In the discussion the suggestion was made that in purchasing lamps for such resistance units a certain power consumption should be specified instead of the candlepower, as by this means low efficiency lamps may be purchased and more power will be consumed in a given space than otherwise. Another device suggested by Prof. Brackett was a plan for making alternating-current wave measurements. Two Prony brake-arms are clamped to the pulley of the machine to be tested. These arms are side by side and similar in construction. Their outer ends are movable between adjustable limit stops, so that by unclamping one of the arms and leaving the other alternately, step by step, rotation of the moving members of the machine is produced.

Other electrical papers presented were of a more purely scientific character, and several of these were of great interest. Prof. H. S. Carhart of Ann Arbor, Mich., discussed two topics—one "The Use of Silver Perchlorate as an Electrolyte in a Silver Coulometer," and the other covering an interesting lecture experiment in thermo-electromotive force. As far as experiments with the perchlorate have been carried the results have been satisfactory when proper precautions are used. The principal advantage appears to be that the deposit of silver produced adheres much more firmly to the cathode than when nitrate is employed. The deposit has a grooved appearance, the crystals being somewhat interwoven, and hence less liable to be detached. It was not found desirable to use a porous cup in the cell, better satisfaction resulting with washed filter paper. Prof. Carhart takes up the method of producing pure perchlorate, as this is not an article which can be obtained on the market.

A simple experiment described by Prof. Carhart and which can be performed readily in a laboratory or before a class is as follows: Copper wires are wrapped about two small test tubes, which are immersed in a $CuSO_4$ solution, the copper wires forming the electrodes to an electrolytic cell, through which current is passed from a battery. Inside the test tubes are thermal junctions connected in series and in circuit with a galvanometer. When current is passed through the electrolyte the absorption of energy at one electrode and the liberation of energy at the other causes a difference in temperature in the two test tubes. The junctions therefore produce electromotive force which is indicated by the galvanometer. This simple experiment serves to illustrate several important facts connected with electrolytic thermo-electromotive force, a subject which has a most important bearing on the theory of batteries and other electrolytic cells.

Prof. Frederick Bedell of Ithaca presented to Section B (Physics) of the association a preliminary note on a new departure in the graphical representation and study of alternating-current quantities. It has heretofore been customary to represent alternating quantities by means of vectors located in a plane, and this is perfectly satisfactory, providing that there is no serious departure from the sine-wave form. Iron in the neighborhood of an electric circuit causes hysteresis loss and harmonics are introduced into the wave. These harmonics are wattless and therefore in quadrature with the electromotive force, and Prof. Bedell shows that they must also be in quadrature with the fundamental component of the current. The only way in which both of these conditions can be satisfied is by rating the harmonics by vectors in a line at right angles to the plane of electromotive force and current vectors. Prof. Bedell promises to carry this matter further and expects to present shortly a complete paper upon the subject.

Some other papers which deal with important fundamental matters comprise careful studies of spark potentials between points and planes and in liquid dielectrics by Prof. R. F. Earhart, while Prof. L. A. Freudenberger described a new form of alternating-current galvanometer.

As a whole the meeting of the association was a most profitable one for electrical engineers, particularly as emphasizing some of the important scientific elements upon which the achievements of engineering ultimately depend. The attendance was approximately 400, of whom 231 were members of the association, the remainder being connected with the affiliated societies.

Methods of Underground Operation.

[From the Question Box of the National Electric Light Association.]

QUESTION.

What means do you employ to protect your cables in manholes from injury due to burnouts in adjacent cables?

ANSWERS.

L. L. Elden, Edison Electric Illuminating Company of Boston: Asbestos tape securely wrapped around the cables furnishes a very satisfactory protection from ordinary burnouts. Where large quantities of current are being transmitted it is advisable to install suitable shelves or partitions to still further protect the cables from each other.

B. E. Strohm, Chicago Edison Company: In place of using brackets, as was formerly the practice, light sheet-iron shelves are put around the manholes, and the cable covered by means of split vitrified tile. The shelf is put in to take the weight of the tile off the cable, and one shelf is sufficient on each side of the hole to take care of a dozen or more cables, as the tile, when put on, is cemented around the joints and when the cement has set, the tile will support its own weight. In this way each circuit or cable is as safe from damage or burnout from adjacent cables as it is in a straight conduit line. When it is necessary to take a tap of any cable in the manhole it is an easy matter to knock this tile off, make the connection and afterward place tile over the joint.

QUESTION.

What devices, if any, are installed to relieve abnormal rises of potential in large cable installations?

ANSWERS.

F. M. Vander Voort, Alliance Gas and Electric Company, Alliance, Ohio: Install General Electric non-arcing lightning arresters as line dischargers in a similar manner as we put them on tub-transformer circuits to protect from the effects of resonance.

L. L. Elden: This company has as yet found no necessity to install any devices to relieve rises of potential in the cable system other than standard lightning arresters on the outlets of underground cables where they are attached to the overhead lines for the purposes of lightning protection.

Ernest F. Smith, Chicago Edison Company: No devices are employed in connection with our high-tension transmission system for the purpose of relieving abnormal rise of potential.

QUESTION.

Which is the best practice, in running underground leads from 2,300-volt three-phase generators to switchboard and from switchboard to step-up transformers—to use three-conductor lead-covered cables or three single-conductor lead-covered cables, and why?

ANSWERS.

L. L. Elden: Single-conductor cables are preferred for this use, and, if possible, cables without lead covering should be used, it being preferable to provide a cable having extra insulation suitably waterproofed if the conditions permit its use.

W. T. Oviatt, Connecticut Railway and Lighting Company, Bridgeport, Conn.: Three-conductor lead-covered cables, as single-conductor lead-covered cables induce current in lead sheath, which causes a drop in voltage on line and heating of the lead sheath.

B. Jamieson, Chicago Edison Company: It depends upon length and facility of run. If lead cover must be used and circular milage of cable is not too great, use three-conductor. Prefer cambric single-conductor to either, wherever possible to use it.

The Philadelphia Electric Company: In regard to running single or multiple-conductor leads from

terminals of 2,300-volt generator to switchboard, and from switchboard to step-up transformers, in large installations, it is generally conceded the best practice to operate with single-conductor rather than three-wire cables, on account of less chance of damage to any pair of conductors. For local reasons, however, the reverse may be the case.

Heating of Bearings and Field Magnets.

By A. S. Atkinson.

In almost any machine in general use for power or lighting purposes, overheating of bearings and field magnets may cause costly interruption of business or even disruption of the whole mechanism. Engineers not familiar with the symptoms of such troubles are frequently at a loss to ascertain the source until a breakdown results. A good electrical engineer in charge of a plant should not only be able to detect the symptoms at once, but also to apply the remedy before it is too late to save accidents.

It is not always possible to locate the cause of the trouble on first examination, but a little study of the subject may soon enlighten one. The heating of bearings may be due to lack of sufficient oil, the presence of grit in the bearings, poor forging of the shaft or roughness due to some other trouble, a poor fit of shaft and journal, a sprung or bent shaft, too great a load or strain on the belt, a hot pulley, commutator or armature, and an uneven placing of the armature so that a greater magnetic attraction is set up on one side than on the other. Any one or several of these causes may be responsible for the trouble. Frequently one cause sets up another, and if the machine is allowed to run without proper repairing its disintegration is rapid and disastrous.

The symptoms are somewhat varied, and in different machines they show a considerable degree of variation. When the bearings become too hot it is not sufficient to stop the machine and pour cold water on them. That is merely a temporary expedient, and in the end a costly one, for in a short time they will become heated again. It will be noticed that heating of bearings occurs more frequently in new machines that have been improperly designed or installed. For instance, a too great tension on the belt is due to improper installation, and the load must either be lessened or the strain relieved by using a lighter belt or a larger pulley. The first symptom of this heavy strain on the belt may be an overheating of the pulley bearings. Where the belt strain has been allowed to continue for some time the shaft has been strained in its position so that overheating may occur there.

The proper adjustment of the belt, pulley and shaft is a question of prime importance at the outset in a new machine, and then a continuance of this under all-load conditions. A rough shaft that does not run smoothly is a prime cause of trouble. This may be due to imperfect casting or to the presence of grit, which wears it rough in places. If there is grit anywhere in the bearings it should be removed immediately. The shaft and bearings should be taken apart and carefully examined. A temporary expedient may be resorted to when it is impossible to stop the machine, by washing with kerosene oil. However, at the first opportunity the machine should be cleaned carefully to remove all grit and then oiled with filtered oil. In using kerosene oil for temporary washing of the shaft and bearings care must be exercised in not letting any of it get on the armature, field coils or commutator. More trouble has been caused by this neglect than good accomplished.

Lack of proper oiling frequently shows similar symptoms to grit in the bearings. The shaft does not turn freely and sometimes gives a squeaking sound. Frequently the oil cups are supplied with sufficient lubricating oil, but the passages are clogged so that the bearings suffer in spite of apparent supply of oil. Inferior grades of oil are more likely to clog the oil-cup passages than a good grade. With good oil, filtered if necessary, careful attention given to the cleaning of the oil cups should prevent any of these troubles. In some cases, however, the grit and foreign substances may get in the bearings in dirty shops, and it is necessary to clean them thoroughly.

The direct results of allowing grit to remain in bearings or of letting them suffer from lack of sufficient oil are quite numerous. The most common is for the shaft to wear rough and in grooves. This prevents it from revolving freely, and it must be removed and smoothed again either in a lathe or with careful filing.

The imperfect fitting of shaft and journal, pulley, collar and shoulder is a source of great trouble, and when detected in new machines immediate remedies should be applied. Frequently the shaft fits too tight. A great many machines have this fault, and some engineers content themselves with the belief that the tight fit is due to the stiffness of a new machine and that it will wear down after running a short time. This may be true, but it may also result in accidents and a bent shaft. It is much better engineering economy to remedy the evil at once. Where a split journal is used this may be done by slightly loosening the case, but if this does not suffice the bearing cup should be removed and the journal examined. In bad cases the journals should be scraped or reamed or the shaft filed or possibly removed and turned in a lathe. The trouble should be remedied without waiting for the doubtful expedient of the machine righting itself by wearing away the stiffness.

Bent shafts have commonly resulted from too tight a fit, and a bent shaft is difficult to straighten out. A good mechanic in the shop may be able to straighten the bent shaft, but in most cases a new one must be ordered or the old one sent to a regular shop. A bent shaft may in turn wreck the whole machine.

Bearings do not revolve freely sometimes when the trouble is not due to either of the above causes, but because of their being out of line. This may be the result of some slight shock to the machine or unusual vibration, and sometimes the work of poor installation. Machines that have been moved while new floors or foundations were being laid have had their bearings put out of line. The shaft does not revolve freely and there is a squeaking, rubbing noise. In order to locate the difficulty the bearings should be loosened a little by unscrewing the bolts holding them in place. A little manipulation will place them in a true position. It may be necessary to file the screwholes of the bearing that is not true or to move it up or down. Unless it occupies a true position when bolted tight so that there is no friction the evil has not been corrected. The chief essential is to see that the clearance is uniform all around, which means that the revolving part is firmly adjusted in the center. Heating of bearings due to their being out of line is quite common, and in many central stations and power shops where motors are employed it gives engineers not acquainted with the weak points of the machine endless trouble.

A hot shaft is not only a troublecome but a very dangerous thing in any shop. When discovered it is not safe to continue running the motor, nor is it safe to stop suddenly. The easiest and safest way is to shut the motor off slowly, permitting the shaft to revolve a little until it has cooled off to some degree. If stopped suddenly when very hot it may stick fast, so that its further usefulness is practically ended. If a little cold water can be applied to it without the danger of letting any of it reach the commutator, armature or field coils this will help the cooling process. If the water, however, is allowed to reach the commutator, armature or field coils it may short-circuit or ground the current. Sometimes the thrust or pressure of pulley, collar or shoulder heats the shaft or bearings. In either of these cases the frictional part should be located and filed off smooth. Usually the difficulty can be discovered by moving the shaft back and forth to examine its different parts. If pushed or scraped against the collar or shoulder more or less scratches will be found.

Poor designing or damage through shipment or setting up of motors are sometimes responsible for the location of the armature nearer the pole pieces on one side than on the other. The result of this is the production of greater magnetic attraction on that side and ultimately heating of bearings or shaft. An examination and measurement of the distances will show whether the clearance is uniform on all sides. If not it may be taken for granted that the heating is due to this faulty construction or accident to the pole pieces or armature. In multipolar machines this trouble is much more frequent than in bipolar and is correspondingly more dangerous. In modern motor designing the clearances should always be much larger and freer in the multipolar than in bipolar machines. When this is not the case troubles of this character are very apt to develop. The constant side pull aggravates the bearings so that they wear away if they do not develop undue heat and cause an accident. The adjustment of the armature so that the clearance is uniform must be accomplished with skill. When the magnetic pull is balanced in all directions the danger is removed.

The heating of field magnets in the modern generators and motors is a source of trouble that makes the work of the manager of a station and his engineer difficult and perplexing. Even the best machine may get the field coils too hot for the hand to rest on them, or the pole pieces get hotter than the coils after a brief run. Field magnets excited by direct current are used now in a great variety of generators, motors and rotary converters, and most of the induction motors and generators carry alternating current in their field coils. When the field coils get too hot to bear the hand, or when their temperature rises above 50° C. by thermometer test, some remedy should be applied. The current passing through the field should be reduced or part of it shunted off. In series-wound machines this can be done by removing a layer or more of wire from the field coils. Another way is to rewind the coils with coarser wire. Either method generally corrects the fault. In shunt-wound machines the trouble may be corrected by decreasing the voltage at terminals of field coils. Another way is to wind on one or more wires, to increase the resistance in the field circuit.

The first step, however, should include a thorough examination to make certain that the trouble is not due to short circuit in the field coils. This could be ascertained by examining the pole pieces. If there is trouble of this character, one pole piece will be weaker than the others. Usually one weaker pole piece is also perceptibly cooler than the others, which will help one to locate the difficulty. By measuring the resistance of field coils it is possible to ascertain absolutely whether there is any great variation. A difference of only one or two per cent. may indicate nothing, but if it is five or more per cent., one coil is either short-circuited or double-grounded. The work of remedying the evil should then be applied immediately, for nothing is so inimical to the longevity and good working of a motor or generator than to have a slight fault like this run on indefinitely.

Moisture in the field coils is another fruitful source of trouble to the engineer and electrician in charge. Overheating almost always follows, and sooner or later there is short-circuiting or a complete breakdown. When field coils are troubled with moisture they get hot, and steam or feel very hot and moist to the hand. Field-circuit tests will verify any suspicion. These tests will show that the resistance is lower than the normal, and in the case of the shunt-wound machines more than the ordinary amount of current is absorbed by the field.

The presence of eddy or foucault currents in pole-pieces is often responsible for the pole-pieces heating up rapidly after a short run while the coils remain much cooler. Here, too, we have imperfect designing or setting up as the leading cause. Where the designing or building is at fault the remedy usually lies beyond the province of the mechanic or electrical engineer. A little tinkering may lessen the evil for a time, but as a rule the machine will never give satisfaction. It is practically a useless machine and the sooner it can be replaced by a new one or rebuilt the better for all concerned.

Very often many of the troubles with motors and generators supposed to be due to faulty designing or poor construction are in reality the work of mechanics who install the plant. A poor, shaky foundation will sometimes cause a motor to vibrate when running rapidly so that different parts of its mechanism get out of order. An uneven foundation will likewise cause one side to sag and thus set up troubles. The importance of securing perfectly level and firm foundations is as great as that of securing good machines at the beginning. Humming, squeaking and shaking of motors and generators are frequently due to this cause entirely, and if the floor or foundation is corrected the noise and vibrations will disappear and also tendency to heat different parts of the bearings and field magnets.

Again, the vibrations of a generator may be caused by the engine to which it is connected. In this case it is some unbalanced or imperfect working of the prime mover which needs correcting. It is unwise to permit an old, shaky engine or a good one mounted on an uneven and unstable foundation to wreck a good generator. It is far better to throw the engine out if it cannot be remedied, for in the end it will cause more damage and loss than it is worth. When the generator vibrates unduly the first step should be taken to ascertain whether the trouble is with the generator or the engine. The two should be joined together in one perfect union so that neither will affect the other harmfully, and without such perfect harmony of all parts it is impossible to secure the highest results or to get the full money returns from the investment.

Load Factor and Fuel Consumption.[1]

By William R. Van Nortwick, M. E.

The curves on the accompanying diagram (Fig. 1) were plotted from data obtained from Diesel oil-engine plants in regular operation, covering a considerable period of months. They are of interest as showing the manner in which the fuel consumption (and therefore the cost of power) varies in remarkably close relation to the load factor.

One characteristic of the ideal engine would be to have the cost per brake horsepower-hour constant at all loads. If this could be obtained the curve plotted from the data would be a straight horizontal line.

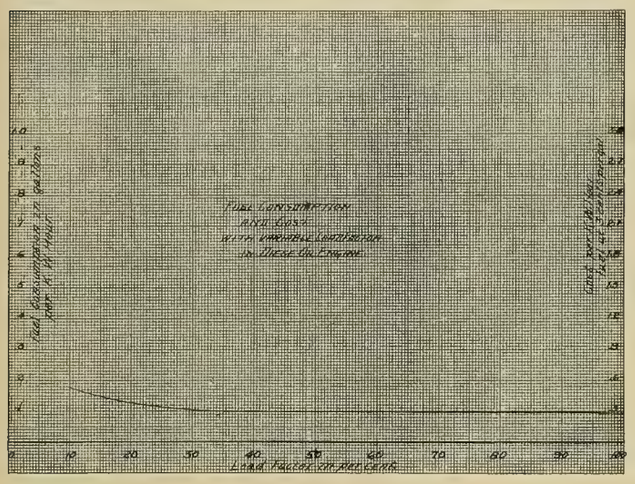


FIG. 1. FUEL CONSUMPTION AND COST WITH VARIABLE LOAD FACTOR IN DIESEL OIL ENGINE.

In practice it is quite impossible to realize theoretical economy at all loads, because of large heat losses by condensation, radiation, friction, etc. These losses in steam plants, as well as others in gas or vaporized-oil engines, occur as practically constant at all loads.

In the reciprocating steam-engine plant this ideal cannot be attained, inasmuch as the boiler must be maintained at full working pressure, and the standby losses of radiation and waste of furnace heat are unavoidable. The losses due to condensation, radiation and friction in the engine itself also remain practically constant for all loads. It is evident, then, that these constant losses, which are measured directly at the coal pile, serve to increase the cost of power per horsepower-hour at partial load over that at full load.

The steam-turbine plant is subject to the same general losses as the reciprocating-engine plant, with the addition of loss of steam by leakage between the blades and loss of the full expansive qualities of the steam, entailing therefore a greater steam consumption than in the reciprocating engine.

In the combustion engine, in which gas or vaporized oil is mixed with air and the mixture compressed and exploded, economy depends on a correct proportioning of the gas used with the air and uniform high compression of the mixture. The allowable range of these proportions is very small for a given gas or oil. Should too much gas be admitted there will be insufficient oxygen present to support complete combustion, and unburned gas will be exhausted and carbon deposited. If, on the other hand, too little gas is admitted, the mixture will cease to be inflammable and will be exhausted in its entirety. And again, if governing be effected by varying the quantity of the mixture, the compression will vary considerably, with great variation and loss of economy on light loads. It is evident then that a considerable increase in fuel consumption per horsepower-hour will be noted as the load factor is decreased in combustion engines which govern by varying either the quality or the quantity of a mixture. The inefficiency of gas engines governing on the "hit-or-miss" principle hardly needs any explanation.

The Diesel oil engine, however, operates on principles which distinguish it from all other internal-combustion engines, and make possible the remarkable economy revealed in the fuel consumption and load curve.

It operates on the four-stroke-cycle principle, having one motor, or impulse, stroke in every four. Its cycle differs from the Otto, or common gas-engine cycle, in that on the first, or admission, stroke the piston draws in a full cylinder of pure air instead of a mixture of air and gas or vaporized oil. During the second stroke this pure air is compressed to such a high point that the temperature, due to compression, is sufficient to ignite any liquid fuel injected into it. This does away with all igniter systems.

At the top of the second stroke a charge of crude or fuel oil, distillate or even water-gas tar, in a finely atomized state, is injected into this intensely heated air by a jet of highly compressed air from an auxiliary reservoir. The third or power stroke is taken up with the gradual burning of the fuel—as fast as it enters the combustion chamber—and the expansion of the burned gases; while the fourth, or exhaust, stroke scavenges the cylinder.

The governor does not act (as in the explosive engine using gas or vaporized oil as fuel) to control the quality or quantity of a mixture, but acts on the oil pump of each cylinder, regulating the amount of fuel injected into the cylinder at each power stroke. The supply of oxygen, even on full load, is more than sufficient to insure complete combustion, thus preventing any loss of unburned fuel and deposit of carbon on the cylinder or piston.

It will be noticed by reference to the curves that the fuel consumption and cost per horsepower-hour is very low at full load, with only a very slight increase as the load factor decreases. The curve not having any practical significance below a load factor of about 10 per cent., it was not extended beyond this point. The explanation of this economy may be found by reference to Fig. 2, which is a typical indicator card taken from a Diesel engine.

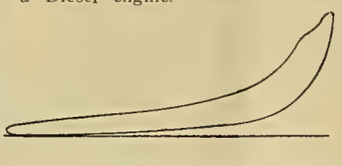


FIG. 2. CARD FROM SINGLE-CYLINDER DIESEL ENGINE.

It will be noted that the card practically agrees with the ideal Carnot cycle. The compression starts on an isothermal, a line of constant temperatures, following an adiabatic (a line of no reception or transmission of heat) at the higher pressures. What corresponds to the admission line of a steam engine is seen to be horizontal or slightly falling, with no increase in the pressure or temperature. It is therefore practically an isothermal.

The expansion of the gases then follows without addition of heat in an almost perfect adiabatic curve. Thus virtually all the work stored in compression is given out on the power stroke, with a minimum loss of heat to the cylinder walls and a minimum of internal friction of the gases burned.

The very high compression developed allows a very complete expansion of the gases. Within reasonable limits, it is a fact that the higher the compression the greater the efficiency of the engine.

As to speed regulation, the Diesel engine is the equal of the best types of steam engine, as its piston receives no sudden impulses, back firing is impossible and the cranks acting at 120 degrees with each other maintain a constant torque on the crankshaft. It may be of interest to note that in several recent large installations Diesel engines are running alternators in parallel.

1. This article was written for the American Diesel Engine Company of New York, but is of sufficient general interest to warrant publication.

Columbus as a Convention City.

Secretary B. V. Swenson of the American Street and Interurban Railway Association is "booming" the forthcoming convention of the association at

COLUMBUS AS A CONVENTION CENTER.

Columbus, Ohio, during the week of October 15th to 20th, with enthusiasm and energy. His convention bulletin No. 3, issued last week, shows in a graphic manner by a map, reproduced herewith in reduced size, the central location and accessibility of Columbus. With that city as a center, a circle of 500 miles in radius takes in New York, Philadelphia, Baltimore, Washington, Richmond, Charleston, Toronto, Buffalo, Pittsburg, Cleveland, Cincinnati, Atlanta, Detroit, Louisville, Chattanooga, Birmingham, Grand Rapids, Indianapolis, Milwaukee, Chicago, St. Louis, Memphis and many other cities.

Wiring Standards in Iowa Cities.

The following information from underwriters' reports has an interest to electrical men:

The standard for electric wiring at Cedar Rapids, Iowa, has improved considerably, much of the wiring being placed in iron conduit systems. Some of the wiring contractors employ inexperienced help, and the mistakes made have occasioned the electrical inspector a large amount of extra work through additional visits, made necessary to assure him that the defects noticed on previous inspections are properly corrected. An informal conference was arranged between the underwriters' electrical bureau inspector and the electrical contractors, central-station men and the light and water committee of the City Council, for the purpose of considering various phases of electrical construction work. The lighting company's representatives advocated the establishment of minimum drop in potential for all interior wiring, to preserve its efficiency and make it possible to give good service. The service company complains that it is often blamed for poor service, when the cause is directly traceable to small wire and long runs. Various details in connection with electrical construction work were also discussed.

The city electrician of Marshalltown, Iowa, is rigidly enforcing the electrical inspection ordinance, and the standard for wiring has been raised. The few suggestions made by the electrical bureau inspector, calculated to bring the wiring up to full compliance with National Code requirements, were gladly received and will be acted upon. Old and defective wiring is coming in for attention as fast as buildings are altered or the wiring is changed in any respect. The inspector has promised to do some systematic reinspection work to preserve the fuse protection and prevent interference with the wires.

The present electrical inspector at Waterloo, Iowa, has had several years of practical experience as a wireman and has established and is maintaining a good standard for wiring. The lighting company and the various contractors are co-operating with the inspector in his efforts to enforce the ordinance. Some progress has been made toward improving old and defective wiring, and where service is discontinued on any old wiring it cannot be again placed in operation until overhauled. Outside wiring is said to be in poor condition and has been the subject of criticism on the part of the inspector and the chief of the Fire Department.

Long Underground Telegraph Circuits in Great Britain.

Some interesting information is contained in the following letter recently sent by the postmaster-general of the United Kingdom to the secretary of the Association of Chambers of Commerce of the United Kingdom, in reply to a memorial in favor of laying all trunk wires underground so as to obviate the delays caused by storms breaking down the overhead wires:

"Sir: The postmaster-general has had before him the memorial of the Associated Chambers of Commerce in favor of more extended construction of underground telegraph trunk lines, which you sent to him on the 26th ult. In reply I am to state that the underground line between London and Glasgow has now been completed. It was begun, as the Chambers of Commerce are no doubt aware, in the year 1896-97, and reached Birmingham in 1900. In 1902-3 it reached Warrington, and at that point it cut an existing underground line between Manchester and Liverpool. It has now been continued to Glasgow through Carlisle. The spur line to Manchester has been continued through Bradford to Leeds. In the south an underground line has been laid from London eastward as far as Chatham, and westward as far as Slough, and thence a pipe, but not yet a cable, as far as Reading. During the present year the postmaster-general hopes to extend this pipe line to Bristol and to provide a cable as far as Chippenham. The intention is to carry this line into Cornwall, to the landing places of important Atlantic and Mediterranean cables. The postmaster-general trusts that the Chambers of Commerce will see in such a programme evidence of a desire to extend the underground system of telegraphs as rapidly as he reasonably may. He is, however, bound to adhere to the view expressed by his predecessor in the letter addressed to you on the same subject on April 13th of last year, that Parliament could not at present be asked to sanction a larger expenditure than that which is now contemplated, and, further, that the Postoffice could not proceed economically with greater rapidity than it is proceeding now."

Some Late Developments in Westinghouse Motors.

Good quality has always been a characteristic feature of Westinghouse motors, and it is obtained not only by careful design and workmanship, but is also assured by means of careful and elaborate systems of inspection which applies not only to the integral machines but also to their component parts. Every coil, every casting, and, in fact, every part of the Westinghouse motors undergo severe tests before being assembled. During the assembling process these tests are repeated as the various integral parts are assembled, and finally before shipment the machine, as a whole, must pass rigid inspection and test.

The insulating material used on the various Westinghouse motors has in itself been an interesting development, and at the present time experienced chemists, provided with the most modern equipment, are constantly experimenting upon various insulating materials with an idea of bettering the quality of this all important factor in successful motor manufacture.

The successful application of motors to the various industries depends upon an intimate knowledge of the various operations involved in that particular industry, and with this in mind the company has employed specialists in many lines of work who are responsible for the proper design and application of the various types of motors. Although the Westinghouse motors constitute an important factor in the successful operation of many industrial plants, the most noticeable increase has probably been in connection with machine shops, textile mills, printing establishments, flour mills, cement mills, paper mills, planing mills and breweries.

For textile, flour and cement mills, the induction motors are particularly adapted, being absolutely sparkless, thus eliminating all danger from fire, and on account of the class of labor frequently employed, the extreme simplicity in operation is an

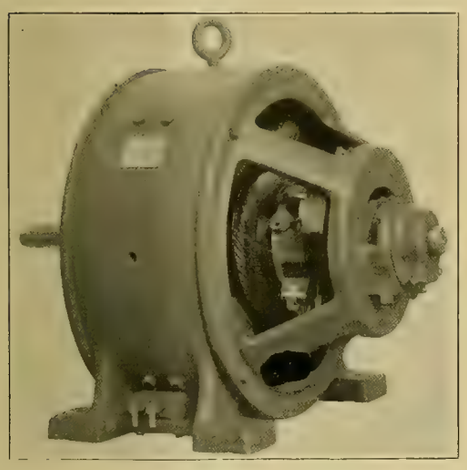


FIG. 1. TYPE S DIRECT-CURRENT MOTOR.

important item. Their simplicity of construction, involving as they do no commutators and consisting practically of but two parts—a stator and rotor—places them, so far as attendance is concerned, on a par with line shafting.

The type S and SA motor, shown in Figs. 1 and 2, for direct-current service, in, for example, the driving of machine shops, elevators and the like, are standards in motor construction.

In the various lines of Westinghouse motors, the split bearings, front and rear alike interchangeable, enabling bearing replacements to be made without removing pinion or pulley, two oil rings on each bearing maintaining copious lubrication, babbit, which is the result of exhaustive tests and liberal mechanical and electrical design, are features which apply to all of the motors manufactured by the company.

Of the many standard types, might be mentioned the type CCL (Fig. 3) and type F (Fig. 4), for alternating current.

Type CCL are made in sizes from one-half horsepower to 75 horsepower. The motor consists of two parts, a stationary primary and rotating secondary. The rotating element is carried by two bearings supported by split-end brackets, which are bolted to the solid cast-iron frame. The line circuit is connected to the stationary winding, and the rotor being of the squirrel-cage type, no sliding contacts are necessary for introducing current to the rotating element. The only wearing parts of the machine are the bearings, which on account of their liberal design and rigid construction, require no adjustment. The only attention required by the motor itself consists in occasionally applying oil to the bearings. These bearings are split and interchangeable, front and rear. They are provided with two oil rings, furnishing a flooded lubrication.

A type not shown in the illustrations is the type CC single-phase induction motor, which is made in sizes from one-fourth to 10 horsepower. In many localities polyphase current is not available and the single-phase motor must be used. These single-phase motors have all the mechanical advantages of the polyphase machine. They are designed and constructed for severe service, are reliable and efficient in operation, and possess a minimum of complications. The self-oil bearings, the starting device, which can be placed in any convenient location, and the clutch pulley, enabling the motor to pick up its load easily, are the principal features of the single-phase motors.

Variable-speed induction motors, as exemplified

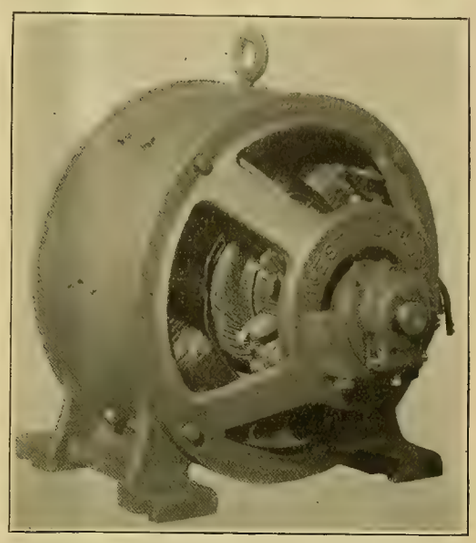


FIG. 2. TYPE SA DIRECT-CURRENT MOTOR.

by the type F, are made in sizes from one to 500 horsepower, and have been designed to meet the demand for a variable-speed motor operating from alternating-current circuits. The essential difference between the type F and type CCL consists in the employment of the wound secondary instead of the squirrel cage, similar, as regards winding, to the alternating-current generator armature. This winding is connected through brushes and collector rings to an external resistance, which may be varied by means of a controller, usually of the drum type.

Type H constant-speed induction motors are made in sizes from five to 75 horsepower. These motors are designed particularly for operation at constant speed in service where the starting conditions are severe.

Type S direct-current motors are made in capacities from one to 110 horsepower, and have been designed with the idea of furnishing a rugged motor, adapted to belt and gear connection. These motors are extremely flexible as regards their application, there being somewhat over 700 ratings obtainable on 13 frames, and the same machine is well adapted to either constant or variable-speed service. While the type S motor has made for itself an enviable record in machine-tool service, requiring as it does an extremely rugged machine, it is at present used in almost every conceivable

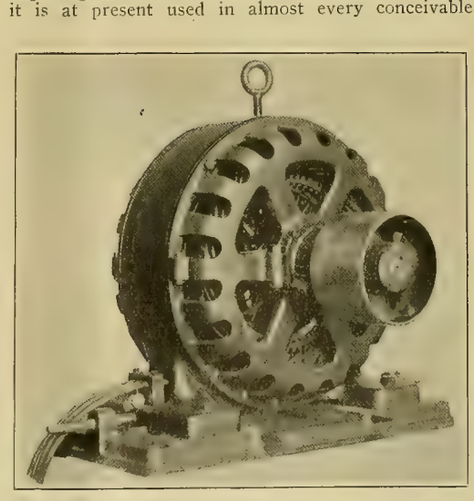


FIG. 3. TYPE C C L POLYPHASE INDUCTION MOTOR.

industry. The same rugged construction is maintained through the line, split bearings, interchangeable front and rear, extremely heavy shafts, substantial frames, improved shunted brush holders and superior brush-holder rigging, being some of the principal characteristics which appeal to the mechanical man when purchasing electrial machinery. The wearing depth of the commutator is exceptionally great. This machine is provided with an exceptionally heavy series winding in combination with the restraining shunt. The starting torque is entirely comparable with the series-wound machine, but the shunt winding prevents the motor from attaining an excessive speed, which has been the weakness of the series-wound motor when used for driving bending rolls.

Direct-current motors, type SA, are essentially voriable-speed motors provided with an auxiliary pole, insuring perfect commutation through a speed range as high as 1 to 4. The control is obtained by the simplest and most effective of all methods, i. e., field control, and the employment of these motors insures satisfactory operation where variable speed is required, combined with a maximum simplicity as regards wiring, etc.

Direct-current motors, known as type K, are made in capacities from 3½ to 40 horsepower, are series wound, and particularly designed for crane hoisting and similar service. They represent the latest development in motors of their general type, and many new features of practical value are incorporated in their construction; among these may be mentioned split frames and bearings, extremely rigid shafts and superior design of shunted brush holder, together with comparatively slow speeds, minimizing gear reduction and insuring long life and a minimum of repairs. The motors themselves are compact, convenient to install and allow of considerable flexibility in the matter of mounting. The frames are enclosed, guarding against dirt and moisture, but are so arranged that the working parts are readily accessible for inspection without dismantling the motor itself.

To meet the demand for a thoroughly reliable machine of small power, which shall be easy to install, and may be operated by the inexperienced, giving continuous service throughout a long life, the type R motors have been designed. Their capacities range from one-sixth to 1¾ horsepower. The fields are shunt wound, and a number of different horsepower ratings and speeds are obtainable on the various frames. Many features of importance, often regarded as unnecessary on small

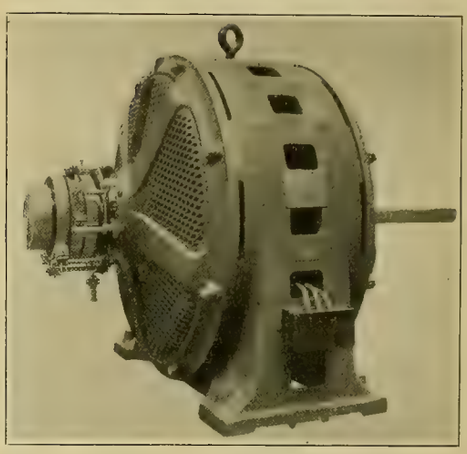


FIG. 4. TYPE F VARIABLE SPEED INDUCTION MOTOR.

machines, have been incorporated in the type R motors. Among the important features may be mentioned rigid shafts, interchangeable bearings, front and rear, the bearings being of extremely simple form, which may be duplicated by the ordinary machine shop at a trifling expense, and superior brush-holder adjustment, maintaining the relation between commutator and brushes, thus obviating regrinding when brushes are adjusted, together with an extremely solid frame construction, which in a measure protects commutator and brush holders. The motors operate sparklessly between no load and an overload of 50 per cent. Within this range the brushes require no adjustment. On the two larger sizes the same type brush-holder construction is used, which the Westinghouse Electric and Manufacturing Company is at the present time furnishing on large engine-type generators.

Northern California Transmission Line Completed.

The Northern California Power Company's new transmission line connecting its Volta power plant with the power-transmission system of the California Gas and Electric Corporation has been completed. The new three-phase line is of aluminum and 66,000 volts will be carried. There is a 1,000-foot span across the Sacramento River at Tehama, the wires being suspended at a height of 110 feet above high-water mark. The surplus power of the Northern California system will be sold to the corporation. The new link will give nearly every point in Butte, Tehama and Shasta counties power from several alternative lines in case of interruption of service from any cause.

The City Council of Milwaukee has passed an ordinance providing for the appointment of an electrical inspector.

BOOK TABLE.

ALTERATING-CURRENT WINDINGS, THEIR THEORY AND CONSTRUCTION. By C. Kinzbrunner. New York: The D. Van Nostrand Company. 1906. Pp. (5½ by 8½ inches), 80, with 89 illustrations. Price, $1.50.

This little book deals with the theory and construction of windings for alternating-current machines, and takes up the subject in a clear manner, but in simple language that will appeal to the non-technical reader. There are seven chapters in all, as follows: "The Production of Alternating Currents," "Alternating-current Windings," "Continuous-current Windings," "Dissolved Continuous-current Windings," "Multiphase Windings," "The Construction of Alternating-current Windings" and "The Insulation of Alternating-current Windings." The book is a thoroughly practical one and recommends itself particularly to the skilled workman who is building this class of apparatus, as well as to the student and designer.

MODERN POLYPHASE MACHINERY. By Andrew Stewart. London: S. Rentell & Co. 1906. Pp. (4¾ by 7 inches), 296, with 181 illustrations. Price, $1.25.

The book begins with the materials out of which an alternator is built, taking up the magnetic properties of iron and steel and the properties of various insulating substances; then it plunges into the matter of the theory of alternators under such headings as the electromotive force of an alternator, armature windings, field-magnet system, determination of the characteristics of a machine, etc. The various kinds of alternators are described, examples being taken of up-to-date machines, not forgetting the turbo-alternator. While the first part of the book is devoted chiefly to generators, the latter part takes up motors, both the induction and synchronous types, going somewhat into speed control and testing. On the whole, the book will be found of a practical nature and helpful to those who have to handle this class of apparatus.

CONTINUOUS-CURRENT ARMATURES, THEIR WINDING AND CONSTRUCTION. By C. Kinzbrunner. New York: D. Van Nostrand Company. 1906. Pp. (5½ by 8½ inches), 80, with 79 illustrations. Price, $1.50.

While intended primarily as a translation of Professor Arnold's book on armature winding, this work has been condensed from the original, some of the discussions being omitted which related to machines seldom employed. The volume contains rules which will enable the reader to design any winding, though it may not be specifically treated in the book. The explanations are given in popular language which will be plain to those possessing an elementary knowledge of electricity. Though intended for students and designers, workmen, such as armature winders and those building electrical machinery, will find it an aid to them in their work. The book is divided into three sections—"The Theory of Windings," "The Construction of Drum Windings" and "The Construction of Armatures." It is printed in large, clear type and has exceptionally good diagrams.

AMERICAN STREET RAILWAY INVESTMENTS. New York: McGraw Publishing Company. 1906. Pp. (9⅜ by 12⅞ inches), 432, with 47 maps. Price, $5.

American Street Railway Investments, or the "Red Book," gives financial statistics of all street-railway companies of the United States, Canada, Cuba and the United States insular possessions. The statistics include, in most cases, operating reports and balance sheets of the companies listed, besides a history of corporate organization of each company. Other information given consists of the population of the city where the line is located and the tributary population, financial status, enumeration of plant equipment, parks and amusement resorts served, officers and directors of the company and location of offices, shops and power plant. The edition of 1906 is an increase of 17 pages over 1905, and the 47 maps show the systems of 52 separate companies. The resume of gross receipts of the 437 companies listed, in the first four pages of the book, shows a marked increase in earnings of the street-railway companies of the country.

THE PRACTICAL TELEPHONE HANDBOOK. By Joseph Poole. London: Whittaker & Co. (New York: The Macmillan Company.) 1906. Pp. (5 by 7¼ inches), 533, with 473 illustrations. Price, $2.

This is the third edition of the book, made necessary by the rapid growth of the telephone industry and the radical changes that have taken place in the construction of the apparatus. The subscribers' apparatus and that at the exchange are dealt with, after which the construction of conduits and aerial lines is taken up. There is a special chapter on automatic exchanges and another on electrical instruments. Engineering problems which come up in the planning and construction of a telephone system are touched upon, though the work is not extensive enough for these subjects to be treated with much detail. Such apparatus as is described is of late pattern, and although the book treats of English methods and contains English ideas as to how a telephone system should be built, it is sufficiently general to make it valuable to the telephone man in this country as well as to the one who is working on English systems.

REPORT OF THE ELECTRIC RAILWAY TEST COMMISSION. New York: McGraw Publishing Company. 1906. Pp. (6 by 9¼ inches), 621, with 212 illustrations. Price, $6.

This report gives the results of the work done under the auspices of the Electric Railway Test Commission of the Louisiana Purchase Exposition looking to the collection of exact scientific data relating to electric-railway operation, important alike to the producer and user of electrical apparatus. The work was done by an executive committee appointed by the commission consisting of the chief of the department of electricity of the Exposition, Mr. W. E. Goldsborough, and three superintendents, who were assisted by a corps of young men from the leading technical schools. The tests extended over a period of five months, during which time data was collected upon acceleration, breaking alternating-current losses in steel rails and in tracks, tests of compressor equipments, storage-battery industrial locomotive, etc. In addition tests were also made on the tracks of the Indiana Union Traction Company to determine air and train resistance, etc. The results of all these exhaustive tests have been carefully worked up and compiled in book form, forming in the end a work of much value in the field of electric-railway operation.

ELECTRICITY METERS: THEIR CONSTRUCTION AND MANAGEMENT. By C. H. W. Gerhardi, London; The Macmillan Printing and Publishing Company. 1906. Pp. (5¾ by 8¼ inches), 337, with 220 illustrations. Price, $4.

The problem of measuring current sold is one of the most important dealt with by the central station. The system may readily, without the proper apparatus and management, become the leak through which the profits of the business may take the form of a disappearing quantity. It is therefore essential that this class of apparatus be thoroughly understood. To even refer to all of the many types of meters that have from time to time appeared on the market would, however, be time thrown away except for what historical interest might attach to such an enumeration. But a book thoroughly describing the meters in use at the present time, or which have been recently introduced, has its place in engineering literature, and the book here considered admirably fulfills its function. In brief, the subjects treated are: Alternating-current meters; direct-current meters; meters for both alternating-current and direct-current; prepayment meters; double-tariff meters, maximum-demand indicators, and electric car meters.

To keep a meter system up to its highest state of efficiency requires frequent testing and calibrating of the instruments. In view of this fact a considerable portion of the latter portion of the book is devoted to the subject of meter testing, reading, cleaning and repairing, meter bookkeeping, and the like. The book is one which will commend itself to manager and operator of the central station alike.

PROCEEDINGS OF THE AMERICAN STREET AND INTERURBAN RAILWAY ASSOCIATION, the Street Railway Accountants' Association of America and the American Street and Interurban Railway Engineering Association. Published by the association. Pp. (6 by 9 inches), 1,032.

The 1905-6 Proceedings of the American Street and Interurban Railway Association and its affiliated associations the Street Railway Accountants' Association of America and the American Street and Interurban Railway Engineering Association have all been substantially bound in one volume, which is now ready for distribution. Evidently much conscientious work has been done in the preparation of this book, which is a credit to the associations represented and a great improvement over the separate paper-covered volumes of proceedings hitherto issued. The proceedings of each association occupy separate parts of the volume and are distinct from each other. Each has as a frontispiece a fine portrait of the president and there is also an excellent one of Mr. T. C. Pennington, who was for so many years the secretary and treasurer of the American Street Railway Association. All the proceedings of the respective conventions in 1905 are given, including the papers and discussions. There are also lists of the present and past officers of the associations and lists of the delegates, ladies and exhibitors at the Philadelphia convention last year.

On the whole the book has been gotten up in excellent shape and reflects much credit on the work of the new secretary-treasurer, Mr. B. V. Swenson.

THE PRINCIPLES OF WAVE TELEGRAPHY. By J. A. Fleming. London: Longmans, Green & Co. 1906. Pp. (6 by 8½ inches), 657, with 316 illustrations. Price, $6.60.

An enormous amount of original research has been carried on during the last 10 years in the field of space telegraphy and the transmission of energy by the Hertzian waves, as the records of the patent offices in the various countries show. Not a few books on the subject have also been written, dealing more or less thoroughly with the subject. The work of Mr. Fleming represents one of the most exhaustive treatises extant, and in it he has not only developed in a highly technical manner the principles of the art of space telegraphy, but he has also embodied much matter of a practical nature concerning the working of the various systems now in common use. The subject-matter is based largely upon a number of courses of lectures which he has been called upon to deliver during the last few years, and includes also a list of the chief patents that have been granted in Great Britain on systems and details of space-telegraph apparatus.

The book has been divided for convenience into three parts, treating, respectively, "Electric Oscillations," "Electric Waves" and "Electric-wave Telegraphy." The first two parts go minutely into the theory and principles of the electric oscillation and wave phenomena upon which are based the working systems of space telegraphy. The last part is of a more practical nature and deals with the several operable systems which are now in commercial use, describing them in the successive steps of their development. Finally, in three appendices are the wireless telegraph act of 1904, the bibliography of electric-wave telegraphy and a review of the patent situation. Any attempt to enumerate even the various subdivisions of the work would here be impracticable, but it may be said in summarizing that Dr. Fleming's book represents probably the most exhaustive treatment of the subject of space telegraphy yet published, and until the progress in the art has outreached its scope the work will be a standard one.

ELECTRICAL ENGINEERING IN THEORY AND PRACTICE. By G. D. Aspinall Parr, London: Macmillan & Co. (New York: The Macmillan Company.) 1906. Pp. (5¾ by 8⅝ inches), 447, with 282 illustrations. Price, $3.50.

It cannot be said that this book covers a new field, nor does the author make any pretensions at so doing. But the rapid progress in the art makes necessary frequent changes in the text of books on general electrical engineering, to keep pace with the developments in the art. In making a thoroughly up-to-date work on electrical engineering the author has succeeded in combining about the right amount of fundamental matter, which is necessary to a clear understanding of the text, with the larger portion of practical information. Historical and obsolete matter has been excluded wherever possible, except that which is necessary to illustrate some principle. At the ends of the various chapters are given the questions which have been given for the technology examinations of the city and guilds of London Institute for the preliminary, ordinary and honors grades of electrotechnology. Such questions are given after each chapter as apply to the subject matter in that chapter, and if carefully studied form a feature of great value in the study of the book.

Not only is the theory of generation, transformation, transmission and distribution of electrical energy taken up, but the latest obtainable data on electrical machinery and appliances is set forth in the proper sequence for profitable study. One subject which has hitherto not received the attention which it merits in books of this kind is that of illumination. A large portion of this work is devoted to incandescent, arc and mercury-vapor lamps, and as indicative of how the subject-matter is kept abreast of the times a description of the latest comer in the arc-lighting field—the flaming arc—is described. Electrostatic and magnetic measuring instruments are also given the space that their importance deserves.

STEAM-TURBINE ENGINEERING. By T. Stevens and H. M. Hobart. New York: The Macmillan Company (London: Whittaker & Co). 1906. Pp. (6 by 9 inches), 814, with 516 illustrations. Price, $6.50.

Three or four years ago the steam turbine was in its infancy, manufacturers were experimenting with its constructional details and central-station men and others thought long and seriously before giving it a trial in their plants. Today all this is changed and the steam turbine has become a standard piece of apparatus whose worth has been proved. Notwithstanding treatises upon it have been published, it still offers a distinctive field for literary effort, particularly in the things which relate to its operation and in the matter of its first cost, economy of steam consumption, maintenance, etc. Much has been written pertaining to this phase of the subject, but the writings have been principally confined to papers prepared for engineering associations. In the work under consideration is to be found probably the most elaborate treatise to date upon what the steam turbine is able to do, its cost as compared with other types of prime mover, what it will cost to maintain it and many other things with which the purchaser is more concerned than with the theory and design of the machine, which is given only in a general way.

The bulk of the book, after an introductory chapter and one on nomenclature, is devoted to the treatment separately of all the different types of steam turbines which are now considered to be in the front rank, a chapter being devoted to each.

These chapters take up first, briefly, a description of the machine itself, after which follows information and data upon the installation and operation of the machine, the dimensions and weights, amount of lubricating oil required, steam consumption under various conditions, results of tests, etc., all of a highly practical nature and for the most part arranged in tabular form. Following these chapters upon the performance of the individual machines are others of a more general nature upon the economy of modern reciprocating engines, comparison of results obtained from piston engines and turbines, pressure, superheat and vacuum in plants under operation, auxiliary apparatus, foundations, buildings, etc. In short, the work is one which commends itself particularly to the man who wants the information which will enable him to compare the advantages of the steam turbine with other prime movers in making a decision as to the kind of apparatus he will install.

THE ELECTRICAL NATURE OF MATTER AND RADIOACTIVITY. By Harry C. Jones. New York: The D. Van Nostrand Company. 1906. Pp. (5¼ by 8 inches), 212. Price, $2.

To those who have followed the developments that have taken place in study of the theories of the nature of matter since the discovery of the X-ray will find this book intensely interesting. Since the discovery of radium by the Curies, with its marked effect on the views held concerning the nature of matter, many have desired to know more of this interesting phase of modern science, but the subject has appeared so complex as to baffle the ordinary person who has not devoted much time to its careful study. This book, however, though it makes no pretensions at being a deeply mathematical analysis of the subject, gives clearly and concisely, step by step, the various things which have successively arisen to form the framework of the theories which are today held concerning the composition of matter. The atom, which was for so long believed to be the indivisible particle of matter, has given way to the electron theory, and in the introductory chapters the electron theory and what led to its acceptance are set forth. Then came the discovery of the X-ray and its startling bearing on this subject, followed later by the discovery of the radioactivity of certain substances, and finally of radium itself. These things are all told in an interesting manner, which appeals to the reader. Having gone this far, the subject of radium is taken up more in detail, the methods by which it is obtained being set forth, also its characteristics, such as the giving off of different rays, the properties of its radiations, the production of heat by radium salts, the production of helium from the emanations, etc. The most recent work done in the study of radioactivity is recounted in the last part of the work, including a description of the interesting and puzzling results obtained by Burke with his "radiobes."

If it be really true that, as Thompson says, all matter is made up of electrons of uniform negative electrification surrounded by a sphere of positive electrification, and separated by comparatively enormous distances from each other, like planets in the solar system, there is certainly opportunity for thought and careful study before the mind of the average reader is prepared to comprehend the nicety with which this theory fits in with the practical results which have heretofore been obtained, working along the lines prescribed in the older view held concerning chemical change. Those who desire to make such a study and for their own benefit to understand in general just what these discoveries mean and how they were made will find in this work the book they have been seeking.

Decker Hydro-electric Development In Indiana Assured.

Articles of incorporation of the White River (Ind.) Power Company were completed June 27th and will be filed with the secretary of state at once. The capital stock is $500,000, is all paid in and owned by the officers and the directors, consisting of Eugene Rush, Detroit, Mich., capitalist, as president and general manager; E. H. DeWolfe, Vincennes, vice-president and assistant general manager; J. T. Small, Frankfort, Ind., secretary and chief electrician; L. C. Embry, Princeton, Ind., treasurer and general counsel; John Gatton, Vincennes; Wayne Edwards, Decker, and Jacob Meirs, Evansville, Ind., directors.

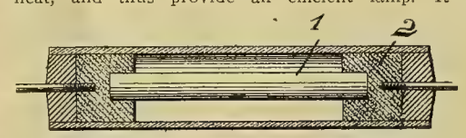
The object is to dam the White River at Decker, Ind., to establish a hydro-electric power plant to generate electricity for light, heat and power, for all the cities about Decker within a radius of 50 or 75 miles. Actual work on the construction of the plant will begin about August 1st. H. Von Schon, a hydraulic engineer of Detroit, Mich., who had the Niagara Falls plant under his supervision, is on the way at the present time to begin his work at Decker.

White River at Decker furnishes every condition for the success of the undertaking, as has been found by the different surveys and soundings. The preliminary surveys have all been made, and soundings of the river show that there is a good bed of rock on which to build the dam.

Incandescent Electric Lamp with Refractory Glower.

A somewhat unusual form of incandescent electric lamp was recently patented by Herschel C. Parker of New York city, the inventor having in mind a cheap and simple, but at the same time durable, lamp in which the light-giving body is a pencil of a refractory non-conducting substance with which is mixed a small percentage of conducting material. The pencil thus formed will allow the passage of current when cold, and will be heated to incandescence upon continued passage of the current.

It was found by experiments that by mingling some refractory non-conductive substance, such as thorium oxide or carborundum, with a small percentage of a refractory conductor, such as graphite, and shaping the mass into a pencil, the latter being preferably compressed, a current could be passed through the pencil when the latter is cold. The substance would have sufficient resistance, however, to cause the pencil to be raised to a high heat, and thus provide an efficient lamp. It is



REFRACTORY GLOWER FOR ELECTRIC LAMP.

probable that other substances than the thorium oxide and carborundum may be used, but the substances must be of such a nature that when mixed with the conductor they will produce a light-giving pencil and not one which will merely glow under the influence of the current.

The principal portion of the lamp, as shown in the accompanying illustration, consists of the pencil (1) and its conducting terminals (2). The pencil is made, as above remarked, preferably of thorium oxide or carborundum mixed with some good refractory conductor. To get the best results, there should be approximately three or four parts of the oxide to one of the conductor, and for the latter graphite works perfectly. To form the pencil, the ingredients are reduced to a fine powder and thoroughly mingled, and the parts may be held together by a suitable binder, forming a sort of dough, which can be forced through a die to make the pencil of the right size, and the pencil can be cut into the requisite lengths and dried and baked. As a result a pencil is produced which will conduct the current when cold, thus obviating the necessity of providing a preliminary heating, and at the same time the pencil is of comparatively high resistance and of such a nature that it will not flame, but will glow with a bright incandescence when sealed within a tube from which the air is partially exhausted.

The terminals are preferably of graphite and receive the leading-in wires, the terminals being also arranged so as to fit snugly like stoppers in a transparent tube, which is preferably made of glass, as the air gap between the tube and the pencil is sufficient to prevent the glass from slagging. The graphite is held in place by a suitable cement or seal. The air can be exhausted from the tube in any usual way, and this can be done easily by leaving a vent in the glass, heating the pencil to incandescence, thus expelling the air and gases and sealing the vent while the pencil is still hot.

What the Municipal Electricians Will Discuss.

"History of the Fire and Police Telegraph," Adam Bosch, Newark, N. J.

"Details of Certain Auxiliaries to Fire-alarm Apparatus," J. B. Yeakle, Baltimore, Md.

"Advisability of Protecting Municipal Electricians by the Civil-service Laws," Jerry Murphy, Cleveland, Ohio.

"Comparison of Underground and Overhead Wiring, and of the Relative Values of Single, Rubber-covered Wire and Lead-encased Cable for Underground Construction," W. H. Thompson, Richmond, Va.

"Conditions Surrounding the Inspection of Wires in the Southwest" (with special reference to the advisability of one inspector completing each inspection instead of several inspectors, each doing a part of it), Clarence R. George, Houston, Texas.

"Question Box," Walter M. Petty, Rutherford, N. J.

This is a partial list of the features that will be presented at the eleventh annual convention of the International Association of Municipal Electricians, to be held at New Haven, Conn., August 15, 16 and 17, 1906. Frank P. Foster of Corning, N. Y., is the secretary.

Steinmetz on High-speed Electric Railroading.

"There is no limit to the speed that may be developed in electric traction—that is, there is no limit up to 150 or 200 miles an hour. Higher speed than that the car wheels could not stand. They would fly to pieces from centrifugal force. Not only can a speed of 120 miles an hour be maintained on a train equipped with electricity, but in my opinion it is an entirely feasible scheme from the commercial point of view."

Thus spoke Prof. Charles P. Steinmetz, consulting engineer of the General Electric Company and one of the greatest authorities on electricity in the world. His remarks were called out by the publication in a Philadelphia newspaper of an article doubting if much higher speed could ever be used on the railroads than that which is attained now. It was pointed out that the first cost would be enormous, entailing a high fare between cities, but more important was the question of signals. The engineer, it was said, could not see the signal in time to stop the train if it is going at a high rate of speed.

"I should say," said Prof. Steinmetz, "that it is largely a question of roadbeds and that signals have little or nothing to do with it. Of course there is danger from high-speed trains, and probably there always will be, but the tendency is not only to increase the speed but to make the railroads safer. This is illustrated by the gradual abolition of crossings at grade and the elimination of sharp curves. I presume that the time will come when grade crossings will be done away with entirely and the railroads so ballasted and straightened out that a speed of 120 to 150 miles an hour can be maintained.

"As a precaution agaist collisions the high-speed electric railroad would have to be built in 15 or 20-mile sections with sections a mile or two long in between, which could not be crossed by a train while another train was in the section ahead. These short sections could be so equipped tthat the power would be cut off as long as there was a train in the long section ahead. The result would be that the train following would come to a standstill until the train ahead got out of the block. However, these are mere matters of detail which I am confident could be adjusted to provide for all emergencies.

"In my opinion we are fast coming to electricity in place of steam, in all densely settled sections at least."—New York Sun.

Electrolytic Deposition of Zinc.

The twenty-first ordinary meeting of the Faraday Society was held on June 12th, at the Institution of Electrical Engineers, in London. Mr. W. Murray Morrison was in the chair. A paper on "The Electrolytic Deposition of Zinc, Using Rotating Electrodes," by Dr. T. Slater Price and Mr. G. H. B. Judge, was communicated by Dr. F. Mollwo Perkin.

An improved form of apparatus for the electrolytic deposition of metals using a rotating cathode is described. The ordinary beaker is replaced by a tap funnel of about 100 cubic centimeters capacity, so that the electrolyte can be run off at the end of the experiment, thus obviating the use of a siphon. Use is made of a bicycle hub for rotating the cathode.

In the deposition of zinc from a pure solution of the sulphate, no extraneous electrolyte being added, with a current of two amperes (cylindrical cathode of gauze, 22 millimeters in diameter and 40 millimeters long) and voltage 4.5-5.5, the results are uniformly low. The error increases with higher currents, and is due to the heating effect of the current. On keeping the electrolyte cool by means of an ice jacket good results are obtained, even in the presence of free sulphuric acid, provided that the concentration of the latter does not exceed a certain amount $\left(\text{about } \frac{n}{6}\right)$.

It is further shown that zinc can be quantitatively deposited from solutions of zinc sulphate, containing 0.2274 gram zinc in the presence of 2-3 grams sodium sulphate. The deposit is better than that obtained by the usual method, using sodium acetate and acetic acid; it is not necessary to cool the electrolyte.

An improvement of the method of Kolloch and Smith (Journal American Chemical Society, 1905, 27, 1,255) using a rotating anode and mercury cathode is also described. It is found necessary not to have present more than two drops (40 drops = three cubic centimeters) of free sulphuric acid in order to obtain quantitative results in the estimation of zinc.

The Chicago Drainage Canal board has found itself in difficulty through its abrogation of the contract of Joseph L. Duffy to excavate for the completion of the waterpower plant at Lockport. There are three miles of solid rock to be removed, and since the board took the Duffy contract away because of delay it has been unable to find another contractor to finish the work except at prohibitive cost. The board may complete the work itself, which might take two or three years.

Extensions in Peru and Brazil.

That there is a healthy growth in the installation of electrical machinery in South America is well shown by several activities in Peru and Brazil. The Empresa Electrica de Santa Rosa, Peru, which already operates a large generating station on the River Rimac, is extending its service to such a degree that an additional power house is necessary. This will be operated in parallel with the present station. The equipment for the new station includes two General Electric three-phase 60-cycle revolving-field generators, each having a capacity of 1,200 kilowatts and operating at 2,300 volts. The generator voltage will be stepped up in three 750-kilowatt water-cooled transformers to 33,500 volts, and transmitted to a sub-station, where distribution will be made from water-cooled step-down transformers at 2,300 volts.

In Brazil the well-known Sao Paulo Tramway, Light and Power Company is also making additions to its present equipment. At the generating station another General Electric three-phase revolving-field 2,000-kilowatt 2,300-volt generator is about to be installed, with necessary switchboards, for the operation of the new machine. In addition, the equipment will be increased by three General Electric 60-cycle 660-kilowatt 24,000-2,000-volt transformers and three 60-cycle 660-kilowatt 20,000-2,300-volt transformers of the same type. This power house furnishes current for railway, light and power. The railway equipment is also being increased.

Another interesting installation about to be made in Peru is at the mines of the Inca Mining Company. The location of the properties of this concern makes transportation difficult, and all material has to be packed up the mountain trails on mules. The electrical equipment includes a General Electric three-phase 200-kilowatt 6,600-volt alternating-current generator of the revolving-field type. In addition, there will be four 67-kilowatt transformers, as well as several induction motors, for hoisting work and the necessary switchboards. In order to facilitate transportation, all the apparatus will be constructed in parts, none of which will weigh over 350 pounds, except the alternator shaft.

Oregon Electrical Interests Merged.

The electric-light, power and railway interests of the lower Willamette Valley have been merged and will be controlled by the newly formed Portland Railway, Light and Power Company, with headquarters in Portland, Ore. H. W. Goode, president of the Portland General Electric Company and the Oregon Water Power and Railway Company, will be the head of the merged interests, while the railway department will be managed by F. I. Fuller, formerly president of the Portland Railway Company and vice-president of the new corporation. H. L. Clark of Philadelphia is the other vice-president. F. G. Sykes, who has long been associated with the Portland General Electric Company, is a director, and will have control of the light and power department of the company.

The capital stock of the new company is placed at $15,000,000. There is also to be an issue of an additional $15,000,000 in bonds.

The objects announced in the articles of incorporation are the operation of street railways, power plants, lighting and heating plants, etc. Mr. Goode is well fitted to head the new company. He is thoroughly familiar with the manufacture and distribution of electric power, and this will be the primary purpose of the new consolidation.

Electrolysis in Pittsburg.

At a long conference in the office of Mayor George W. Guthrie of Pittsburg between city officials and the representatives of the Pittsburg Railways Company and the Allegheny County Light Company the question of preventing or lessening the damage to water pipes by reason of corrosion from electrolysis was discussed. The companies were given notice that some action must be taken at once. It was decided to adopt the Brownell system of bonding the ends of the pipes with copper wire, thus preventing corrosion. The cost of this will amount to about $40,000 and will be paid by the companies.

Independent Telephone Consolidation in North Dakota.

Announcement has been made of the consolidation of a number of Independent telephone lines in North Dakota and the organization of the North Dakota Independent Telephone Company, with headquarters at Fargo. The new company will connect with the Tri-State Telephone Company and will begin business with about 1,000 miles of toll lines. The construction of a line from Fargo to Bismarck in the immediate future is also planned.

A report from Antwerp states that never before has the demand been so great from the United States, at any one time, for cement as at the present time. One vessel recently took 6,100 tons of cement from Antwerp to San Francisco.

Indiana Telephone Items.

The Home Telephone Company of Flora has been taken over by the Flora Telephone Company, which has a large country patronage. The combined plants will be improved, new equipment installed and better service given.

A new Independent telephone company has been organized at Shelbyville with a view of competing with the company recently acquired by the Bell company for the business in Shelbyville and community.

Three good offers have been made to the receiver for the purchase of the Hannah Jackson telephone plant in Greenfield. The receiver cannot dispose of it until the fall term of the Circuit Court. It was generally supposed that the plant would be discontinued or else purchased and put out of business by the Morrison company, but there appears to be a desire on the part of several bidders to operate the lines. The company has a good many telephones in operation in Greenfield besides a complete system extending to all parts of the county. The liability of the company is $6,000.

The Central Union Telephone Company was recently denied a franchise in Franklin because the company refused to agree to a maximum rate to be charged for service. Thereupon the company set about to buy up all the country exchanges and is now in control of the southwestern part of the county, largely through exchanges recently absorbed. With a chain of smaller exchanges around the city it is expected that the company will soon make another demand for the right to operate inside the city.

The Central Union Telephone Company recently acquired the New Home Telephone Company of Linton. The price is said to have been between $25,000 and $35,000. It is stated that the Independents will organize another company to regain the lost territory the same as they have done in the gas-belt territory.

The Citizens' Telephone Company of Kokomo has filed a third petition for an amended franchise, one which will allow it to enter into a contract with the Bell company without forfeiting its franchise right to do business in the city.

The Indiana Independent Telephone Association closes its first year with a membership of 122 operating companies, constituting more than half of the Independent telephone property of the state. There are still more than 200 companies, principally rural organizations. It is the purpose of the officers of the district association to bring them into the association during this year. It is proposed to make the association a force for the upbuilding of Independent telephone interests in Indiana.

S.

Ohio Telephone Notes.

The directors of the United States Telephone Company have set aside $200,000 for extensions, improvements and betterments of various kinds, but the greater part of this will be spent in stringing wires over the present system to various points where the business is growing most rapidly. New wires will be put up from Cleveland to Toledo and additional wires will be strung from Toledo to Lima, Findlay and Fremont. Through wires from Cleveland to Elyria, Lorain, Berea, Chagrin Falls, Canton and Akron will be put up. Most of the material has been purchased for this work, it is said, and at some points men are already engaged in putting the wires in place.

Stockholders of the Federal Telephone Company have organized to take over the assets of the company. At the meeting a few days ago E. W. Moore was made chairman and J. B. Hoge secretary. Members of the Everett-Moore syndicate owning about 70 per cent. of the stock of the company subscribed to their proportion of the assets, and some of it was taken by other stockholders. The remainder of the underwriting will be taken by the syndicate, and it is hoped to pay off the debts of the company by December, when it will go out of business. The underwriters may sell the bonds taken over.

The Amesville Telephone Company of Chesterhill has been incorporated with a capital stock of $25,000 by A. E. Swayne and others.

C.

Telephone News from the Northwest.

The Northwestern Telephone Exchange Company started work in Thief River Falls, Minn., installing a local exchange, but was promptly stopped by local authorities, the city having refused to grant a franchise. The company will seek an injunction to require the city to show cause why it should not permit the company to proceed.

The Northwestern Telephone Exchange Company will build two new branch exchanges in St. Paul, one in West St. Paul and one in the Dayton's Bluff district.

H. A. Patterson has been elected president of the Mankato Citizens' Telephone Company of Mankato, Minn., to succeed Dr. J. H. James, who has resigned.

The Moorland (Iowa) Mutual Telephone Company has filed articles of incorporation, with D. F. McCarville as president and F. C. Cochran as secretary and treasurer.

The Michigan Telephone Company is building a telephone line from Sault Ste. Marie to Brimley, Mich.

Work has been commenced on the new exchange building which the Iowa Telephone Company will erect at Burlington, Iowa.

Five Independent long-distance telephone companies entering Des Moines, Iowa, have made a contract with the Mutual Telephone Company to handle their business. They formerly operated an exchange of their own under the name of the Mutual Terminal Association.

The Preston (Iowa) Telephone Company has been incorporated with a capitalization of $20,000. John Maher is president and E. L. Cain secretary.

R.

Southeastern Telephone Developments.

On the recent trip of the "Boosters'" train through Tennessee to advertise the city of Nashville the Cumberland Telephone Company made it possible for the business men on board to talk with their offices over a telephone connection carried on board the "special." The company on reaching a stopping place throws out wires which are immediately attached to the regular lines leading to Nashville and other points, and telegraph and telephone connections are immediately secured. On the trip to Alabama the American Telephone Company takes up the service with Nashville at the other end, and there is no interruption whatever. The train telephone service works with clock-like precision.

Negotiations have been completed, it is said, between the Central Home Telephone Company at Louisville and the Independent Long-distance Telephone Company of Kentucky, affording a most satisfactory service in the territory covered. Stock in the Independent company will be exchanged for stock in the holding company. The deal practically completes the effort of the Home company to consolidate the Independent long-distance lines in Kentucky. E. L. Barber is president of the company and J. D. Powers of Louisville is treasurer.

The Interstate Telephone Company of North Carolina has just completed a new directory. The book besides contains much valuable information to the public in general.

The case of the Southern Bell Telephone Company against the comptroller-general of Georgia was set to come up in Atlanta about this date. The Bell company seeks to prevent the collection by the state of occupation taxes, amounting to $30,000. The taxes include those of several years back which the company claims are unconstitutional.

The Southern Bell has been granted the right to lay wires underground on several additional streets and to increase the underground equipment on others in Norfolk, Va.

E. L. Myers of Norfolk, Va., has been awarded the contract for the new office building to be erected in Richmond by the Southern Bell Telephone Company at $92,874. The company is now spending $200,000 in extending its subways and making many improvements, including a new switchboard with a capacity of 10,000 telephones.

L.

GENERAL TELEPHONE NEWS.

The Suburban Telephone Company of St. Louis has increased its capital stock to $600,000.

The Salina Telephone Company will erect a new exchange building in Salina, Kan.

The Independent Telephone Construction Company of Topeka, Kan., has been incorporated with a capital stock of $10,000.

The Mutual Construction and Extension Company of Guthrie, Okla., has been incorporated with a capital of $3,000,000 and will erect telephone exchanges in Oklahoma, Indian Territory, Kansas and the Southwest.

The Illinois Manufacturers' Association has presented to the mayor a draft of the ordinance under which it is seeking a telephone franchise from the city of Chicago. But the document will not be presented to the City Council until after the summer vacation.

The Chicago Telephone Company reports that during June it increased the number of its instruments in service by 1,726. Of these 1,151 were installed in the city and 575 in the country and small towns. The company had at the end of June 157,322 telephones in service in city and country.

The Cleveland Telephone Company is arranging to equip its new East Exchange Building with special reference to the comfort of the girls. The exchange will be on the third floor and the offices on the first. The second will be equipped with a large dining room and a kitchen adjoining, where lunches will be served. An emergency hospital and a handsome library will also find places on tthis floor. In all about 150 girls are employed at this exchange.

CORRESPONDENCE.

Great Britain.

London, June 27.—The proposal to construct a railway running on a semicircle from east to west of London around by the northern suburbs has been rejected by the House of Commons committee which considered the bill for five weeks. It may be remembered that the electrical interest in the proposal was the intention of the promoters, had the scheme been approved, to adopt the single-phase system of traction.

Only the decision now remains to be given in connection with the London County Council proposal to supply electric power in London, and this will be given tomorrow. The latest pronouncement upon the scheme is by the Board of Trade, which recommends Parliament to make it compulsory upon the council to give a supply to anyone asking for it (at present it is only permissive), to include a schedule of maximum prices in the bill where there are none so far, and to fix a limit of time within which the powers under the act are to be exercised in order to prevent the bill becoming a "blocking" bill to future promoters.

The well-known Swiss firm of Brown, Boveri & Co. is about to open an English house in London. For this purpose the firm of Witting, Eborall & Co. is being acquired, and a new firm with a capital of $250,000 is being formed for this purpose. Mr. A. C. Eborall will become managing director of the new company, which will take charge of the interests of the Swiss company not only in Great Britain but in the colonies.

In connection with the visit of the foreign engineering societies a meeting of the International Commission which is considering the question of units and electrical nomenclature was held on Monday morning in London.

Considerable outcry is being made in municipal circles against the inconsistency shown by the local government board in fixing the periods during which loans have to be paid off when granted for the various portions of an electrical supply installation. Thus, only five years is allowed for meters, many of which have been in use much longer; the period for cables, also, is complained of as being far too short, it being stated that mains laid 16 years ago when taken up now have still the original whitewash on them and have deteriorated practically not at all. Of course, such being the case, the municipal electrical undertakings are handicapped to a considerable extent in their fight against competition of gas, for it means larger annual sums in repayment of principal and interest. On the other hand, it must not be overlooked that for certain other portions of the equipment the period is too long, and what seems necessary is a complete revision both of the periods and of the system adopted to arrive at those periods.

A good deal is being heard just at present concerning the commercial development of electrical supply undertakings, everyone being apparently seized with a mild form of mania to push the supply of electricity. All this is quite legitimate and welcome, of course, but probably the best effort to meet competition from gas is that made at Sunderland, where the municipality has organized an "intelligence" department to keep in touch with what the gas company is doing and to purchase samples of every new gas lamp in order to test it for comparison. There certainly seems to be considerably more "pushing" than the average person is aware of.

The electrical equipment of the portion of the Great Western Railway which has connection with the Inner Circle—and which has hitherto been the cause of steam trains still running on the Circle—is almost complete. A separate generating station has been erected in anticipation of many further lines being converted in the future. Current is generated at 6,600 volts, 50 cycles, three-phase, which is transmitted to sub-stations and transformed down to 630 volts continuous. The generating sets are 750 kilowatts each, the prime movers being reciprocating engines. There are 10 Babcock & Wilcox water-tube boilers in the station arranged in two rows of five. The feeders from the power station to the sub-stations are carried underground and the track equipment is more or less standard. G.

New England.

Boston, July 7.—The Massachusetts Legislature has adjourned sine die without passing either a merger or anti-merger railway bill. The bill relative to investments by railroad corporations in the securities of street-railway companies was read a second time in the House, and Representative Weeks of Everett moved to amend by the substitution of a bill to prohibit investments by railroad companies in street-railway companies. The House voted to substitute the Weeks bill for the one reported by the committee, and that bill was ordered to a third reading and was passed to be engrossed on the following day. The Senate substituted the bill and report submitted by the joint committees on street railways and railroads. Both Houses appointed conference committees, which failed to agree, and the Legislature was prorogued.

Before adjourning, the Massachusetts House of Representatives adopted the order that the board of gas and electric-light commissioners be directed to transmit to the House of Representatives a transcript of all the answers made by the Edison Electric Illuminating Company and the Boston Consolidated Gas Company to the questions sent to each company by the board on March 30th and April 13, 1906, respectively. No report was received from the commissioners before the prorogation of the Legislature. On the heels of this, however, the Edison Electric Illuminating Company announced a reduction in its charges for electricity, stating that it was made possible by the development of business and the improved methods of production and charging. New contract customers have been charged 18.2 cents per kilowatt-hour. The new primary rate is 15 cents per kilowatt-hour. According to the company some 14,000 consumers will have their rates reduced 17½ per cent. Power customers have been charged 18 cents per kilowatt-hour for 15 hours of the demand, and the new rate will be 15 cents per kilowatt-hour for 18 hours.

The Consolidated Railway Company is preparing to survey the route for an electric railway between Meriden and Middletown, Conn., the officials of the two towns being very desirous that the road should be built. The company is ready to begin stringing the trolley wires for the proposed fast interurban electric line between Hartford and Rockville, Conn. This line will be operated over steam railroad tracks for a portion of the distance.

The New England Street Railway Club held its annual summer outing at Salisbury Beach on June 28th, and the 150 persons present reported a fine dinner and a very enjoyable outing. John J. Lane, secretary of the club, had charge of the arrangements.

Charles H. Dalton has declined reappointment as a member of the Boston Transit Commission. He has served on the commission for 13 years.

The Rhode Island Contract and Engineering Company of Providence, R. I., has obtained the contract for the construction of the Salmon River Power Company's plant at Leesville, Conn. The plans call for two generators with a capacity of 8,600 kilowatts each, two concrete dams, one earth dam, 30 miles of wire, two power houses 30 by 130 feet each, and two horizontal turbine engines with a capacity of 8,000 horsepower. The total cost will be $750,000. B.

New York.

New York city, July 7.—On Thursday Supreme Court Justice Truax denied the application of the Consolidated Telegraph and Electrical Subway Company for a writ of mandamus to compel the Board of Taxes and Assessments to reduce by $14,547 the assessment on the corporation's property. It is declared that the company spent this amount in behalf of the city and that the money should be deducted. Justice Truax says that according to the contract between the company and the city the former was to furnish to the latter spaces for the city's electrical conductors free of charge. He adds that in his opinion the company cannot deduct the amount claimed because the sum is not based upon a percentage of its gross earnings or any other income of the relator, nor is it a sum of money paid on account of its subway franchise.

The severe electric storm that visited Bloomfield, N. J., last Saturday evening did great havoc among the old elm trees in the park and along Belleville Avenue. Large limbs were wrenched from the trunks, and some of them fell across electric-light wires, putting the whole electric-light system out of commission. The streets were left in total darkness all night, and the stores just at a busy time were left dark also.

George Farrell, chief operator in charge of the Fire Alarm Telegraph Bureau at fire headquarters, died on Sunday. He was 58 years old and had been in charge of the Fire Alarm Bureau since 1898. He entered the department in 1873. He was a bachelor and had no near relatives.

Governor Stokes of New Jersey has signed the bill authorizing cities to construct, acquire and operate electric-light and gas plants. The bill, while particularly intended for Camden, is general in its application.

It is reported that representatives from several civic organizations in Brooklyn will meet Monday evening at the rooms of the Brooklyn League to urge the construction of the Behr mono-rail line to Coney Island. A permanent organization will be effected, according to the call issued by the Real Rapid Transit Association. William G. Morrisey, president of the association, will speak, and F. B. Behr, inventor of the mono-rail system, will explain the system by which he purposes to ruyn trains at a speed of 100 miles an hour and make the trip from Brooklyn Bridge to Coney Island in eight minutes. Borough President Coler and his predecessor, Martin W. Littleton, will be present.

The Civic Association of Morristown, N. J., has presented to the Board of Aldermen a petition asserting that the Public Service Corporation and the Morristown Gas Light Company have violated their contracts with the town for the lighting of the streets, and are also charging exorbitant prices to consumers for electricity and gas furnished.

The association suggests that in any new contracts made the companies should furnish gas to private consumers for not more than $1.25 per 1,000 feet, and electricity for not more than 15 cents per kilowatt.

The new five-cent pay station rate of the New York and New Jersey Telephone Company has gone into effect. It appears, however, that the five-cent rate is not to be so general as the public was led to suppose. The company's five-cent rate does not include the entire city, but divides Manhattan and the Bronx into three sections, within which calls are five cents. Calls from one section to another are still 10 cents. Of course calls to Brooklyn and other parts of New York a greater distance away range from 10 to 20 cents. In the month that ended yesterday 3,591 additional telephones were installed, the gain over last June being 62 per cent. A representative of the company thought that the large gain was partly due to the reduced rates. C. I. C.

Southeastern States.

Charlotte, N. C., July 7.—Machinery for the substation of the Virginia Passenger and Power Company at Petersburg, Va., has been received, and the large plant will soon be in operation.

The preliminary survey of the Appalachian Interurban electric railway, from Hendersonville to Rutherfordton, has been completed, and will likely be the route selected.

Mayor W. H. Hardin of Chester, S. C., and others, constituting a delegation from that town, visited Charlotte, N. C., recently to confer with the Southern Power Company relative to securing power for that town.

Surveys are being made for an electric railway from Nashville to Chattanooga, and a loop will be constructed to Bridgeport, Tenn., where the headquarters of the company will be located.

The Charlotte (N. C.) Consolidated Construction Company will build a new power house and other additions to its plant, preparatory to enlarging the system and installing gas engines, to be used instead of steam to supply power to run the generators.

An important step has been taken by the Georgia Railway and Electric Company at Atlanta, where the street-railway employes will be given a handsome $30,000 clubhouse at the corner of Piedmont and Armstrong avenues. There will be a library, lounging room, baths and offices. The structure will be three stories.

S. L. Kelley, counsel for the Citizens' Rapid Transit Company of Richmond, Va., declares that the electric road will be built. H. D. Eichelberger is president of the company, which was chartered some months ago. L.

Ohio.

Cleveland, July 7.—Greenwood & Co. of Philadelphia, acting for the Consolidated Public Utilities Company of New Jersey, have made a proposition to purchase the controlling interest in the People's Light, Heat and Power Company of Springfield, which was organized and is largely owned by Columbus men. The company has a capital of $1,500,000 common stock and $500,000 of six per cent. preferred stock.

The interurban freight station at Scioto and Water streets, Columbus, will be remodeled at once, after which the general passenger offices and other business departments of the Schoepf lines will be moved to the passenger station on West Gay Street. All conveniences for travelers will be arranged there. It is said that the freight station will be arranged with a spur running into the center of the building so that two express cars can be loaded or unloaded at the same time.

The officers of the Cleveland Electric Railway Company are said to have for consideration a written proposition from Henry Everett, representing an Eastern syndicate, for the lease of the property. A number of Cleveland capitalists are said to be interested with New York men in the proposition.

Ordinances have been introduced in the Cleveland City Council giving the Forest City Railway Company franchises on three streets—Central Avenue, Seventy-third and Sixty-fifth. The routes do not lie altogether on these streets, but will cover a considerable territory.

The Cleveland Railway Promotion Company has been incorporated with a capital stock of $10,000 to do a general railway promotion business. F. B. Krause, W. N. Hayden, Max P. Goodman, A. W. Thomas and C. F. Buxton are the incorporators.

C. F. Franklin has been appointed receiver of the Toledo and Western, a road that has given special attention to the freight business. A year or more ago a floating debt of over $350,000 was incurred in building to a beet sugar factory and building switches at farm stops. The late Luther Allen, then president of the company, furnished a large part of the money, and it is said that his estate is urging a settlement of the claim. Two attempts have been made to sell, but in neither case would the stockholders abide by the terms. A syndicate headed by J. R. Nutt made the last offer and it is possible that it would still take the road.

The Youngstown and Ohio River Railroad Com-

pany has increased its capital stock from $10,000 to $2,500,000.

Reports have been sent out from Schenectady that the invention of Mayor Johnson of Cleveland, by which he expects to produce a car that will travel at almost any desired speed, will shortly be given a trial. It is said that a speed of 250 miles an hour will be made, but that the car as planned is capable of much greater speed. The idea is to operate on an overhead track.

City Solicitor George S. Marshall of Columbus has been urging the City Council to arrange for the enlargement of the municipal lighting plant so that current may be sold. He contends that water power may be secured from the river at the Jeffrey dam to operate the generators.

Cleveland city officials are considering the advisability of securing an electric plant for the new city hall that will not only furnish current for lighting the city buildings but for all the downtown district and for power to operate the new high-pressure water system.

While nothing certain is known of what the directors of the Cleveland Electric Railway Company anticipate, it is said they have been working upon several plans of settlement with the city should Mayor Johnson again ask for a conference.

A. S. White and J. Alvin Young, both of New York, were in Cincinnati a few days ago looking after the details of the lease of the properties of the Cincinnati Gas and Electric Company to the Union Gas and Electric Company. Reports are that everything is progressing satisfactorily.

Albert E. Boone is organizing the Southern Ohio Promotion Company to look after the construction of the roads that he has planned in the southern portion of the state. O. M. C.

Indiana.

Indianapolis, July 7.—Under the new city charter this city has the right to compel railroad companies to maintain street lights at railway crossings, and an ordinance which is now pending in the City Council looks to the charging of the expense of such lights to the railroads. Under the present contract with the Indianapolis Light and Heat Company the city pays $70 a year for each electric light, and it has been estimated by David S. Bell, light inspector, that there are more than 200 points in the city where lights are now maintained by the city at railroad crossings. If the council passes the ordinance now pending the railroads will have to pay out about $15,000 yearly for lights at crossings. In addition to saving the city this money the passing of the ordinance would considerably increase the number of electric lights in some sections of the city, for there are many crossings which do not now have lights. The measure provides that these lights shall burn at least 30 minutes before the passing of each train, and in most cases this would mean that they would burn all night, for it has been estimated that it would cost more to turn the lights off and on than it would cost to burn them all night.

General Manager H. S. Hickey of the Winona Interurban line ridicules the report sent out to the effect that the Winona line would run no cars on Sunday. The Winona people have never run a car from Warsaw to Winona (two miles) on Sunday, and it is probable that this order will not be changed. The majority of the public knows that Winona is not on the Winona line proper, but lies east of Warsaw, and is connected to the Winona line by a spur with a loop at the end.

The Indianapolis and Cincinnati Traction Company's line has been placed in the hands of Charles L. Henry, president of the company, as receiver under a bond of $100,000. William Frazee of Rushville, one of the principal stockholders, made the application and the action is entirely friendly. This is the first electric railway in Indiana to go into the hands of a receiver on account of its inability to meet large outstanding indebtedness at present. The proceedings are intended to promote the convenience of the company in completing extensions. It was found that too much of the expense of construction involved in the extensions that the company is making is represented by the bonds, and that for this reason the bonds were not marketable. It is proposed to issue preferred stock or second-mortgage consolidated bonds to cover the costs of the extensions now under way. In the meantime the resources of the company, which are said to be ample to meet the claims, will be handled under the direction of the court.

The officials and contractors of the Indianapolis, New Castle and Toledo electric railway have decided to locate the large power house near New Castle on the Elliott site southwest of the city. The site consists of 35 acres. The power plant will furnish power for the entire system of 147 miles.

Mrs. A. Bright of Ontario, Canada, arrived in Richmond, Ind., on July 2d and is said to have made the entire trip by trolley, traveling over at least a dozen different systems.

A mortgage has been filed at Logansport covering the issuance of $1,000,000 in bonds by the Guarantee and Safe Deposit Company of Philadelphia to enable the Lafayette and Logansport Traction Company to construct its line connecting these cities. It is proposed to have cars running on this new line by December 1st.

The Evansville, Boonville and Newburg Traction Company opened its Boonville extensions on July 1st.

The Fourth of July was a day of unprecedented travel on the Indiana interurban lines. Many thousands were handled on that day and transported to the numerous resorts and not a single accident has been reported due to the interurban lines.

The People's Gas and Electric Light Company's plant and franchise at Bloomington have been sold to a syndicate of Philadelphia men, who propose to improve and reinstall the plant.

The city of Kokomo has brought suit to have the franchise of the Kokomo Gas and Light Company declared void and to enjoin the company from doing business in the city. The city authorities wish to correspond with persons or corporations willing to construct and operate an up-to-date gas and light plant in Kokomo. S. S.

Michigan.

Grand Rapids, July 7.—Both interurbans from Grand Rapids to Lake Michigan demonstrated the value of the power of the Grand Rapids-Muskegon Power Company when they operated to the fullest capacity of their rolling stock on the Fourth of July. The Grand Rapids, Holland and Chicago Railway even pressed into service flat cars with improvised seats between Holland and Jensison Park. Next year the Grand Rapids Railway Company will secure its power from the Grand Rapids-Muskegon Power Company as soon as a second dam is completed on the Muskegon River. The power company is moving its offices from Ottawa Street to larger quarters at 47 Monroe Street.

The ordinance committee of the Common Council has decided favorably on a street-sprinkling proposition of the Grand Rapids Railway Company. General Manager Hanchett proposes that the first contract be drawn for three years, the street-railway company to sprinkle the streets twice each day, or as much oftener as the council may deem desirable, at a rate of 12 cents a mile, the city to furnish the water. The street-railway company operates on approximately 29 miles of the city's streets.

The Queen City Electric Light and Power Company has been granted a franchise in Traverse City for a period of 30 years. An addition was made to the franchise proposed that the maximum charge to consumers shall be 10 cents per kilowatt for the current.

The Detroit Edison Company, or interests identical with it, in New York, has purchased the entire capital stock of $120,000 of the Central Heating Company of Detroit. Bingley R. Fales, who has been vice-president and general manager of the Central Heating Company, becomes assistant general manager of the Detroit Edison Compay.

The Village Council of Laingsburg has granted a franchise to Joe Thick of Detroit for a period of 30 years for operating an electric railway through the village. This is the proposed road from Owosso to Pine Lake and Lansing. The company agrees to begin the construction of the road within eight months.

The Kalamazoo City Council has granted a franchise to the Kalamazoo, Gull Lake and Northern Railroad Company, which proposes to build a line from Kalamazoo to the North Shore of Gull Lake to connect with the proposed Battle Creek and Grand Rapids electric. W. J. Jacobs of Chicago is at the head of the new company. The company will build a loop encircling the business district of Kalamazoo.

President J. J. McMichael has announced that the Benton Sarbor and St. Joseph Railway and Light Company will extend its lines to Kalamazoo this fall, and that the line as far as Eau Claire will be in operation in August. Cars are now running as far as Tabor's resort, 12 miles from Benton Harbor. The line will go from Eau Claire to Dowagiac. L. W. B.

Illinois.

Peoria, July 7.—The new owners of the Peoria Gas and Electric Company have taken charge and have elected H. A. Waldridge, president; Emil G. Schmidt of Springfield, vice-president and general manager, and John M. Robb of Peoria, secretary and treasurer. These officers together with the following stockholders are the new board of directors: George Hardy, Alfred Ely, F. W. Little and Sumner R. Clarke. Emil G. Schmidt says he will endeavor to extend the present system and if possible give a more satisfactory service.

The McKinley syndicate may lay tracks in East St. Louis. County Judge Hay of St. Clair County has sustained a demurrer to the injunction filed against the company by property owners.

W. B. McKinley, head of the interurban lines of the Illinois Traction Company, has made a thorough inspection of the lines of the company. He was accompanied by General Manager L. E. Fisher.

The City Council of Ottawa has granted the Peoria, Streator and Ottawa Railway Company a 50-year franchise to operate on the public streets of that city. The entrance to the city of Ottawa will be over a new steel bridge to be constructed across the Illinois River.

The Illinois Traction Company is extensively advertising the "Corn Belt Limited" from Springfield to St. Louis. This train leaves at 7:45 a. m. and 3:30 p. m. daily, with a fare of $1.95 one way, or $3 round trip, with a buffet service.

At Bloomington a movement has been started to abandon the municipal lighting plant and let the contract for lighting the streets to a private company. The city has owned the system for 20 years and it is pretty well worn out and must be thoroughly overhauled, but there is no money to make the necessary improvements.

Articles of incorporation have been filed by the Eldorado, Marion and Southwestern Railway Company. The principal office is to be at Marion and the capital stock is $10,000. The object is to construct an electric railway from Eldorado through the counties of Saline, Williamson, Jackson, Union and Alexander to the Mississippi River. The incorporators and first board of directors include Sam T. Brush of Carbondale, Charles A. Gent of Marion, and Charles E. Owen of Carterville. V. N.

Northwestern States.

Minneapolis, July 7.—The proposition to issue bonds for $12,000 with which to construct an electric-light plant at Rush City, Minn., has been voted down.

J. A. McGilvray of Chippewa Falls is preparing to begin work on a new electric-light plant at Chetek, Wis.

The Fox River Valley Railway Company has awarded the contracts for the grading work on the proposed interurban line between Sheboygan and Manitowoc.

The Wisconsin Power Company has made application at Eau Claire, Wis., for a 22-year power franchise. The Chippewa Valley Electric Railroad Company has applied for a similar franchise.

The Oskaloosa (Iowa) and Buxton Interurban Railway Company has decided to commence work at once on the construction of the new line and it is expected that it will be ready for operation by December 1st.

The Grand Forks (N. D.) Gas and Electric Company will begin work at once on a new power house which will cost about $40,000.

The City Council of Owatonna, Minn., is considering the granting of a new franchise to the Owatonna Gas, Electric and Heating Company.

John Martz of Seward has received the contract for the installation of an electric-light plant at Red Cloud, Neb.

The Southern Wisconsin Power Company of Madison has let the contract to the Wellman-Seaver-Morgan Company of Cleveland for new water turbines to be used in the Kilbourn project and to the General Electric Company for electrical generators and equipment.

Stock is being subscribed liberally for an interurban railway from Iowa City, Iowa, to Montezuma, and the construction of the road is assured.

The old talk of a trolley line from Minneapolis to Anoka, Minn., has been revived. A. B. Robbins of Minneapolis has applied to the latter city for a franchise to use the streets. It is the intention to extend the line now running from Minneapolis to Robbinsdale and to erect a power house at Anoka.

Grimes & Absher have about completed their new electric-lighting plant at Wagner, S. D.

The contract for city lighting with the Edison Electric Company will be renewed by the city of Duluth, Minn., the company making the lowest bid for the work, at a substantial reduction from the old contract.

The street committee of the St. Paul Council reported to the council in favor of granting a 25-year franchise to the Northern Heating and Electric Company. The council has reported it back to the committee to have a 10-year purchase clause inserted, and the amended ordinance will probably be passed shortly. R.

Rocky Mountain States.

Salt Lake City, Utah, July 6.—The councilmen of this city are considering a proposition for the bettering of the lighting system of the city. Thomas J. Yates of the Utah Light and Railway Company has been asked to submit estimates for the installation of incandescent lights along certain streets at the next meeting.

The light committee of Ogden, Utah, has recommended that Washington and Twenty-fifth streets be illuminated from now to October 1st and that the city pay the Utah Light and Power Company $35 per night for furnishing power.

P. Augustus Heinz of Butte, Mont., has applied to the council for a franchise to build and operate an electric-light and power plant in the city of Butte. Work will begin as soon as the franchise is granted. The plant will be thoroughly modern and will be completed within 10 months from the beginning of the work.

The Electric Railway, Light and Power Company of Torreon, Mexico, has recently perfected plans for the installation of a new circuit. All the con-

tracts have been closed and the work will commence at once.

George R. Welborn, president of the Ellwell Gold Mining Company of Tombstone, Ariz., states that it is the intention of the management to equip the mill at the mines with electric power and do away with gasoline for light and power purposes.

A.

Pacific Slope.

San Francisco, July 5.—The United Railroads after several weeks of rushing work has completed a single-track trolley line out Sutter Street from the junction with Market, and cars are in operation out Post and down Sutter.

The Berkeley Electrical Company has been organized and will erect works at South Berkeley, Cal., with Adolph Phillips of Chicago as manager. The company will be incorporated at once. It is the intention to manufacture a line of alternating and direct-current motors besides electrical sundries.

Hetty Bros., who were burned out by the great fire on April 18th, have resumed business with a full line of electrical supplies at 326 Ellis Street in a new frame building erected for their use.

The Ocean Shore Railroad Company's bonds will be sold in New York. J. Downey Harvey and other local capitalists who organized the company at first intended to keep the securities off the market, but since the fire there has been a change of sentiment. Walter E. Dean, who was the first president of the company, has disposed of his interest to J. A. Folger, a wealthy wholesale coffee dealer of San Francisco. Work on the main line, 83 miles in length, between San Francisco and Santa Cruz, was suspended for some weeks after the fire, the contractors, C. E. Loss & Co., using most of their force on track work within the city limits. Work will now be rushed once more on the main double-track contract. About 12 miles of single track recently completed from Santa Cruz north is being operated as a steam railroad for hauling machinery and materials to the Santa Cruz Portland Cement Company's new plant at Davenport. The Ocean Shore Railroad Company's electric power house at Halfmoon Bay is in course of construction and will be completed in ample time for the opening of the road.

The council of San Diego, Cal., has adopted a concurrent resolution to grant an electric street-railway franchise to the South Park and East Side Railway Company.

A contract has been closed between Manager John Otto of the Santa Barbara branch of the Edison Electric Company and Smith & Hunt, contractors, on the water front of Santa Barbara water tunnel, by which thte Edison Company will deliver the power to the contractors for operating their plant. Smith & Hunt have made arrangements for the installation of a 40-horsepower electric motor.

The directors of the Escondido Mutual Water Company of Escondido, Cal., have been in consultation with engineers with a view to using the flow of the Escondido reservoir for the purpose of developing of electric power.

On July 21st the stockholders of the Coast Counties Light and Power Company will meet at 1100 O'Farrell treet, San Francisco, to vote upon the creation of $1,000,000 of bonded indebtedness. George H. Sussman is secretary of the company.

The San Bernardino Traction Company of Riverside, Cal., has ordered rails and ties for a new street railway which is to connect Riverside, Colton, San Bernardino and Redlands. An application for a franchise will be made at once.

James Burwell of Hermon & Burwell, engineers of Vancouver, B. C., has been on the ground arranging for the St. Mary's River Power Company's power plant on St. Mary's River. The company has a claim on water from St. Mary's River and will develop sufficient power to light the towns and operate the mines in that locality. This will include the Kimberly, Cranbrook, Fort Steele, Moyie and St. Eugene districts. The company is controlled by Charles Mackay, Robert Campbell, J. A. McDonald and J. D. Kay of Moyie; W. Handwell of Port Hammond, and L. Shaw of Vancouver.

The Willamette Valley Company, owner of the public utilities throughout the valley, is in full possession of the Dallas electric plant. C. B. Rhodes, manager, states that the plant will be rebuilt on modern lines. A new plant will be built at Cone, Ore., with an initial capacity of 300 horsepower, to be increased this fall to 1,000 horsepower. Construction will commence immediately. The Dallas plant will be a distributing station and will furnish light to Monmouth and Independence.

H. E. Huntington, C. A. Canfield, Burton Green, W. S. Porter and Joseph Chanslor are the principal stockholders in a corporation which recently purchased the Hammel & Denker ranch at Los Angeles, Cal. They have set aside $400,000 for the furnishing of gas, electricity and improvements. They wish to establish a town at the tract.

The standard-gauge electric road which is being built from Grand Ronde Valley to the Indiana Mines and Medical Springs will likely be extended to Baker City, Ore., as Chief Engineer Cook and a party of 11 surveyors have run the grade to the summit, about six miles above the reservoir, and are running the line on down to Medical Springs and the Indiana Mines.

The City Council of La Grande, Ore., has authorized the mayor of that place to enter into a contract with the Grande Ronde Electric Company for lighting the city streets with 30 arc lights at a rate of $8 per month.

A.

PERSONAL.

W. R. Abbott, president of the Fort Smith (Ark.) Light and Traction Company, has sold his stock and resigned.

J. L. Adams of Columbus, Ohio, has been made manager of the Dayton and Northern Traction Company, succeeding John E. Feight, who retired when the road was taken over by the Schoepf syndicate.

Alpha H. Kling has severed his connection with the Peru Electric Manufacturing Company as sales manager, and is now representing a number of leading manufacturers in the central states as manufacturers' sales agent, with headquarters in Peru, Ind.

E. N. Percy, formerly of the engineering staff of the Abner Doble Company of San Francisco, was in Chicago early in the week. Mr. Percy is on his way to Germany and Switzerland to pursue engineering studies, having particular reference to high-speed electric railroading and waterpower development.

Henry W. Young has resigned his position as associate editor of the Western Electrician to take charge of the department of publicity of the Cutler-Hammer Manufacturing Company of Milwaukee. Mr. Young was a faithful member of the editorial staff of the paper, and leaves with the good wishes of his associates.

Frank Lukenbell, for some years manager of the Central Union Telephone Company's office at Findlay, Ohio, has been promoted to the management of the Toledo office out of 32 applicants. A. J. Mellen, who has had the management temporarily at Toledo, will again devote his entire attenton to the duties of district superintendent.

George C. Towle, formerly manager of the Syracuse (N. Y.) and South Bay Railway Company, has been chosen by the American Railways Company to assume the management of its Dayton (Ohio) lines, succeeding the late Joseph L. Breen, whose untimely death at the Washington Street temporary bridge in Dayton was recorded some time ago. Mr. Towle has been for several years connected with street railways, and left the Syracuse and South Bay company after having made it a valuable piece of railroad property.

E. C. Bradley, vice-president and director of the Postal Telegraph-cable Company, resigned his position at a meeting of the executive committee in New York on June 3d. He intends to engage in other business. Mr. Bradley has been connected with the Postal company for 15 years. The committee placed on record an expression in recognition of the valuable services rendered the company during this time. As the result of the resignation George G. Ward, formerly third vice-president, became second vice-president; Charles C. Adams, fourth vice-president, became third vice-president, and Charles P. Bruch, assistant general manager ad assistant secretary, was made fourth vice-president; Thomas E. Fleming was appointed assistant secretary.

The Salt Lake City News says that Mortimer S. Allen, for the last year manager of the General Electric Company in Salt Lake, has received orders to go at once to San Francisco and take charge of the business there. The promotion is a decided one, as the San Fracisco establishment now occupies a large fireproof building and is completely equipped to carry on the task of furnishing supplies for everything electrical that will be needed in rebuilding. It is quite likely that more business will be done in the San Francisco office during the next five years than at any other office of the company in America, and Mr. Allen's selection for the important post comes as the result of his success in the Salt Lake office. Mr. Allen is yet well under 30 years of age.

ELECTRIC LIGHTING.

F. Braatz has been granted an electric-light franchise in Bryan, Tex.

Talbotton, Ga., has voted $10,000 in bonds for an electric-light plant.

Bluff City, Ark., is considering the establishment of a municipal lighting plant.

The council of Graysville, Ill., has appropriated $5,000 for improving the electric-light plant.

The Fairfield Gas and Electric Company of Fairfield, Iowa, has sustained a loss by fire.

A company is being formed at Harrisburg, Pa., to take over the stock of the Harrisburg Light, Heat and Power Company. It will be known in all probability as the Harrisburg Securities Company. The details will be anounced in a short time.

The Carmen (Okla.) Electric Light and Power Company has been incorporated with principal of $12,000.

The city of Ottawa, Kan., has purchased the light and water plant. The city will expend $8,000 in improvements.

J. G. Vogel has been granted a franchise to install an electric-light, heat and power plant in Little Rock, Ark.

Clay Center, Kan., contemplates issuing bonds for the purpose of putting in an electric-light plant. Thomas G. Ryan is city clerk.

The Upper Darby Light, Heat and Power Company of Upper Darby, Delaware County, Pennsylvania, has been formed. The treasurer is C. L. Rihl, Arcade Building, Philadelphia.

A charter has been granted in Pennsylvania to the Citizens' Electric Light Company of Philadelphia, which has a capital of $10,000. Matthew K. Shiffen and Lewis L. Everson of Philadelphia and others are incorporators.

The Berks County Light Company, which is to furnish electricity in Reading and other cities in that county, has been granted a Pennsylvania state charter. James Bell, 1242 South Fifteenth Street, Philadelphia, is treasurer.

The Sydney (Australia) electric-light committee recently decided to recommend the City Council to adopt the proposals of the city electrical engineer (Mr. T. Rooke) to purchase $50,000 worth of distributing cables for further extensions, and to reduce the charges for current for power, heating and cooking from four cents to three cents per kilowatt-hour.

The Pike's Peak Hydro-electric Company, which supplies the residents of Manitou, Colo., has announced that rates have been reduced from 10 to 5½ cents per kilowatt-hour. The reduction, which began July 1st, is attracting attention in Colorado Springs in view of the fact that the City Council of Colorado Springs is considering a recently introduced ordinance to compel the Colorado Springs Electric Company to reduce its charges to six cents per kilowatt-hour. The Pike's Peak Company furnishes power to the Colorado Springs Electric Company.

Charters have been issued in Pennsylvania to a group of men, among whom are Jacob B. Van Wagener, Clarence W. Scheck and John F. Cockburn of Pittsburg, for the following-named companies, each with $5,000 capital stock at the start: Smithfield Electric Company, Vanderbilt Electric Company, Youngwood Electric Company, South Electric Company, Southwest Electric Company, Youngstown Electric Company, Everson Electric Company, Georges Electric Company, New Haven Electric Company. The offices of all are in Pittsburg, Mr. VanWagener being treasurer.

Bids are requested until July 20th for rebuilding, extending and improving the municipal waterworks and electric-light and power plant in Ottawa, Kan., in accordance with the plans and specifications of the city. Owen Ford is consulting and supervising engineer, 710 Security Building, St. Louis, Mo. Included in the improvements are electric pumps, engines, station pipe work and connections, dynamos, switchboards, apparatus, appliances and station electrical work, exterior electrical work, motors, poles, wire, transformers and electrical materials. J. H. Bell is city clerk.

A paper on the "Lighting of Factories" was read by Mr. A. Pollitt at the meeting of the Textile Workers Managers Association in England recently. Mr Pollitt confined his attention to a comparison of the illuminating power and cost of the various systems of lighting by electricity and gas. Taking the provision of 20,000 candlepower as the basis of calculation, Mr. Pollitt gave the following estimate as the total cost per hour for the several forms of lighting most commonly used: Ordinary flat gas burner, 18s. 3d.; incandescent mantle, 4s. 9.18d.; Welsbach self-intensifying burner and mantle, 4s. 4.6d.; compressed gas, 4s. 0.19d.; incandescent electric, 13s. 2.68d., and electric arc lighting, 4s. 6.44d. Gas is reckoned at 2s. 6d. per 1,000 feet (a very low estimate), but the price of electricity per unit was not given.

The new electric lighting of Euston station and of the offices, hotels, carriage sheds and junctions of the London and Northwestern Railway, which comprises some 4,000 incandescent lamps and about 250 arc lamps, is supplied from the railway company's own generating station at Camden, which also supplies power for the electrically worked track switches and signals. The plant consists of Dowson suction gas producers fed by anthracite coal (five 150-horsepower and two 75-horsepower), Westinghouse vertical three-cylinder gas engines, together with the necessary air compressors, etc. Continuous current is generated at 460 to 500 volts, and is distributed from the power house through booster balancers at 230 volts for working and lighting the points and signals. Separate mains carry the current, also at 460 to 500 volts, to a

balancer and switch room at Euston, where it is distributed for arc lighting at 460 volts, and, by a three-wire system, for the incandescent lighting at 230 volts.

ELECTRIC RAILWAYS.

The Athens (Ga.) Electric Railway Company will increase its capital from $125,000 to $275,000 and make a number of extensive improvements.

Neal Stewart and W. A. Caldwell of Brookings, S. D., are interested in a company being organized to build an electric road from Sioux Falls to Brookings.

Stone & Webster have purchased the plant of the Key West Electric Company, now controlling the electric railway in Key West, Fla. Extensive improvements are to be made.

The Milwaukee-Northern Railway has bought the dock property of C. O. Mueller in Fort Washington, Wis., where it will build its power house and offices. Work will commence by September 1st.

Since July 9th Adamston, W. Va., has received its mail from Clarksburg by means of electric cars. The mails will leave Clarksburg three times each week day once on Sunday and two mails on holidays.

The Gary and Hammond Traction Company has been organized to connect cities of Hammond, East Chicago and town of Gary, Ind. The capital stock is $10,000, and the directors, Kemper K. Knapp, William Duff Haynie, Gilbert R. Call, Mark Breenen and William Beve.

Articles of incorporation for the Tulsa (I. T.) Street Railway Company have been filed. J. M. Hall is president, P. L. Price vice-president, and Fred S. Clinton, secretary. The capital stock is $200,000 and under the franchise construction must be commenced within 90 days.

The Clinton, Cheyenne and Canadian Interurban Railway Company of Cheyenne, Okla., has been incorporated with a capital stock of $1,000,000, to build a total of 225 miles. C. S. Gilkerson is president, L. L. Collins vice-president and R. V. Converse secretary and treasurer.

The stockholders of the Gleason (Tenn.) Water and Light Company have organized by electing W. B. Bynum, president; W. H. Williams, general manager, and J. C. Ammons, secretary and treasurer. The general manager was instructed to place an order for the machinery at once.

The Ely Street Railway syndicate is said to have taken over the Steubenville (Ohio) Traction and Light Company's gas and electric plants, park property and railway lines in Steubenville, Ohio, and extending to Empire. It also took over the Toronto, (Ohio) Electric Light Company, paying $50,000 for the latter.

The Guatemala Street Railway Company has selected the site for its new power plant 30 miles south of Guatemala City, Central America. It will furnish light and power to the public in addition to running the street cars of the city. A large amount of electrical equipment and waterpower machinery will be purchased in the United States for the work.

The contract has been awarded for the $75,000 worth of new machinery to be used in the new power house of the Alabama City, Gadsden and Attalla Railway Company to be built in Gadsden, Ala. The contract for the steam turbines was awarded to the Westinghouse Company. The Henry R. Worthington Company secured the contract for the pumps and condensers.

In answer to a question in the British House of Commons recently, Mr. Kearley said that the question of there being only one man in the motor cars on several of the electric railways had been considered by the inspecting officers of the Board of Trade, but no accident could be traced as having arisen from this cause, and there was no reason for regarding the present system as dangerous to the lives of the traveling public.

The United Railroads of San Francisco has completed its plans for a repair shop and car works, which it will build at Ocean and San Jose avenues. The new car shops will cost $400,000 and will be the most modern, says an official of the company, in the country. Employment will be given to over 400 mechanics. All the repair work and the construction of crossings will be carried on at these shops. It is also the intention of the company to build its own rolling stock.

The De Kalb-Sycamore and Interurban Railway Company has been incorporated, with principal office in De Kalb, Ill. The capital is $100,000. It is proposed to build an interurban railway from De Kalb to Belvidere from Sycamore to Elgin, and from De Kalb to Yorkville, with branch lines from De Kalb to points in the counties of Boone, McHenry, Kane, Ogle, Lee, Kendall, La Salle and Du Page. The incorporators and first board of directors are John W. Glidden, S. E. Bradt, W. H. Zimmerman of De Kalb, Ill.; David A. Syme and Frederick B. Townsend of Sycamore, Ill.

Citizens of Richmond, Va., particularly the insurance people, are making a vigorous protest against the proposed ordinance to require the street-railway companies to install double overhead trolley systems as a cure for electrolysis. They assert that the fire risk would be increased to an extent which would outweigh the evil of electrolytic damage. Through a letter and petition to the Board of Aldermen they have secured a recommittal of the ordinance, and will appear before the committee on streets and electricity to oppose it later on.

A Chicago daily newspaper of July 8th prints a page advertisement designed to sell to the great public stock in the "Chicago-New York Electric Air Line Railroad." It is alleged that surveys are being made for a 750-mile direct air-line electric railway between Chicago and New York. Passenger trains are to run hourly at the rate of 75 miles an hour, the lowest rate between the two cities being $10. Power houses are to be located 50 miles apart, the third rail being used. Electric locomotives will pull the trains. Power may be sold to consumers along the line. There are to be no grade crossings, practically no curves, and no grades greater than one per cent. It is declared that men who have been connected with the Aurora, Elgin and Chicago electric railway and Burlington steam railroad are interested in the new enterprise. The first section of the road out of Chicago, ending at Goshen, Ind., and about 100 miles long, may be in operation within a year. The completed line to New York will cost a trifle of $150,000,000, which the dear public is asked to subscribe. No names are given in the advertisement, except that of the fiscal agents, to whom remittances for stock are to be made. The men behind the project "do not come out into the open and show their hands at this stage of the project, because it would interfere with their other business interests." The whole affair is mysterious and to be regarded with caution.

POWER TRANSMISSION.

The Gold Road Mining and Exploration Company will install a large electric plant in Kingman, Ariz., to transmit power to Gold Road.

The Washita (I. T.) Electric Power Company has been incorporated with a capital stock of $250,000 and will install an electric power plant in Berwyn, I. T.

The Potomac Electric Power Company of Washington, D. C., has filed a deed of trust upon all its property rights and franchises to secure an issue of $7,000,000 in bonds. The object of the issue of bonds, it is stated, is to furnish funds with which to purchase additional real estate, construct a new power house and otherwise better the condition of the company's property. The property pledged consists of all the holdings of the company in Washington and Georgetown, as well as the recently acquired site for the new power house on the Benning Road. The Commercial Trust Company of New Jersey is the trustee named in the mortgage.

PUBLICATIONS.

Telephones, switchboards, construction material and electric telephone specialties and accessories of all kinds are listed in a new catalogue just issued by the Farr Telephone and Construction Supply Company of Chicago. This catalogue contains about 50 pages and is descriptive of a comprehensive line of apparatus.

"Allis-Chalmers Type B Motors and Generators" is the title of Bulletin No. 1052 of the Allis-Chalmers Company of Milwaukee. These are direct-current machines ranging from one to 30 horsepower, made open or enclosed, bipolar and multipolar. They receive the same finish given to larger apparatus and are well adapted for driving machine tools and other machinery.

Railroad men especially will be interested in two of the late bulletins of the Electric Storage Battery Company of Philadelphia. No. 99 has to do with "The Application of Storage Batteries in Railway, Electric Signal and Interlocking Devices," while the title of No. 100 is "The Application of Storage Batteries to Railway Car Lighting." Both are illustrated, and, like all of this company's publications, should be preserved for reference.

The Automatic Electric Company of Chicago has just issued two beautifully illustrated loose-leaf catalogues, one entitled "Magneto Switchboards," and the other "Magneto Telephones." The former contains a brief description of the company's magneto telephone switchboards of both express and bell types, and the latter describes its magneto or generator-call telephones of both series and bridge types, together with code numbers and a description of the various parts. While the company has been devoting itself almost exclusively to the manufacture of automatic telephones, switchboards, etc., it has been necessary in the installation of automatic systems to develop a line of manual apparatus for use in making up the wire chiefs, trouble and information clerk's disks and the toll and farmer-line switchboards used in connection with the automatic system. Since this manual apparatus is carefully designed the company is putting it on the market for small use.

"Commercial America in 1905" is the title of a monograph just issued by the Department of Commerce and Labor through its bureau of statistics. It discusses commerce and commercial conditions in each country of America in 1905 where possible, or in the latest available year where the figures of 1905 have not been announced. The special purpose of this monograph is to present the latest available information regarding commerce and commercial conditions in the various countries south of the United States, practically all of which are to be represented in the Pan-American Congress which is to meet in Rio de Janeiro in the present month, and to supply to the delegation from the United States, and to others attending the congress this information in a single volume and in convenient form for study and reference.

The Wesco Supply Company of St. Louis announces that its new General Electrical Catalogue No. 100 is now completed and is being distributed to those actively engaged in electrical trade. This is said to be the most complete catalogue of its kind ever published, containing as it does complete descriptions with valuable data concerning all modern electrical goods, appliances, devices and specialties, together with much useful information, etc., of value to all electrical workers. All buyers of electrical goods are invited to send in their name and address together with their occupation to the Wesco Supply Company for a copy of this catalogue. The company is also distributing a complete new price-list in booklet form covering its line of magneto and central-energy telephones, also prices on lineman's tools, construction material, exchange equipment and supplies.

MISCELLANEOUS.

Turbines are to be substituted for the large reciprocating engines at the new London County Council generating station. A London paper says that the latter engines are already obsolete and seriously affect the near-by Greenwich Observatory.

At a recent meeting of the Faraday Society in London Dr. F. Mollwo Perkin described "A Simple Form of Rotating Cathode for Electrochemical Analysis." The cathode consists of a spiral of platinum wire, or, better, iridio-platinum wire. Nickel wire may be substituted for platinum, and the author recommends its employment in place of the more expensive metal. Attention is also drawn to the solubility of platinum anodes, with heavy current, 0.0016 gram being dissolved in a cyanide solution in 35 minutes.

With a rope attached to a harness encircling his slender body, a ferret is being used by the Central Union Telephone Company, which is installing an underground conduit system in Lafayette, Indiana. The little animal completed in less than an hour a task that would require the services of twelve men a whole day. It consisted of drawing through five sections of the conduit, just two blocks long, the rope with which the heavy cables are pulled through the pipes. It is an ordinary ferret that is used. J. C. Fessmeyer, superintendent of construction, obtained the animal in Indianapolis. A large crowd of people watched the unusual operation. The ferret's nose is pushed into the opening of the conduit at the manhole. At the other end a piece of fresh meat is held. Soon the ferret scents the meat and darts into the conduit. After him goes the rope that is attached to his harness, and he never stops until he is at the other end and the rope with him. He makes the run rapidly.

TRADE NEWS.

The Hunter-Parry Electric Company of Dallas, Tex., has been incorporated with a capital stock of $10,000.

The Chicago Commercial Association is sending out the first circular announcing summer and fall merchants' excursions to the Chicago market W. F. Hypes chairman of the trade-extension committee.

Tenders will be received by the deputy postmaster-general, Melbourne, Australia, until August 7th for 20,000 Western Union pattern double-shed single-groove glass insulators and 5,000 double-groove glass insulators.

Bids will be received until July 23d for making improvements at the institution for the deaf and dumb at Jackson, Miss. The work includes the purchase of electric motors, etc. J. R. Dobynes is superintendent.

The Electric Ventilating Company of Chicago, manufactures of air-cooled motor fans and electric air-conveying machinery, has moved from 253 to 221 East Kinzie Street, where it occupies much larger quarters on the ground floor.

The Eau Claire Electrical Construction Company of Eau Claire, Wis., is now prepared to do a general electrical business, construct electric plants, wire residences and factories and do electric repair

work in all its branches. W. A. Sperr and William Runkle constitute the company.

Sealed proposals will be received at Newark, N. J., until July 30th for the construction of buildings and the installation of electrical and heating systems at the county hospital for the insane at Overbrook, N. J., in accordance with drawings and specifications on file at the office of Hurd & Sutton, architects, Union Building, Newark, N. J. Separate proposals will also be received for the electrical work, engines, and electrical generators. Plans and specifications for the electrical work may be seen at the office of Runyon & Carey, consulting electrical engineers, 122 Market Street, Newark, N. J.

The second annual conference of the sales and manufacturing departments of the Franklin Electric Manufacturing Company of Hartford, Conn., maker of incandescent lamps, was held at Hartford on June 25th to 30th. There were numerous meetings at the factory and social features in Hartford and Farmington, Conn., and at Manhattan Beach, N. Y. On June 28th the annual dinner was held at the Farmington Country Club. President Charles I. Hills, Vice-president E. D. Redfield, Secretary J. W. Morrell, Manager Jonathan Camp, E. B. Hatch, J. A. Butler, P. S. Klees and others were present at this pleasant gathering.

The Crocker-Wheeler Company of Ampere, N. J., has recently sold the Fitchburg and Leominster Street Railway Company of Fitchburg, Mass., a 100-kilowatt direct-current generator at 550 volts, this being an additional unit to the railway power equipment. The Warwick Iron and Steel Company of Pottstown, Pa., has purchased from the Crocker-Wheeler Company a direct-current generator of 150 kilowatts, 250-volt, to furnish additional power for its shop equipment, and the Emfield Construction Company of Windsor Locks, Conn., has purchased two alternating-current generators of 180 and 165 kilowatts capacity, respectively.

"Analysis of the Commerce of the United States with the Various Countries of the World" is the title of a monograph just issued by the Department of Commerce and Labor through its Bureau of Statistics. The purpose of this monograph, as the title implies, is to show the articles forming the trade with each country of the world, article by article, during a term of years. The tables show the principal articles forming the imports from and exports to each country in each year from 1895 to 1905. The foreign commerce of the United States has grown during that period from $1,540,000,000 to $2,636,000,000, an increase of 71 per cent.; the imports have grown from $732,000,000 to $1,118,000,000, an increase of 53 per cent., and the exports from $808,000,000 to $1,519,000,000, an increase of 88 per cent.

Having purchased the plant, good-will, patents and property of every description of the National Water Tube Boiler Company of New Brunswick, N. J., the Brunswick Refrigerating Company of New Brunswick announces that it is prepared with ample capital and equipment promptly to take care of any orders that may be placed with the company for National water-tube boilers, or for any parts for repairs of same. There will be a thorough overhauling of the new plant and any additions which may be necessary to building or equipment will be made at once.

The Cutter Company of Philadelphia has recently opened its own office in London. English engineers appreciating the value of I-T-E circuit-breakers are specifying them largely, and in many of the more important recent installations in London and elsewhere they have been used, one of the most notable installations being that of the London County Council, one of the largest switchboards in England, recently installed by the British Westinghouse Company. In order that its foreign business might be more advantageously handled the I-T-E Electric Company has been established with offices and stores at 20 Great Russell Street, London, W. C., England. The resident manager is Mr. W. E. Gibson, who is well known in this country, having been associated with Messrs. Robert W. Blackwell & Co. for some years. Mr. A. E. Newton, president of the Cutter Company, is sailing for Europe to look over the ground and see what further improvements can be suggested for the conduct of the English business.

BUSINESS.

W. S. Barstow & Co. have been engaged as engineers for remodeling the plant of the Jamestown Worsted Mills, Jamestown, N. Y. Plans will be drawn covering an extensive addition to the power plant and the plant will be changed over to electric motor drive throughout. Barstow & Co. recently completed a similar installation for the Hartford Carpet Corporation, Thompsonville, Conn.

The Interstate Railways Company of Philadelphia has recently concluded the purchase of new power equipment for the Wilmington and Edgemoore Electric Railway Company, Wilmington, Del., consisting of a 500-kilowatt Allis-Chalmers steam turbine and alternator and a 40-kilowatt Allis-Chalmers generator for direct connection to an Ideal engine. The turbo-generator unit is a 2,300-volt two-phase 60-cycle machine, operating at a steam pressure of 140 pounds, and producing its rated output at 100 per cent. power factor, with a 40-degree rise in temperature of the generator. Units similar to this one are now on order for the Meriden Electric Light Company of Meriden, Conn.; Canton Light, Heat and Power Company, Canton, Ohio; Western Gas and Electric Company of Aurora, Ill., and the city of Jacksonville, Jacksonville, Fla.

The Stromberg-Carlson Telephone Manufacturing Company of Rochester, N. Y., reports having closed contracts for switchboards at the following places: Knox, N. D.; Lowville, N. Y.; Adams, N. Y.; Paola, Kan.; Fort Wayne, Ind.; Camillus, N. Y.; Superior, Wis.; Holloway, Minn.; Pine Bluff, Ark.; Sioux City, Iowa; Chicago, Ill.; Louisville, Ky.; Ravenswood, W. Va.; Dundas, Ill.; New York city, N. Y.; Kansas City, Mo.

The Crocker-Wheeler Company of Ampere, N. J., reports among recent sales the following: Twenty-one direct-current motors ranging from six to 75 horsepower, sold to the National Tube Company of McKeesport, Pa.; one 500-kilowatt direct-current generator to the Pensacola Electrical Terminal Railroad Company of Pensacola, Fla.; a 100-kilowatt alternating-current engine-type generator and one 6½-horsepower exciter to the American Multigraph Company of Cleveland, Ohio, and one 75-horsepower 115-volt direct-current motor to the New Jersey Zinc Company, Franklin Junction, N. J.

The Philadelphia Rapid Transit Company has recently placed orders with the Westinghouse Machine Company of Pittsburg for a complete equipment of Roney mechanical stokers for the large subway power plant now being built in Philadelphia. This plant was constructed for turbine machinery and Westinghouse-Parsons turbines of 6,000 kilowatts capacity will be installed. The order covers stokers for the entire boiler plant of 32,700 horsepower. Boilers are of the Parker water-tube type. The New York, New Haven and Hartford Railroad Company also recently adopted mechanical stokers for its large power plant at Cos Cob, now being built to serve the electrified section of the New York city terminal. The initial order comprises 12 Roney stokers. These stokers will serve 12 520-horsepower Babcock & Wilcox water-tube boilers. The United Railways and Electric Company of Baltimore, which has in operation one of the most modern and efficient boiler plants in the country has equipped the recent extensions to its plant with mechanical stokers. The boiler house is double-decked and three new batteries on the second tier are now being installed. This plant is the largest steam plant in Baltimore and passed through the Baltimore conflagration without damage, although the adjacent engine house was destroyed.

ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued (United States Patent Office) July 3, 1906.

824,700. Flush Plug and Receptacle. Charles E. Avery, Jersey City, N. J., assignor to the Manhattan Electrical Supply Company of New Jersey. Application filed April 18, 1904.

The invention relates to plug receptacles, embodying a receptacle adapted to be supported in a recess and carrying contacts connected with the main circuit wires.

824,701. Multi-party-line Exchange System. Garrison Babcock, Chicago, assignor to the Stromberg-Carlson Telephone Manufacturing Company of Rochester, N. Y. Application filed November 30, 1903.

A multi-party telephone exchange system is described, having for its object improved central-exchange apparatus and connections whereby the central operator may more readily establish circuit conditions necessary for such systems. The invention is adapted to such a system as described in Mr. Babcock's patent No. 763,351, issued June 28, 1904.

824,756. System of Alternating-current Motor Control. August Sundh, Yonkers, N. Y., assignor to the Otis Elevator Company. Application filed March 10, 1905.

The system of alternating-current motor control described relates more particularly to an automatic push-button controlling system as applied to the operation of electric elevators.

824,767. Telephone-exchange System. Harry G. Webster, Chicago, assignor to the Stromberg-Carlson Telephone Manufacturing Company, Rochester, N. Y. Application filed March 25, 1903.

The invention relates especially to trunk circuits for use in connection with large telephone-exchange systems.

824,804. Auxiliary Fire-alarm System. George F. Milliken, Boston, Mass., assignor to the Gamewell Fire-alarm Telegraph Company, New York, N. Y. Application filed October 20, 1905.

The object of the invention is to provide an indicating device by which the number of the sub-station in an auxiliary circuit which has been operated to cause the street box to send in an alarm will be indicated at a point conveniently observed by the firemen.

824,812. Magnetic Apparatus. Henry Richardson Plimton II., Newton Center, Mass. Application filed February 25, 1904.

It is proposed by the apparatus to demonstrate in a new manner and by new means the repelling power of bar magnets as well as the attracting power.

824,828. Secondary-battery Plate. William L. Silvey, Dayton, Ohio. Application filed March 5, 1906.

A secondary-battery plate or conducting support and means for receiving and retaining the active element of a battery in a more permanent and substantial manner than has been heretofore employed, is the principal object of the invention. (See cut on next page.)

824,833. Trolley. Joseph Tetlow, Saco, Maine, assignor to Herbert R. Jordan, Saco, Maine. Application filed November 7, 1904. Renewed January 19, 1906.

The construction of the running contact of a trolley and the method of mounting it in the harp so as to be able to replace the part of the contact most subject to wear without renewing the sides is the main feature.

824,834. Trolley. Joseph Tetlow, Saco, Maine, assignor to Herbert R. Jordan, Saco, Maine. Application filed April 19, 1905. Renewed January 19, 1906.

The invention relates to improvements in trolleys.

824,843. Operator's Key for Telephone Switchboards. William M. Brown, Johnstown, Pa., assignor of one-fourth to George H. Parmelee, Johnstown, Pa. Application filed June 26, 1901.

An operator's key for telephone switchboards has a movable contact-carrying member through which in its normal position a talking circuit between two connected subscribers is effected and stationary contacts to which the operators' instruments are connected, the member being movable to connect the operators' instruments with either of the subscribers and thereby makes impossible a simultaneous connection between the subscribers.

824,845. Rail Bond. Walter G. Clark, Seattle, Wash. Application filed October 13, 1905.

A cheap and simple bond for electric railways is described.

824,856. Telephone System. Samuel B. Fowler, Lafayette, Ind., assignor to the Sterling Electric Company, Lafayette, Ind. Application filed December 10, 1903.

The invention relates particularly to a local battery system in which the talking circuit at the subscriber's sub-station is supplied from a local battery and from which sub-station calling current is sent into the line usually from a hand generator. A relay is employed provided with a winding normally bridged between the limbs of the line and connected directly in circuit with the sub-station generator when actuated.

824,884. Fuse Box. Howard E. Richards and Robert H. Ramsay, Bellevue, Ohio. Application filed May 15, 1905.

A combination fuse box for use on primary and secondary electric wires, transformers, junction boxes, etc., is described.

824,887. Train Dispatching and Recording System. Paul J. Simmen, Chico, Cal. Application filed July 31, 1905.

To show the position of a number of trains on a track there is combined a recording sheet, a series of sections of a track, a corresponding series of wires leading from the sections to a point adjacent the sheet, an electromagnet in the circuit of each wire, an electric generator for the circuits, means operated by each magnet for marking the sheet, clockwork for uniformly advancing the sheet and means for closing each circuit operated by the passage of a train over the corresponding section.

824,893. Magnetic Ore Separator. Joseph Weatherby, Jr., New Cumberland, Pa. Application filed August 3, 1905.

Improvements in the construction and arrangement of the magnet and movable armature elements are such that a single magnet may be employed with a number of movable armature elements to increase the capacity of the machine and to effect economy in its operation.

824,922. Dynamo-motor. Edward W. Fahl, Shirley, Ind. Application filed December 18, 1905.

In this motor-generator the idea is to produce a self-contained machine for smaller plants in such a manner that the mass of the motor will be approximately concentrated in that portion of the motor corresponding to the flywheel. (See cut on next page.)

824,953. Electric Tool. Paul Schiemann, Dresden, Germany. Application filed November 7, 1904.

The solenoids driving the tool have subdivided coils, the parts of which are consecutively short-circuited.

824,980. Telephone System. William W. Dean, Chicago, Ill., assignor to the Kellogg Switchboard and Supply Company, Chicago, Ill. Application filed November 9, 1903.

The invention relates to supervisory systems for telephone lines, and has for its object generally to provide a system in which complete supervision in the most approved manner is carried out, and in which at the same time the number of relays required for the operation of the supervisory system is reduced.

824,988. Electric Signaling Device. Patrick Kennedy, New York, N. Y. Application filed October 13, 1904. Renewed December 15, 1905.

This is a closed-circuit fire-alarm signal arranged so that signals from one station do not interfere with or confuse those of another station.

824,989. Signaling Device. Patrick Kennedy, New York, N. Y. Application filed February 13, 1905. Renewed January 23, 1906.

By this invention a fire-alarm box may be operated at a distance by electrical means, or the button may be operated manually at the box.

824,990. Electric Signaling Device. Patrick Kennedy, New York, N. Y. Application filed March 23, 1905. Renewed February 23, 1906.

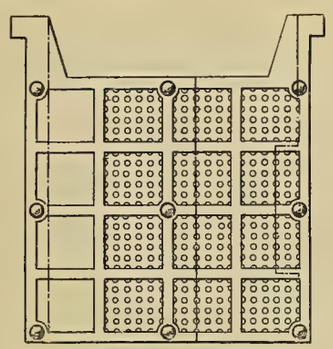
In a fire-alarm system the movements of the armature of the main or line magnet serve to set in motion or arrest a mechanism which acts to break the shunt about the auxiliary magnet.

824,991. Electric Signaling Apparatus. Patrick Kennedy, New York, N. Y. Application filed August 23, 1905.

The invention provides a fire-alarm telegraph box with means whereby the act of pushing in a button sets the signal-sending mechanism in operation and automatically locks the button rod or slide in its operative position until the signal is sent.

825,055. Signaling Apparatus. John C. Hubinger, Keokuk, Iowa. Application filed September 22, 1905.

Balancing and adjusting means for the armature of signaling or signal-controlling apparatus, such as alternating-current bells and relays, are the particular features of the invention.



NO. 821,828.—STORAGE-BATTERY PLATE.

825,069. Dowel Pin for Electrical Conduits. Ralph S. Peirce, Chicago, Ill. Application filed February 27, 1905.

An improvement in dowel pins for securing the proper alignment between the several sections of material used in the building of underground electrical conduits is described.

825,070. Method and Apparatus for Hanging Aerial Cables. Ralph S. Peirce, Chicago, Ill. Application filed February 27, 1905.

This cable hanger consists of a closed loop of marlin or similar material, the ends being fastened together by a metal clip.

825,084. Wall or Snap Switch. Peter Sorensen, Brooklyn, N. Y. Application filed November 27, 1903.

Details are described.

825,091. Electric Switch. Charles S. Van Nuis, New Brunswick, N. J. Application filed December 10, 1904.

The invention aims primarily to secure and maintain an accurate alignment of knife switches.

825,092. Circuit Breaker. Samuel Waterbury, Schenectady, N. Y. Application filed September 23, 1904.

The principal object of the invention is to secure independence between the two operating mechanisms of circuit-breakers which are operated both automatically and by hand.

825,134. Attachment for Telephones. Albert G. Kountz, Mount Oliver, Pa. Application filed January 22, 1906.

An attachment for warning persons at a distance from the telephone that a call has been made is described.

825,142. Trolley Harp. Hermann Mangold, Carnot, Pa. Application filed November 10, 1905.

An improved trolley harp is described.

825,144. Circuit-breaking Mechanism. Walter S. Mayer, Philadelphia, Pa., assignor to A. E. Newton of Daylesford, Pa., and W. M. Scott of Philadelphia, Pa. Application filed May 17, 1905.

In automatic circuit-breakers the tripping of one in a bank will cause the others to be tripped.

825,182. Electric Lamp Fitting. Albert J. Bonnella, London, England. Application filed August 7, 1905.

The inventor describes a fixture by which a fancy library or parlor candle is closely imitated.

825,199. Electrical Fittings. John Dugdill, Manchester, England. Applicatio filed May 22, 1905.

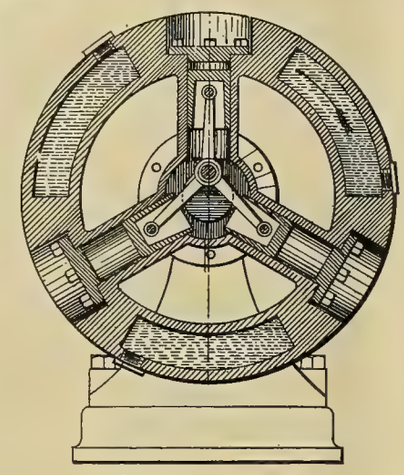
This device consists of the combination of a spring reel, upon which flexible conductors are coiled. The reel is placed in a ball and socket joint on the base of a bracket or fixture.

825,204. Insulator of Overhead Electric Conductors. Emil Giraud, Paris, France. Application filed April 10, 1905.

This invention relates to improvements in connection with insulators used to support overhead electric lines of high voltage, so that should one conductor break both are thrown out of circuit.

825,211. Resistance Unit. Harry E. Heath, Lynn, Mass., assignor to the General Electric Company, Schenectady, N. Y. Application filed July 13, 1905.

One claim relates to a sheet of asbestos, a resistance conductor wound thereon and secured thereto by corrugations.



NO. 824,922.—DYNAMO-MOTOR.

825,222. Dynamo-electric Machine. Marius C. A. Latour of Sèvres, France, assignor to the General Electric Company, Schenectady, N. Y. Application filed November 21, 1902.

To prevent sparking an auxiliary circuit is connected between the commutator bars and wound in a way opposite to the winding of the corresponding main coil of the armature.

825,225. Self-propelled Vehicle. Hermann Lemp, Lynn, Mass., assignor to the General Electric Company, Schenectady, N. Y. Application filed January 14, 1904.

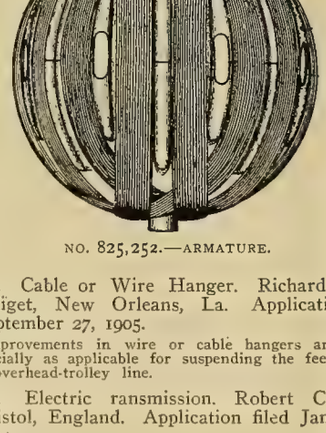
The invention consists in the method of increasing the output of a generating unit comprising an internal-combustion engine and a compound-wound generator, which consists in decreasing or cutting out the series excitation of the generator on maximum loads.

825,227. Flexible Conduit. George A. Lutz, New York, and Clarence S. Sibley, Perth Amboy, N. J. Application filed March 14, 1905.

The insulating paper lining of the tube is weakened at intervals so that if the workman attempts to withdraw it to admit a larger wire, the paper will be torn near the end of the conduit, the rest of the lining remaining in the conduit.

825,228. Adapter for Lamp Sockets. Norman Marshall, Newton, Mass., assignor to the General Electric Compay, Schenectady, N. Y. Application filed January 28, 1905.

The invention is designed to prevent the removal of a lamp-socket adapter after once being applied to a Thomson-Houston socket.



NO. 825,252.—ARMATURE.

825,236. Cable or Wire Hanger. Richard C. McKiliget, New Orleans, La. Application filed September 27, 1905.

Improvements in wire or cable hangers are related, especially as applicable for suspending the feed wire of an overhead-trolley line.

825,245. Electric ransmission. Robert C. Sayer, Bristol, England. Application filed January 27, 1904.

The object of the invention is an electric railway with vehicles to travel over it so constructed as to secure "rapid" short-distance and "express" long-distance transmission of passengers and goods without interference.

825,251. Electric Soldering Iron. Tycho Van Aller, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed July 3, 1905.

An improved electrically heated soldering-iron is described.

825,252. Armature. Frederick M. Vogel, Lynn, Mass., assignor to the General Electric Company, New York. Application filed August 4, 1905.

An armature comprising a hollow supporting shell and having projections on it to hold the winding in place, the shell being of moldable material substantially spherical in shape. (See cut.)

825,254. Combined Outlet Box and Light Fixture. Emanuel D. Weber, Easton, Pa. Application filed May 23, 1905.

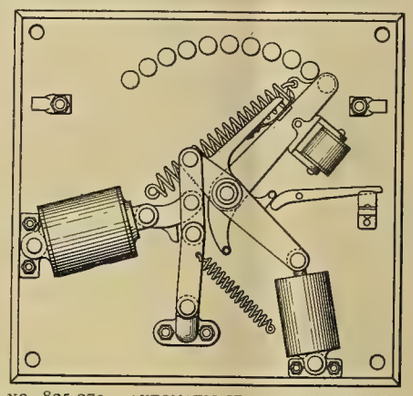
An improvement in electric-light wiring for combination gas and electric fixtures or straight electric fixtures has an insulating outlet box surrounding the pipe, and insulated sleeving extending through the box for the wires.

825,259. Snap Switch. Montraville M. Wood, Schenectady, N. Y., assignor to the General Electric Company, Schenectady. Application filed November 7, 1903.

An improved push snap switch in which the movable contact member is normally locked in either its extreme open or closed position. The parts of the switch can be made from metal punchings without expensive machinery, thus reducing the manufacturing cost.

825,272. Automatic Starting Rheostat. John L. Hall, Schenectady, N. Y., assignor to the General Electric Company, Schenectady. Application filed August 15, 1902.

A starting rheostat which is so constructed that it will automatically actuate the switch-arm and cut out the resistance when the line switch is closed and then automatically reset the switch-arm when the line switch is opened. (See cut.)



NO. 825,272.—AUTOMATIC STARTING RHEOSTAT.

825,276. Automobile. Hermann Lemp, Lynn, Mass., assignor to the General Electric Company, Schenectady. Application filed January 14, 1904.

This invention relates to self-propelled vehicles, and has especial reference to that class of vehicles which derives its motive power from an electric generator driven by a prime mover, the driving motors being energized from the generator. Considerable flexibility of control may be obtained by varying the connections of the electric circuit while running the prime mover at substantially constant speed.

PATENTS THAT HAVE EXPIRED.

Following is a list of electrical patents (issued by the United States Patent Office) that expired on July 9, 1906:

406,415. Dynamo. W. S. Andrews, New York, N. Y.
406,420. Electric Railway Switch. F. O. Blackwell, New York, N. Y.
406,421. Electric Railway Circuit. J. L. Blackwell, New York, N. Y.
406,423. Signaling Apparatus for Elevators. J. F. Bower, Chicago, Ill.
406,429. Dynamo Armature. S. C. C. Currie, Philadelphia, Pa.
406,439. Secondary Battery. W. W. Griscom, Haverford College, Pa.
406,468. Electrical Switch. J. A. Powers, Lansingburg, N. Y.
406,489. Telegraph Key. H. A. Waldo, Reno, Nev.
406,492. Armature Winding for Dynamos. J. J. Wood, Brooklyn, N. Y.
406,493. Self-regulating Dynamo. J. J. Wood, Brooklyn, N. Y.
406,494. Regulator for Dynamo Electric Machines. J. J. Wood, Brooklyn, N. Y.
406,498. Incandescent Lamp. C. A. Backstrom, New York, N. Y.
406,567. Telephone. T. A. Edison, Menlo Park, N. J.
406,599. Dynamo Electric Machine. W. L. Silvey. Lima, Ohio.
406,600. Electric Railway Motor. F. J. Sprague, New York, N. Y.
406,629. Electric Horse Disconnector. G. A. Coulter, Omaha, Neb.
406,636. Galvanic Battery. M. Dougans, Worcester, Mass.
406,656. Galvanic Battery. F. Lotz, New York, N. Y.
406,678. Recording Apparatus for Electric Meters. G. W. Walker, New York, N. Y.
406,709. Invisible Burglar Alarm Electric Mat. J. W. Dawson, St. Louis, Mo.
406,726. Galvanic Battery. H. Groswith, Philadelphia, Pa.
406,743. Electric Railway. W. H. Knight, New York, N. Y.
406,751. Electrical Apparatus for Regulating Steam Boilers, Etc. F. Martenot, Paris, France.
406,769. Signal or Alarm Transmitter and Time Indicator. A. J. Reams, El Dorado, Kan.
406,771. Secondary Battery Electrode. A. L. Riker, New York, N. Y.
406,776. Laminater Core for Electrical Apparatus. A Schmid, Allegheny, Pa.
406,777. Armature for Electric Machines. A. Schmid, Pittsburg, Pa.
406,797. Closed Slotted Conduit for Electric Railways. C. J. Van Depoele, Lynn, Mass.
406,798. Mechanism for Controlling Electric Railway Motors. C. J. Van Depoele, Lynn, Mass.
406,803. Carrier for Electric Railway Systems. D. G. Weems, Baltimore, Md.
406,804, 406,805, 406,806. Electric Railway. D. G. Weems, Baltimore, Md.
406,822. Secondary Battery. H. E. Dey, New York, N. Y.
406,824, 406,825. Electric Meter. T. A. Edison, Menlo Park, N. J.
406,828. Block for Stereotype or Electrotype Plates. H. Fietsch, Jr., Chicago, Ill.
406,833. Means for Propelling Vehicles by Secondary Batteries. W. W. Griscom, Haverford College, Pa.
406,858. Method of Forming Laminated Cores for Electrical Apparatus. A. Schmid, Allegheny, Pa.
406,859. Method of Forming Cores for Electrical Apparatus. A. Schmid, Allegheny, Pa.

WESTERN ELECTRICIAN

EVERY SATURDAY

Vol. XXXIX. CHICAGO, JULY 21, 1906 No. 3

The Overhead Trolley Car on Chicago's Downtown Streets.

It was not in a spirit of pride that Chicago viewed the very recent arrival of the overhead trolley in State Street and other downtown thoroughfares. But the situation is tolerated by the people because the prospect of relief from the ancient cable cars atones for the disappointment in having the streets to some extent disfigured and obstructed by trolley poles and wires.

Although electric traction in outlying parts of Chicago dates back 15 years, the city has been successful in keeping overhead trolleys off the principal downtown streets. Trolley cars approaching the congested district have therefore either been drawn to their destination by horses or trailed around a loop by a cable train. This determination to keep the trolley out of the business district has been one of the causes contributing to the long life of the cable cars in the city.

But the time has come when the cables must go. The recent Supreme Court decision annulling the street-railway companies' claims to 99-year rights in the streets has removed all fear on the part of the city of strengthening the companies' position by granting trolley privileges. The strong demand of the people for better transportation facilities and the recent federal order to lower the three river tunnels used by the street railways have been the principal factors in causing the present trolley extensions.

The accompanying picture shows the new trolley equipment at the corner of State and Madison streets, one of the busiest corners in the city. The electric car just turning from State into Madison is one of the first ever run in downtown State Street by the overhead trolley. It is one of the old single-truck cars from the Archer Avenue line of the Chicago City Railway Company. The service will be improved, however, when the work is finally completed, by the addition of new double-truck cars. To the left in the picture can be seen one of the old cable trains. These may continue to operate on the South Side lines for a month or more. The North and West Side cable cars of the Chicago Union Traction Company may operate somewhat longer, but the tunnels must be lowered by January 1st next, and by that time at the latest all lines will be electrically operated.

The work of erecting poles and stringing trolley wires has been in progress day and night for about three weeks. While the construction is substantial, there is something about the work which does not impress one as being of a permanent character. This condition is more apparent to one familiar with the situation. True, the City Council has passed an ordinance permitting the companies to install the overhead trolley, but the situation still remains unsettled. It is reasonable to suppose that overhead trolleys in Chicago, at least in the congested portion, must soon give way to an underground conduit system or a comprehensive subway system. These two questions are receiving attention at present by the local transportation committee of the City Council, and the committee has the advice of Bion J. Arnold as consulting engineer and William Carroll, city electrician.

Mr. Arnold has made several elaborate reports to the council committee on the subject and he has prepared plans for a downtown subway. In his most recent report he says that the running of electric cars over certain streets or portions of streets by means of the overhead trolley and then changing to the underground conduit system necessarily means delay and annoyance at the point of transfer, and makes the use of the underground conduit system under such conditions more difficult than it would be could the cars operate throughout their entire course with the underground conduit system. To use the underground conduit system for the entire surface railways of Chicago would make the cost so much as to make the reconstruction of the present systems practically prohibitive; therefore, if any underground conduit system is adopted in the city at the present time it would be necessary to change from the overhead trolley to underground construction at certain points.

Going further into the subject, Mr. Arnold says: As shown by my original report, and by my specifications for the Adams Street line, I have always insisted that these transfer points should be removed as far from the center of the city as possible, bearing in mind the largely increased cost of underground construction as compared with overhead. The principal object of having these transfer points removed from the center of the city is that the change may be made after the car has passed out of or before it has reached the zone of congested traffic. I have also recommended that this transfer should take place in a building or other locality that could be equipped with apparatus especially adapted for prompt service. The subject, therefore, resolves itself largely into a question as to how much underground conduit the city is prepared to insist upon at the present time. If it is now proposed to insist upon

THE OVERHEAD TROLLEY CAR ON CHICAGO'S DOWNTOWN STREETS.—SCENE AT STATE AND MADISON STREETS.

only a limited amount of underground conduit construction, and that in the strictly central district, it is my opinion that the benefits from this will not be sufficient to justify the additional cost, considering the fact that the change from underground to overhead will be attended with annoyance which will substantially equal that which will arise from the use of the overhead trolley in the business district.

There are other objections to the immediate construction of the underground system in the business district, arising from the necessity of a certain amount of sewer reconstruction in that district, and the possible installation of a high-pressure water system. The subway question is also involved and is of great importance. The construction of a certain amount of subway for taking care of the cars which now pass through the river tunnels must be borne in mind as one of the strong probabilities if not reasonable certainties of the near future. To construct underground conduit on streets which are likely to be used for subways within any reasonable time would be obviously uneconomic, as these conduits would have to be taken out in the event of a high-level subway being constructed in any street where conduit construction had previously been built. For instance, State Street is now one of the streets, if not the principal street, upon which underground conduit is desired from the public point of view. In the plans which I have heretofore recommended for subway construction I have advised a high-level subway on State Street. If there is any probability of the construction of such a subway in the early future, it would be unwise to install an underground conduit on this street at the present time.

Owing to the fact that the plan of financing the street-railway reconstruction has radically changed since my original report, and that it is now proposed to reserve to the city, or its licensee, the right to purchase the entire railway system for the value of the present property and the additional investment for improvements, it would appear to me wise to omit the construction of any underground conduit at the present time, but to specifically reserve in any ordinances or permits that may be granted, the right that the city may require the construction of underground conduit as soon as the subway and sewer questions have been disposed of and the city has then determined upon a sufficient amount of conduit construction to carry the transfer points well out of the business center.

When it has become sufficiently clear that the city should and can provide for the construction of underground conduit in any one street, such as State Street, for a sufficient distance to enable the cars to be operated solely by underground conduit throughout their entire course, or at least until they have reached the point where the traffic has clearly ceased to be congested, I should recommend the adoption of the underground conduit, and not until then.

With regard to subway construction, it is my opinion that all cars which pass through the tunnels under the Chicago River should be kept underground and off the surface of the streets in the downtown business district. It seems sufficiently clear that in any future development of the transportation system in this city we shall have to use some tunnels under the Chicago River between the business district and the North Side and West Side, in order to give the citizens of these divisions the same reliability of access to the business center that the citizens of the South Side now enjoy.

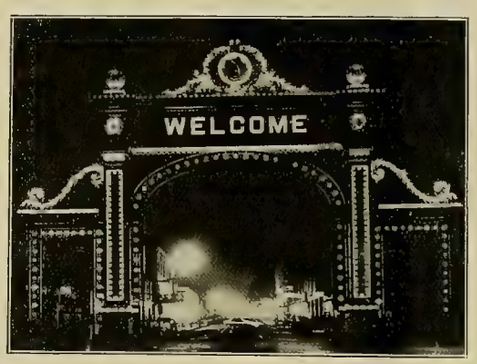
As it will be, in my judgment, impracticable to permanently take care of the traffic by the use of bridges alone, owing to the interference from navigation on the river, and from the fact that we must at once modify the river tunnels, I can see no reason why a beginning should not be made at once in the direction of the development of a subway system. I understand that it is now contemplated to lower the existing tunnels as soon as a permanent solution of the traction question can be reached, either with the present companies or otherwise. That being so, we should provide for taking care of the traffic through these tunnels by the necessary amount of subway in the central part of the city, and so plan that this subway shall be available as part of the complete system in the future. Any subway which is now constructed should be available for any reasonable development of subway construction at any time hereafter.

It is thus apparent that if Mr. Arnold's ideas are carried out, the present overhead work will prove to have been only a temporary expedient. The work now in progress was begun by the companies immediately after the Council passed the ordinance which permitted the work to be done. Many poles were set and wire strung before the city officials were aware that the work was in progress. It was then found that some of the work was not in accordance with the requirements of the ordinance, and work was stopped. Alterations were made in the work already done, and now the electrical construction is being done under the supervision of City Electrician Carroll, while the setting of poles and the like is directed by the Department of Public Works.

Until more definite conclusions are reached as to future plans of the city, it is not probable that the Chicago City Railway Company will reconstruct its cable power houses. To supply the present trolley extensions the company will probably purchase current from the Chicago Edison Company, which company may erect several new sub-stations. The Chicago City Railway Company has plans prepared for the erection of new power houses and other improvements, but, as the franchise-extension negotiations are still in progress and the outcome, complicated with municipal-ownership ideas, is uncertain, these improvements are still some distance in the future. Some new cars will be added to the service, and already the best of the cable cars are being equipped for electric service by the company. In a general way the situation as to electrical improvements is the same with the Chicago Union Traction Company.

Denver "Welcome" Arch at Night.

The accompanying picture is a night view of the electric "Welcome" arch in Denver, Colo., as it now stands completed at the Union Depot in Denver. A day view of the arch when not quite finished was printed in the Western Electrician of June 30th. The arch was dedicated before 10,000 people on July 4th. The mayor accepted it on behalf of the city in a speech that emphasized the value of lights as a welcome to strangers. The arch weighs 70 tons, is 60 feet high, and the driveway is 34 feet wide. It is constructed of iron, plated with bronze, and with an antique finish. There are 1,600 lights. The cost of the arch was $22,000, which was raised by public subscription. It is the outgrowth of a lighting campaign begun by the Denver Gas and Electric Company several years ago.



DENVER "WELCOME" ARCH AT NIGHT.

Mail Transportation Begun in Chicago Freight Tunnels.

Regular carriage of mail was begun in the Chicago subways of the Illinois Tunnel Company on July 16th. The first train to carry mail was operated (electrically, of course) between the general postoffice and the La Salle Street railroad station. Several postoffice officials and officers of the tunnel company followed in another train. It is said that similar service will be extended to the other railroad stations before September 1st. In addition to this the tunnel company by that date promises to handle merchandise from all the local freight yards.

Steel-concrete Arch Bridge over Power Canal in Niagara Falls.

By Orrin E. Dunlap.

The Niagara Falls Hydraulic Power and Manufacturing Company has a work of considerable magnitude under way in replacing the bridge over its waterway at Third and Niagara streets, in Niagara Falls, N. Y. For years there has been a dispute between the company and city as to whose duty it is to rebuild certain canal bridges. In order to get a court decision on the question, a friendly suit was started, and is now pending. In the meantime, the city of Niagara Falls and the Niagara Falls Hydraulic Power and Manufacturing Company have entered into an agreement under which the city will meet the expenses of the bridges, which the company is going ahead to build, in case the courts find the city responsible for their construction.

Commercial interests have greatly increased in the vicinity of Third and Niagara streets, and traffic at that point is now large, so that a new bridge over the canal is a necessity, outside of the fact that the power company desired a new structure erected, so that it might enlarge its canal at that point to the full width of 100 feet, this beig the only point on the canal where it remained at the width of 70 feet. The style of bridge to be erected is a concrete arch, reinforced with steel. The actual span of the arch will be about 110 feet, and it will have a rise of 17 feet. The average width of the bridge will be 200 feet. The structure will contain approximately 5,000 cubic yards of concrete, the mixture to be 1, 3 and 5. It will also contain about 125 tons of reinforcing steel bars. The floor will be of asphalt. The bridge will be erected in four 50-foot sections. Conduits will be built in it for various cables, wires and pipes that cross the canal at this point, the Niagara Falls Power Company now being at work bringing its conduit line running to Canada up to the bridge site.

The work of removing the rock and enlarging the canal to its width of 100 feet is now in progress. This is considerable of a task. A large section of the old truss bridge has been taken down, closing Third Street to traffic, but leaving Niagara Street open. Plate-glass windows in nearby business blocks have been taken out, the space being filled in with frames containing smaller glass, so that damage from flying stones from the blast, if there be any, shall not be great. About 2,000 cubic yards of rock will be removed. This rock is loaded onto scows, and then taken down the waterway to the canal basin, where it is crushed and sold to the New York Central Railroad for ballast, the company having erected a large crusher to handle stone from this and other work it has in progress. Completed, the bridge will cost about $48,000, a saving of about $25,000 being effected by the power company doing the work. It is expected that the structure will be completed by October. Chief Engineer Harper is looking after the interests of the Niagara Falls Hydraulic Power and Manufacturing Company in connection with the bridge, and City Engineer W. W. Read is looking after the

ENLARGING POWER CANAL AT NIAGARA FALLS PREPARATORY TO ERECTING STEEL-CONCRETE ARCH BRIDGE.

city's interests in the matter. The bridge scheme in connection with the canal includes a new heavy iron bridge at Erie Street, while the iron bridge now standing at Erie Street will be moved down to Fourth Street. This new bridge over the canal at Erie Street will allow the International Railway Company to double-track its line over the canal at that point, a great necessity, as all Buffalo cars cross that structure, as do also the "Power House" cars. When the new concrete arch is over the canal at Third Street, the Electric City Railway Company, controlled by the International Railway, will lay a double track across the bridge, making it possible to connect its new line up Niagara Street and out Nineteenth Street.

German Prepayment Meters for the Sale of Current.

By Dr. Alfred Gradenwitz.

Apparatus for the automatic sale of all sorts of goods is taking an ever-increasing importance as ready intermediaries between the producers and consumers. After being applied to the sale of gas, the idea has just been adapted (in Germany, at any rate) to the automatic distribution of electricity by the Siemens-Schuckert Works. A description of

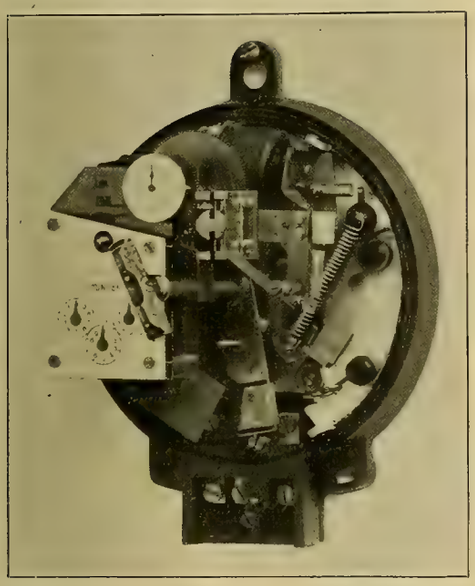


FIG. 1. GERMAN "HOURS" PREPAYMENT METER WITH COVER REMOVED.

these interesting instruments will be found in what follows.

In relation to advantages afforded by the prepayment apparatus it may be said that while payment is considerably simplified, the keeping of accounts at the central station is rendered particularly easy. Moreover, perfect security as to payment is secured, while the machinery of credits and accounts is avoided. As any abuse of the apparatus may be ascertained at a moment's notice, the amounts of electricity recorded are most efficiently checked.

The automatic electricity selling apparatus may be divided into two classes, one of which comprises such instruments as yield predetermined amounts of current in given times, while in those belonging to the second class, given amounts of watt-hours or ampere-hours are yielded with any desired amounts of energy. The first type of apparatus accordingly comprises a clockwork and the other type a watt-hour meter or ampere-hour meter. Both types may be designed for any kind of coins and any description of direct, alternate or rotary-current plants. They show no consumption of energy of their own nor do they require any standardizing or special superintendence.

As regards, in the first place, the former type of apparatus or "hours apparatus," this mainly contains a switch, an efficient clockwork and a coin-switching device (see Figs. 1 and 2). The switch is of the single-pole type and is designed for a current intensity of 20 amperes with 125 volts, 10 amperes with 250 volts, or four amperes with 440 volts. It is operated by hand and works as an instantaneous current-maker and breaker. The clockwork is designed for hand winding and 300-350 hours working; it comprises an escapement located in jeweled bearings as well as a counter with three pointers, enabling the total amounts of burning hours to be read so as to afford a means of checking the amount of coins introduced into

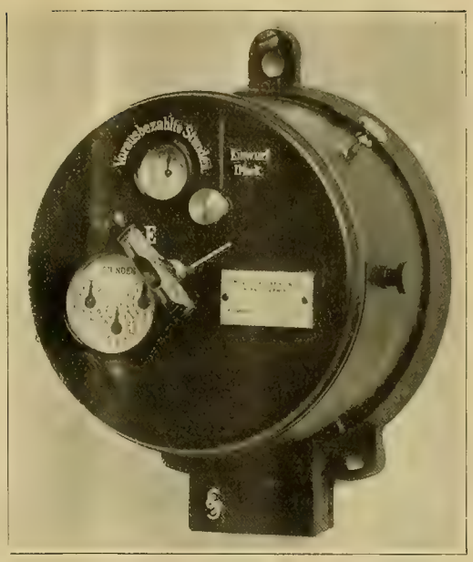


FIG. 2. GERMAN "HOURS" PREPAYMENT METER.

the apparatus. After the switch has been closed the clockwork will begin running until the switch is opened again.

The coin-switching device serves for the prepayment of several coins, thus allowing as many coins to be introduced successively into the apparatus as to prepay for an interval of 45 hours. When introducing further coins the apparatus, while not being damaged in any way, will not yield any additional amounts of current.

For each coin introduced into the apparatus the switch may be closed for a given interval, the number of hours prepaid for being recorded on a dial. If the pointer of the latter is at zero, all the introduced coins have been consumed, the switch being automatically thrown out in order to be closed again after introducing a further coin.

The coins introduced drop into a case protected

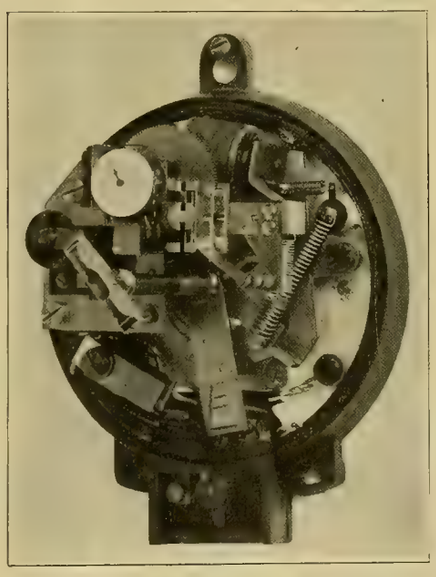


FIG. 3. GERMAN AMPERE-HOUR PREPAYMENT METER WITH COVER REMOVED.

by lead, while coins other than those the apparatus has been designed for, are not allowed to exert any effect, but immediately drop into the money case.

Whenever there is some danger of the consumer exceeding the predetermined consumption, for instance, by fitting lamps of higher candlepower, this may be prevented by arranging an overload relay. This apparatus mainly comprises an electromagnet traversed by the main current and the armature of which is thus adjusted by a spiral spring as to not be attracted until a given limit of load is reached. On exceeding the latter the armature will be attracted, closing an auxiliary circuit and throwing the automatic selling apparatus out of circuit. The switch may be immediately closed again after reducing the load in the plant to the predetermined limit. The overload relay may be adjusted for any desired figures.

As regards, secondly, the other type of automatic apparatus serving for the sale of given amounts of watt-hours or ampere-hours, this (Figs. 3 and 4) comprises a switch, a coin-switching device and switching relay, there being no clockwork provided. The switch is designed for a current intensity of 20 amperes with 125 volts, 10 amperes with 250 volts, or four amperes with 440 volts. It is similar in working to the one described in connection with the former type. The coin-switching device serves the same purpose as that used in the hour apparatus. The working of the counter in conjunction with the automatic-selling apparatus is as follows:

On the axle of the counter has been mounted a contact device. Whenever after the introduction of a coin the switch is closed and, for example, one lamp thrown in, the pointer will be set moving and after some rotations will close this contact, thus exciting the switching relay of the apparatus and reducing the pointer through some short interval towards zero. The same operation is repeated over again until, after a given number of contacts—i. e., after a given consumption of watt-hours—the pointer will be perfectly reduced to zero, thus interrupting the circuit. By introducing another coin in the meantime the pointer may evidently be removed from zero by an interval corresponding to this coin. The coins introduced into the apparatus drop into a money case.

This type of apparatus is provided either with a

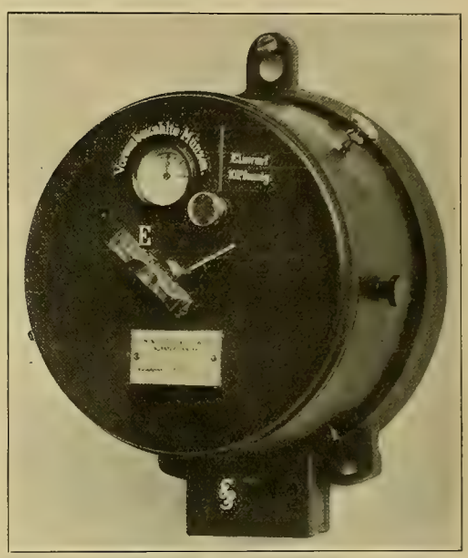


FIG. 4. GERMAN AMPERE-HOUR PREPAYMENT METER.

single-pole switch for use in connection with double-conductor plants or with bipolar switches for use both in connection with three-conductor and two-conductor plants.

It may be said that any ordinary electricity meter may by the addition of the automatic apparatus above described be converted into a watt-hour automatic selling apparatus, it being only necessary to screw the contact device to the counter and to connect it to its circuit.

A deduction device (Fig. 5) is intended to serve as an additional apparatus to several types of electricity meter. It comprises a clockwork for hand

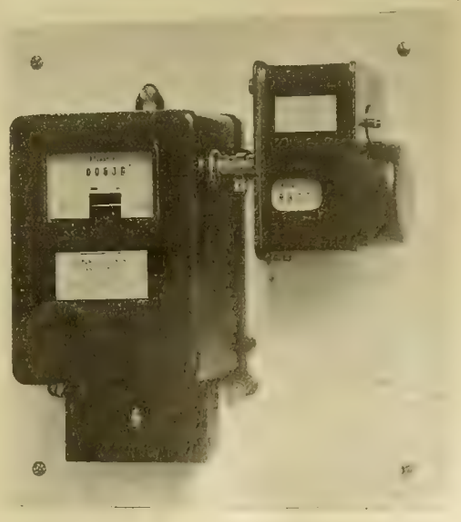


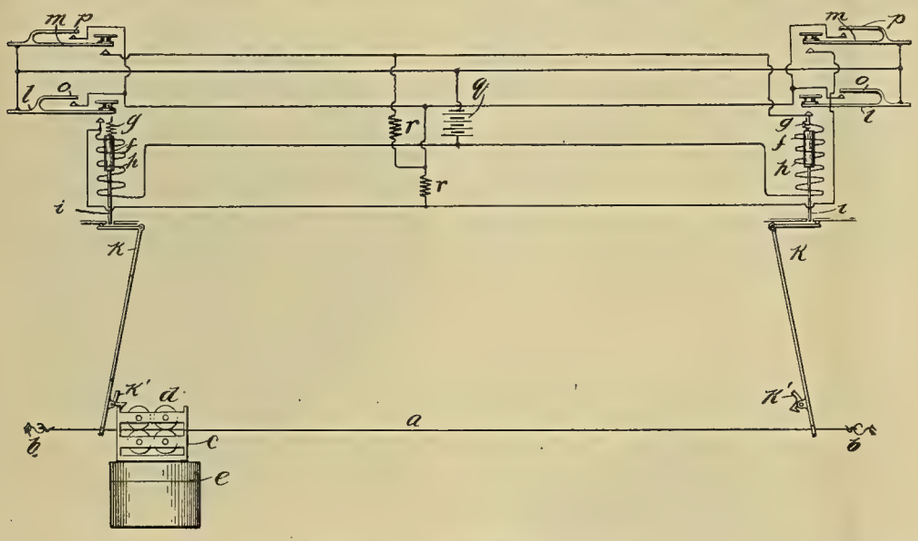
FIG. 5. DEDUCTION APPARATUS FOR GERMAN PREPAYMENT METER.

winding, with cylinder escapement for about four weeks' running, being fitted into a cast-iron casing together with a differential counter. The counter and clock are connected together by a flexible shaft and are mounted on the same marble slab. While the counter records the total energy consumption the clockwork records the surplus energy beyond the lump amount arranged for.

[Referring to the German words on the faces or the meters, it may be explained that "Vorausbezahlte Stundent" means "Hours Prepaid," "Einwurf 1 mark" means "Insert 1 mark" (24 cents), "Stunden" alone means "Hours," "Vorausbezahlte Münzen" means "Coins Prepaid," and "Einwurf 10 Pfennig" means "Insert 10 Pfennigs" (equivalent to 2.4 cents).—Ed.]

Electric Coin Carrier for Store Service.

Joseph A. Suerth of Chicago has patented an electric carrier system for use in stores in transmitting money from a clerk's position to the cashier's desk and vice versa. The propulsion and control of the apparatus is attained by the use of electromagnets. There is a governing device at each clerk's position, serving to operate the magnetic apparatus at that position, and there is also preferably provided a similar governing device at at least one position and desirably at each of the communicating positions, whereby the clerk at one position may effect operation of the electromagnetic



ELECTRIC COIN CARRIER FOR STORE SERVICE.

apparatus at the other position, so as to effect the travel of the carrier from the other position to the first position. The governing devices are preferably in the form of push keys or buttons—two for a position—which buttons co-operate with circuit connections, whereby the magnetic apparatus at either of the communicating positions may be operated at either position for the purpose stated.

By means of this system, if a salesman has sent the carrier to a cashier's position and should for any reason desire the return of the carrier before the cashier may have opportunity to return it, the salesman will press that one of the two buttons that will operate the magnetic apparatus at the cashier's position to impel the carriage toward the salesman's position. The cashier, desirably, though not necessarily, has similar control over the carriage at the salesman's position.

The accompanying diagram shows two communicating positions. The carrier (c) supporting coin box (e) travels on the wire (a). There is a solenoid whose core (f) is normally held up by a spring (g), the core being drawn downward against the force of the spring when current passes through the solenoid winding (h), a non-magnetic extension (i) engaging the short arm of a bell crank lever (k) whenever the core is thus pulled to effect the rotation of the bell crank upon the pivot at its elbow, whereby the long arm of the bell crank will engage the frame of the carriage and give the same a gradual push rather than a sudden impulse.

The switching mechanism (l o) at each station is termed the "local" switching device, because it controls the circuit of the solenoid or other electromagnetic device located at the same station with the switch (l o). The switching devices (m p) are those devices that enable a clerk at one position to close circuit through the winding (h) at another position, there being preferably two sets of switches.

Assuming a clerk at the left-hand position desires to move the carrier to the right-hand position, the switching device (l o) at the left-hand station is operated, whereby circuit through the left-hand solenoid winding (h) is closed, as will be apparent by the connections illustrated. If the clerk at the right-hand station should desire the carriage and the carriage then should be in the position indicated, the switching device (m p) at the right-hand station is operated, whereby circuit through the winding (h) at the left-hand station is closed to cause the carriage to move toward the right-hand station. The clerk at the right-hand station may return the carriage to the left-hand station by operating the switching device (o l) at the right-hand station; but if this clerk fails so to return the carriage, the clerk at the left-hand station may cause its return to the left-hand station by manipulating the switching device (m p) at the left-hand station.

The Electric Microseismograph.[1]

This new instrument, built and installed at our observatory, is well deserving of its name, for the reason that not only the earth tremors are taken up by electric contacts, but also because the transmission and recording of the seismograms is effected by means of electric appliances. It consists of two distinct parts—the pendulum, with its electric contacts, placed in a vault below ground, and the recording device, which stands in the instrument room of the observatory in the sixth floor of the college tower. The electric microseismograph is a radical departure from all known forms used in registering earth tremors, great and small, and we therefore intend to give a full description of it for the first time in the following report. The recording part is not altogether new, but will be recognized by the regular reader of the yearly report as a reproduction of the electrograph invented by the director of this observatory, and described in the third annual report. The pendulum with its electric contacts is a new idea, based on the principles of the microphone, and, partaking of its sensitiveness, promises to bring out some new and interesting features regarding earth tremors.

The vault is formed by an excavation under the college tower. It is 10 by 10 feet and six feet high, surrounded by a double brick wall with air space, and there is also an air space between the outer wall and the ground. The ceiling is formed by three layers, oak, cement and cypress, with air spaces between them. The single opening to the vault is closed by a double door. The floor is eight feet below the outer ground surface and is unpaved.

The pier stands in a well four by four feet and eight feet deep. It is built up in hard brick and cement, standing absolutely clear of the retaining walls of the well on a four-inch layer of clay, which was found at a depth of 15 feet below the outer ground level. Below this clay, borings discovered 11 feet of coarse sand, the water level at 21 feet, and after that quicksand. The two columns are formed by extensions of the pier at either end. They are of the same material, eight by eight inches thick and five feet high. They are capped by a block of sandstone eight by nine inches spanning the three feet between the columns.

The pendulum has for its bob a cylinder of cast-iron weighing 115 pounds. Three steel hooks intended for suspension are let through it and secured by nuts on the under side. On its circumference, and at distances of 90 degrees, four contact plates are secured on hard-rubber plates. Opposite plates are joined by a wire, and the latter run up to the recording device in the observatory. We have, therefore, two pairs of plates, each with one wire for a return to the battery, and these we will designate as the N.—S. and E.—W. pairs.

The suspension is effected by three brass rods, two chucks and a piece of brass wire. The three brass rods have steel screw-eyes at both ends. The lower ones hook into the three hooks attached to the pendulum bob; at the top they are gathered and hooked to a bell-shaped brass casting, the upper part of which ends in a steel chuck. This chuck receives the brass suspension wire, six inches in length and 0.058 inch thick (about No. 15 B. & S.). The upper end of the wire is grasped by the second chuck, which forms the continuation of a steel rod let down through the stone cap and secured by means of a large cast-iron disk for a washer, and a levered nut, the latter doing service in raising, lowering and adjusting the pendulum bob.

The Carbon Contacts.—At a distance of two inches below the suspended bob lies a cast-steel cross of four equal arms. This cross is laid in cement, and bolted down to the top of the pier in such a position that the four arms point N., S., E. and W. To each arm, projecting three inches beyond the circumference of the bob, is fastened a brass post three inches high. The heads of these posts have horizontal threaded holes, through which a brass shell may be screwed and sent forward toward the contact plate opposite to it. These shells hold pointed cylinders of carbon and are in electric contact with them. The posts, however, are insulated from the cross. Each carbon with its shell and post has a wire, and these four wires, together with the two leading from the N.—S. and E.—W. pairs of plates on the bob form a cable running to the observatory above.

The adjustment is made in the following manner: The pendulum having been swung round until the N., S., E. and W. plates are in opposition to the N., S., E. and W. carbons, the shells of the latter are now screwed forward until a telephone placed in the circuit announces that contact has been made. Each carbon and plate should make a slight but continuous contact. When this is the case the pendulum is no longer able to swing freely, and the pens of the recorder (unless there is a seismic disturbance) will follow a straight neutral line. This will be better understood after reading the description of the recorder, which follows.

The recorder is made up of the following principal parts: A delicate balance, a pair of magnets, a pair of coils and a pen; all this in duplicate for the N.—S. and E.—W. co-ordinates. Besides this, a revolving cylinder with a driving clock to feed the paper and two devices for marking time. These various parts are assembled as follows: Two magnets are suspended by means of light chains and knife-edges from the ends of the scale-beam in such manner that one-third of their length projects into the coils placed below them. The two magnets (with like poles down) are of equal strength and the two coils of the same winding, both as regards the number of turns and the direction of winding; hence, a current sent through both when connected in one circuit will have no effect on the scale-beam, since the pull on the magnets is equal on both sides. We have, therefore, two scales each with two magnets and their respective coils, and we will call them the N.—S. scale and the E.—W. scale; the N., S., E. and W. magnets on the N., S., E. and W. coils. If we now connect the wires from the N., S., E. and W. carbons with one end of the N., S., E. and W. coils, respectively, and the free ends of these coils, i. e., of N. and S., to the wire from the N. and S. plate on the bob, etc., and include one or two gravity cells in the circuits, the whole system will be alive to the slightest vibration affecting the carbons on the cross. These, of course, get their motion from the earth, while the pendulum bob is inert, and causes a pressure at this point of the line. A tap of the finger on the pier or column in a N. to S. direction will increase the pressure of the N. carbon on the N. plate; more current will flow over the N. wire to the N. coil, which will draw its magnet down and thus tilt the scale-beam. In the same manner, pressure on the other plates will affect the corresponding magnets and scale-beams of the recorder.

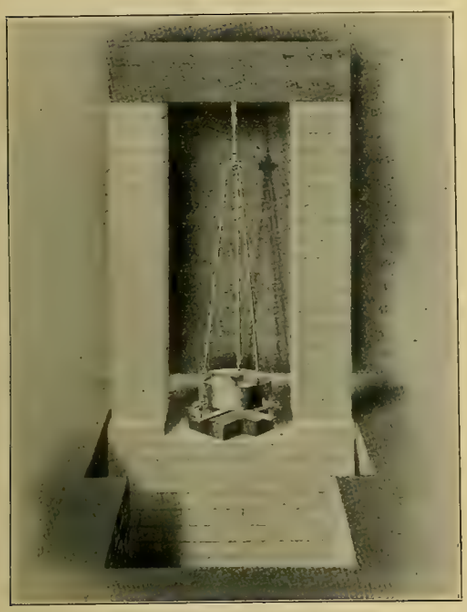
We may here call attention to the fact that any increase of current through one coil of a given pair means a decrease in the other member; because they have their return wire in common.

The pens are made to partake in the motion of the scale-beams. To achieve this the index rods on the scale-beams were removed and replaced by others of aluminum. At the end of these an aluminum arm is run out at right angles toward the recording cylinder, which is placed between the two scales. At the end of each aluminum arm is a miniature scale-beam, from the outer end of which the finely pointed glass fountain pen is suspended, while the inner end carries an adjustable counterweight to reduce the friction of the pen on the record sheet. The pens, however, are not left to dangle freely from the pen arms, but are let through a very thin sheet of phosphor-bronze attached to the rectangular projection, which acts as a spring, taking off most of the weight of the pen, and at the same time prevents any wabbling motion independent of the scale-beam.

The record is produced on paper fed along by

1. From the eleventh annual report (1906) of the Meteorological Observatory of St. Ignatius College, Cleveland. Rev. Frederick L. Odenbach, S. J., is director of the observatory.

the cylinder attached to a driving clock. The paper is four inches wide and passes under the pens at the rate of 0.60 inch per minute. Both pens register on the same paper, the one to the right, the other to the left. Between these two the time line is drawn by a third pen under the control of an electromagnet and a good clock, making contact for every minute, while an extra circuit ad-



PENDULUM OF ELECTRIC MICROSEISMOGRAPH.

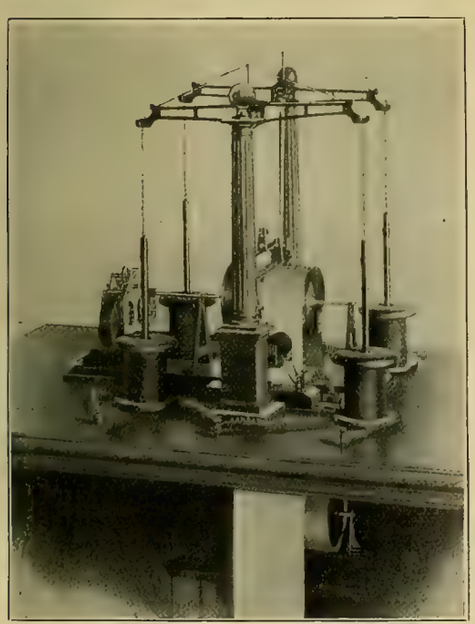
mits the Western Union Signal at the beginning of every hour.

Some peculiar features of this seismograph are very interesting and deserve special notice.

The pendulum acquires no proper motion of its own, as is the case with the instruments commonly in use at the present time. It will therefore record a local seismic disturbance just as easily and accurately as one coming from a distance, though it be a violent one.

Though the record allows of no direct conclusions regarding the amount of motion, it more than makes up for this by its delicacy, which is equal to that of the telephone and microphone.

The recording device may be separated from the pendulum and distance will make no material difference in the record. From this it follows that the record sheet may be inspected at any time, that there is no damp air to interfere with the paper, that the seismogram may be sent by one pendulum to different recorders in diverse localities



RECORDER OF ELECTRIC MICROSEISMOGRAPH

and to any distance; and finally, that the pendulum may be placed in a position most favorable, though very difficult of access, as in the depth of some cave or in some mine far from the disturbing influences of accidental surface motion.

The record being directly in ink on paper, there is no smoked paper to be handled or fixed, or costly films to be developed.

The multiplication of the record is easily accomplished if black ink is used. It will then only be necessary to oil the paper and use it as a negative over blue print, velox or one of the many other commercial copying papers.

The size and detail of the record may be increased at will by means of the battery and resistance.

The vertical co-ordinate might be obtained from the same pendulum by means of carbon contacts placed above and below the pendulum bob, though it would be necessary in this case to increase the weight of the bob so that there would be little chance for the vertical contacts to interfere with the horizontal shocks.

In conclusion we may remark that with sufficient means at hand many improvements might be made which would place the usefulness of this seismograph beyond all doubt and make it, if not the most delicate of its kind, at least such as has many valuable points claimed by no other device serving the same purpose.

Transformers.

[From the Question Box of the National Electric Light Association.]

QUESTION.

What is the largest transformer used on poles? Give details of method of hanging.

ANSWERS.

F. C. S., Malden Electric Company, Malden, Mass.: Two 40-kilowatt. We mount transformers of this size in pairs by bolting two pieces of four-inch by six-inch hard pine; one piece to each side of the pole. These pieces should be of a length to extend the proper distance each side of the pole so as to make a platform on which to set a transformer on each side of the pole, the back of each transformer being against the pole. These pieces are braced from the bottom with heavy iron braces. We have several installations of this kind and find same very satisfactory. The accompanying cut shows two 50-kilowatt transformers mounted in this way.

N. B. Neth, superintendent of Connecticut Rail road and Lighting Company, Waterbury, Conn.: We have some 50-kilowatt transformers installed here. We received them from the General Electric Company with their regular hangers, and we hang them the same as we do any transformer, using these hanging irons. We used a Georgia pine cross-arm four inches thick and eight inches wide. These were secured to the pole with two ordinary standard five-eighth-inch pole bolts, and we find this will carry the weight of two of this size transformers very well, and has thus far shown no sign of weakness.

Dan Boyle, Chicago Edison Company, Chicago, Ill.: The largest capacity transformers I have had occasion to use on poles were 50-kilowatt, supported by two pieces of three-inch by eight-inch oak plank bolted to both sides of poles with four angle-iron braces to support the end of each of the two planks. Also placed 32-inch flooring on the above support for transformers to rest on.

QUESTION.

What type of transformer—air-cooled, oil-cooled and water-cooled—has experience shown to be the most satisfactory for high-tension work, i. e., for voltages exceeding 25,000?

ANSWERS.

J. L. Moore, Camden, N. J.: We have no trouble with self oil-cooled 11,000-volt transformers. We have less trouble with our high-tension lines of this voltage than with any other link between the boiler and the lamp.

F. D. Sampson, Charlotte, N. C.: Oil and water-cooled transformers are generally used with such potentials. A modern transformer maker would hardly advocate air-cooled transformers for 25,000 volts with guarantees that would be attractive to the purchaser.

H. A. Strauss, Allis-Chalmers Company, Milwaukee, Wis.: For 25,000 volts and over, transformers are generally water-cooled and oil-filled. They are rarely water-cooled below 25,000 volts, because air-cooled transformers have the advantage of being nearly fireproof. Burnouts with air-cooled transformers are very rare, because a low temperature can be maintained at all overloads by varying the air blast.

As to simple oil-insulated transformers—these can be used only in units up to about 1,000-kilowatt. Above this size it becomes absolutely necessary to cool by air or water, as the external surface of transformers larger than 1,000-kilowatt is insufficient to radiate the internal losses.

QUESTION.

What is considered good practice in changing oil in pole-line transformers?

ANSWERS.

The Colorado Springs Electric Company, Colorado Springs, Colo.: This year we started to replenish and renew oil in transformers, but found after investigation that the oil did not need changing, so abandoned the scheme. However, whenever a transformer is returned we remove old oil and put in new oil when transformer is taken out again.

R. N. Kimball, Kenosha, Wis.: Oil should be inspected at least every two years. Drawing some from bottom of each transformer will tell the condition of same.

QUESTION.

Has anyone experimented with any system of lightning arresters or spark-gaps across transformer terminals that will prevent or reduce the burning out of transformer primary fuses during lightning storms?

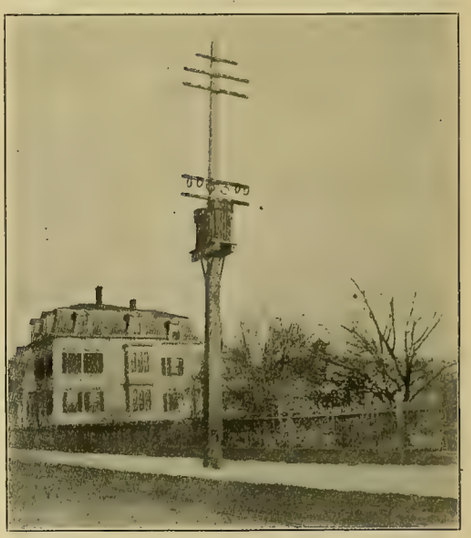
ANSWERS.

F. C. S., Malden Electric Company, Malden, Mass.: We had several transformers with spark-gap across terminals during the summer of 1905. These transformers caused more interruption to our service during lightning storms than we had previously had without them, and as only about two per cent. of our total number of transformers were equipped with these, and as we did not lose any transformers that were not equipped with them, the writer hardly sees that there is any advantage in installing spark-gaps.

M. O. Troy, General Electric Company, Schenectady, N. Y.: Well-designed primary and secondary lightning arresters will assist very materially in reducing the blowing of fuses installed on the primaries of the transformers protected.

A Pit's Mouth Electric Plant in Nova Scotia.

An important development in connection with power production in Canada is being made by the Maritime Coal, Railway and Power Company, which owns extensive coal-mining properties near Amherst, N. S. It is proposed to utilize the vast quantities of coal screenings and other refuse at the pit's mouth, which now usually go to waste,



TWO 50 KILOWATTT TRANSFORMERS MOUNTED ON POLE.

in the production of electric power. A beginning is being made with a comparatively small electrical installation, sufficient for the supply of Amherst and other towns and villages in the vicinity of the mines. The cost will be about $200,000. Should the enterprise prove successful, as is anticipated, the plant will be greatly enlarged and its area of operations extended in all directions and to a great distance. The experiment is attracting a good deal of interest in financial and industrial circles, as it is the first time a concentrated effort has been made to utilize this coal waste in Canada. An enterprise of the kind on one of the English coal fields is now successfully operated on a large scale. The company has already started work on its power house and transmission line at the Chignecto mines, where the power house is situated at the mouth of the pit. The plant is expected to be in operation before the first of January next. David Mitchell of Chignecto, Nova Scotia, is the general manager.

Electric Water Heating for Biltmore House.

Electricity is quite extensively used at Biltmore House, the country place of George W. Vanderbilt, near Asheville, N. C. Just at present it is reported that an electric water-heating device is to be installed, by which it is proposed to heat the large supply of water used at the house. The power will be derived from the power plant of the W. P. Weaver Power Company on the French Broad River, 10 miles away.

The house is equipped with a tank holding 8,000 gallons, which must be heated daily to furnish hot water for the laundry, kitchen, bathing room and swimming pool. The equipment for the work is being installed under the supervision of C. E. Waddel, the electrical engineer of the Biltmore estate. It is understood that the electricity will be applied directly to the tank, the heating units being submerged in the water.

WESTERN ELECTRICIAN

EVERY SATURDAY.

PUBLICATION OFFICES:

507 Marquette Building, - CHICAGO.

TELEPHONE, MAIN 1746.

Eastern Office, 150 Nassau Street, New York.

Telephone, 5220 Beekman.

Trade Supplied by Western News Co.

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DATES AHEAD.

International Association of Municipal Electricians (annual convention), New Haven, Conn., August 15th to 17th.

Ohio Electric Light Association (annual convention), Put-in-Bay, Ohio, August 21st and 23d.

Colorado Electric Light, Power and Railway Association (annual convention), Denver, September 18th to 20th.

Illinois State Electric Association (annual convention), Springfield, Ill., September 19th and 20th.

American Street and Interurban Railway Association (annual convention), Columbus, O., October 15th to 20th.

BY VOLUNTARILY reducing their rates to the schedule proposed in the recent ordinance passed by the City Council and vetoed by Mayor Dunne the Chicago Edison and Commonwealth Electric companies did not only a praiseworthy but a very clever thing. The companies have demonstrated their determination to do the fair thing, ordinance or no ordinance, and they can now await with composure the next step to be taken by the City Council, if any, knowing that they have voluntarily given to consumers the prices that the City Council has itself agreed to be reasonable. By pursuing this enlightened policy the electric-light companies strengthen themselves with the public and will probably actually increase their business also, owing to greater volume, even at reduced rates. At least we hope so. The private electric-lighting interests of Chicago are managed very fairly and intelligently. They manage to retain the confidence of the public and make money too. It is very curious that in the street-railway field of the same city a directly opposite state of affairs exists—at least as to public confidence.

SEATTLE is one of the latest of American cities to realize that a municipal-ownership programme has a depressing effect on the market for its securities. Recently bids were opened for the sale of the $600,000 lighting bond issue and the $500,000 park bond issue, and it was discovered that not for many years had there been so few bids, and these, with one exception, so disadvantageous. The only reasonable bid received was from the state, financial men exhibiting a disposition to offer less liberal terms than heretofore. Through the land commissioner the state offered to take the lighting bonds at a rate netting 3¾ per cent. The state cannot take the park bonds, so no mention was made regarding them. The state will probably get the lighting bonds, and the sale of the park bonds will be called off until after the coming municipal-ownership election. Heretofore Seattle has sold its securities at a good premium and a low rate of interest. The result of these bids, therefore, has proved not only a disappointment but a distinct shock to those who endeavored all along to believe that the municipal-ownership craze has not injured the city's credit in the eyes of financiers.

INTERCHANGE of passenger business between steam railroads and electric railways is a subject that has for some time formed a theme of discussion for railroad managers, the electric men naturally favoring the arrangement on any fair basis of adjustment. The topic came up at the recent meeting of the Central Passenger Association of steam-railroad men in Chicago, and it is reported that the proposition to arrange for an interchange of business with the electric lines in representative territory was considered favorably. While some of the officials are opposed to the plan, others are determined to overcome the opposition to such recognition. If the proposed action is taken, it will be, it is said, the first formal and official recognition that the steam roads have given their electric competitors.

The proposition to interchange business is one of long standing, and will mean a great deal to residents along the numerous electric lines, as well as to the traveling public that wishes to reach points on the electric lines. Where the arrangement has been effected in individual cases in Indiana, it has proved attractive to the public, and has caused little trouble, it is said, for the railroads. The greatest objection raised by those opposed to the interchange of business is that the low fares charged by the electric lines will result in a rate reduction, and that the plan will give certain roads entry into territory now controlled by other lines. However, traffic officials admit that the time is not far distant when an interchange of business is bound to come; but they doubt if the steam roads are yet ready for the change.

WITH the growth of telephone service in cities the telephone directories have become bulky, closely printed volumes, almost rivaling the general city directories themselves in size. The Chicago Telephone Directory, for instance, contains 692 pages of small type, three columns to a page. In the directory proper there are 450 pages, and the list classified by business occupations, printed on tinted paper to distinguish it readily, takes 242 pages more. The number of names given in the telephone directory is about 135,000, and contains practically all the business establishments in the city of any size, all public institutions, theaters, hotels, hospitals, etc., and a large proportion of the householders. Besides, there are hundreds of names of suburban subscribers in towns for miles around Chicago, a feature valuable alike to the suburban and the city residents. The lists are well arranged, clearly and accurately printed, and practically free from errors.

So large and comprehensive have the telephone directories become and so generally is their accuracy recognized that they are often used purely as books of reference, without relation to the telephone numbers, in place of the city directories. A man wants to find an address and steps into the nearest store. "May I see your directory, please?" he asks. The answer is, very likely: "We have no city directory. Will the telephone directory do?" If the inquirer is looking for a business address, the telephone directory will not only do as well, but better, for it is more conveniently arranged. Thus the telephone company furnishes an incidental directory service of not a little value but for which it gets no credit. But there is no doubt that a substantial part of the service rendered by the company to each subscriber is represented by the big telephone book, which, at an expenditure of care and money not often appreciated, is frequently revised and delivered to telephone customers literally by the drayload.

RECENTLY, in deploring the number of street-railway accidents in Chicago, the Western Electrician said that a grave responsibility rests on the companies. But, as was then pointed out, the street-railway people declare that nearly all accidents are due to the carelessness of the victims; and it is of course true that a very large proportion of these distressingly frequent accidents result from the imprudence or folly of passengers or people using the streets. Exactly how large this proportion is cannot be known, for almost always there is a dispute as to the cause of the accident, while in many cases both the company and the injured person are to be blamed. However, it is well to bear in mind that there are two sides to the story. That of the companies is set forth in rather an effective way in a letter signed "Conductor Fitzgerald" and published in one of the daily papers. Here is a part of this communication:

"Dr. Doty of Mayor Dunne's office tells of 21 fatalities in 50 days, and these figures are looked upon with astonishment and surprise. But if Dr. Doty or anybody else operated a street car 10 hours on Saturday night or Sunday and saw the number of drunken and foolish people who are out, he would be surprised that there are not 21 fatalities in one day instead of in 50 days. About one passenger in 10 at these times is either drunk, foolish or ignorant and not at all in a condition to take care of himself. People are constantly trying to catch cars after the cars have begun to move, and if the car does not stop just where they want it to, they jump off before it stops, generally facing backward. Or a teamster will drive out of a dark alley directly in front of a moving car and then be surprised if he gets hurt. Thousands of other mistakes are made by the traveling public, and I do not think that it is fair to hold any transportation company responsible for the resulting accidents. Ninety-nine accidents out of every 100 are not the fault of the company or of its employes."

The writer of the above underestimates the companies' responsibility; and it is not to be forgotten that train crews should exercise a double vigilance in relation to the weak, the timid and the ignorant, although it must be admitted that the duty is often a trying one. But perhaps if the street-railway companies of Chicago set a higher standard of carefulness, politeness and attention their example would be followed by an increasingly large proportion of the diversified aggregation of men, women and children that patronize the street cars. It is doubtful, however, if this standard will be greatly improved while the present unfortunate traction tangle exists.

Visiting Electrical Engineers in Great Britain.

[From a special correspondent of the Western Electrician.]

Glasgow, July 3.—After leaving Manchester, the party of visiting electrical engineers in England proceeded to Liverpool, where June 30th was spent. Here the Lister Drive power station and the Dingle station of the Liverpool Overhead railway were inspected. Other power houses were visited, and there was a reception by the lord mayor of Liverpool. In the evening the party returned to Manchester and slept there. Sunday, July 1st, was spent in the Lake Region of England, the travelers arriving in Glasgow at night.

The stay in Glasgow was one of the memorable features of the tour. The party numbered over 200, and was shown many attentions.

Leaving their headquarters, the Central Station Hotel, at half-past nine o'clock, the visitors were conveyed to the Pinkston and Port Dundas electricity stations of the corporation, where an interesting forenoon, Monday morning, July 2d, was spent. They were accompanied, among others, by the celebrated Mr. James Dalrymple, general manager of the Tramways Committee, well known in Chicago, owing to his advisory visit at Mayor Dunne's request. Then there was a luncheon, and in the afternoon a large number of engineering works were inspected. In the evening Lord Kelvin, chancellor of the University of Glasgow, held a reception in the large hall of the college, and in the course of the proceedings his lordship was the recipient of a presentation from the Italian section of the party. It consisted of two volumes of old drawings of mathematical and mechanical subjects by Leonardo da Vinci, and an address from the University of Palermo. The books were very elegant folios, especially bound in parchment.

At the luncheon, which was given in the banqueting hall of the City Chambers, a company of 460 was entertained. The lord provost presided, and Mr. John Gavey responded to the toast, "The Institution of Electrical Engineers." Among other things, Mr. Gavey said:

"In the early days we derived our electrical energy from primary batteries, and if it were considered desirable to obtain a current of eight or 10 amperes for experimental purposes we had to fit up acid batteries, with which we stained our fingers and burned holes in our clothes, and when the men were at work they emitted poisonous and noxious fumes. They got these eight or 10 amperes of current for five or six hours. Now, in the course of our visit we have seen apparatus and switches which are capable of dealing with 10,000 amperes of current. In the olden days it was the custom of writers to talk of electricity as being equivalent to the nerves of the human system, while steam was the equivalent of the muscles. These writers referred to the fact that even in those early days the movements of railway trains which were driven by steam were actually directed by electrical apparatus. At the present time electricity was not only the nerve, but it had usurped the position of the muscles. We have our electrical tramways and our electric railways driven by what was in those early days considered the nervous force, or the equivalent of the nervous force."

In proposing the next toast of the luncheon, "The Corporation of Glasgow," Lord Kelvin said that in being allowed to propose the toast that stood in his name he felt that he was speaking for a very large and world-wide alliance of good workers—the British Institution of Electrical Engineers and its kindred societies from the rest of the world. Every part of the world was included in that alliance. Signor Semenza and Herr Naglo, as well as other speakers, had pointed to the admirable beneficence of electricity as a peacemaker for the whole world, north and south and east and west. Think of the tremendous progress there had been since the commencement of the Institution in England from 10 amperes to 10,000 amperes, from 100 volts to 20,000 volts.

Lord Kelvin said that in practical working, the progress had been astounding, and now, literally without wires, almost without appliances—without appliances more than the eloquence, as it were—wireless telegraphy spoke out at once as to the whole world. [Hear, hear.] We had now got wireless telegraphy half-way across the Atlantic, and in prospect even further. It was literally making of the whole world one assemblage such as the present, where a person spoke and his voice was heard and 500 heard it. Under wireless telegraphy one person spoke, and within a radius of 2,000 miles all round he might be heard simultaneously. That was a wonder which the founders of the Institution of Electrical Engineers would have thought impossible. He believed that if Sir William Siemens himself had been asked, "Do you think it is possible?" he would have said to the scientific workers in electricity, "No; it is impossible. It is a wild and fanciful dream." But they knew that wild and fanciful dreams were realized by electricity. [Applause.]

There was another dream sometimes thought to be wild and fanciful, and that was universal peace, universal alliance between the nations all over the world. They had heard of our alliance with France, Italy and Germany, and the rest of the world. [Hear, hear.] They had heard that the Institution of Electrical Engineers, by this visit with which it had been favored of fellow-workers from all parts of the world, had tended to make true friends of Great Britain, and Herr Naglo had told them that friendships were strengthened and perpetuated by such evidences as that. When Mr. Semenza told them, on behalf of his comrades from all parts of the world, that they were the true friends of Great Britain, they might respond that Great Britain now looked upon as true friends and allies Germany and Italy and France, and all the rest of the world. [Applause.]

Electricity was the material means by which these abiding friendships would be instituted and perpetuated, and with electricity to help Christianity they might hope that in this world the times of war would cease and there would be universal peace and friendship. He did not think that was chimerical at all. They would see it yet. Many present, he hoped, would live to see it. [Applause.]

The British Institution of Electrical Engineers had some analogy with the city and the Corporation of Glasgow. Glasgow had had many hundred years to come to its present proud position. A mediæval cathedral city a thousand years ago, it was now, he did not say the greatest city for manufactures and electrical work and engineering and shipbuilding, but it was among the greatest regions of engineering work in the world. [Applause.] He could almost remember the time when one could wade across the Clyde at the place where recently the largest ship that was ever built and the largest ship now afloat, the Lusitania, was launched. [Applause.] The Corporation of Glasgow had been one of the most successful employers of electricity in the world. He did not know that there was any place that could show better electrical results than had been achieved within the last 15 years by the Corporation of Glasgow. He therefore ventured in one small voice to express the feeling of all when he asked them to thank the lord provost and the Corporation of Glasgow and to wish them good health and perpetuity of their works. [Applause.]

The lord provost, in responding, said that no community in the kingdom had derived more direct benefit from the invention and application of steam power than had Glasgow and the West of Scotland, and it was due to the University of Glasgow that James Watt was able, as a citizen of Glasgow, to perfect his invention in connection with steam power. [Applause.] They knew what steam power had done for them, and it was a remarkable coincidence that now, nearly 100 years after James Watt's day, they had with them Lord Kelvin as chancellor of the University of Glasgow. His name had been closely identified with progress in connection with the development of electricity. The Corporation of Glasgow had been deeply indebted to the beneficent help of electricity as applied to municipal enterprise. In referring to some of the improvements in municipal service which had resulted from the application of electricity, his lordship said that by the telephone service instituted by the corporation, if they had not achieved conspicuous success, they had at least endeavored by strenuous opposition to improve the telephone service of the community. [Applause.]

On the following day, July 3d, the Babcock & Wilcox Company tendered a special excursion on the Clyde, on the turbine steamer Queen Alexandra. The party was taken 125 miles in six hours amid the beautiful scenery of the West of Scotland. There was an elaborate luncheon and fine music. The day was propitious, and all enjoyed a most delightful outing.

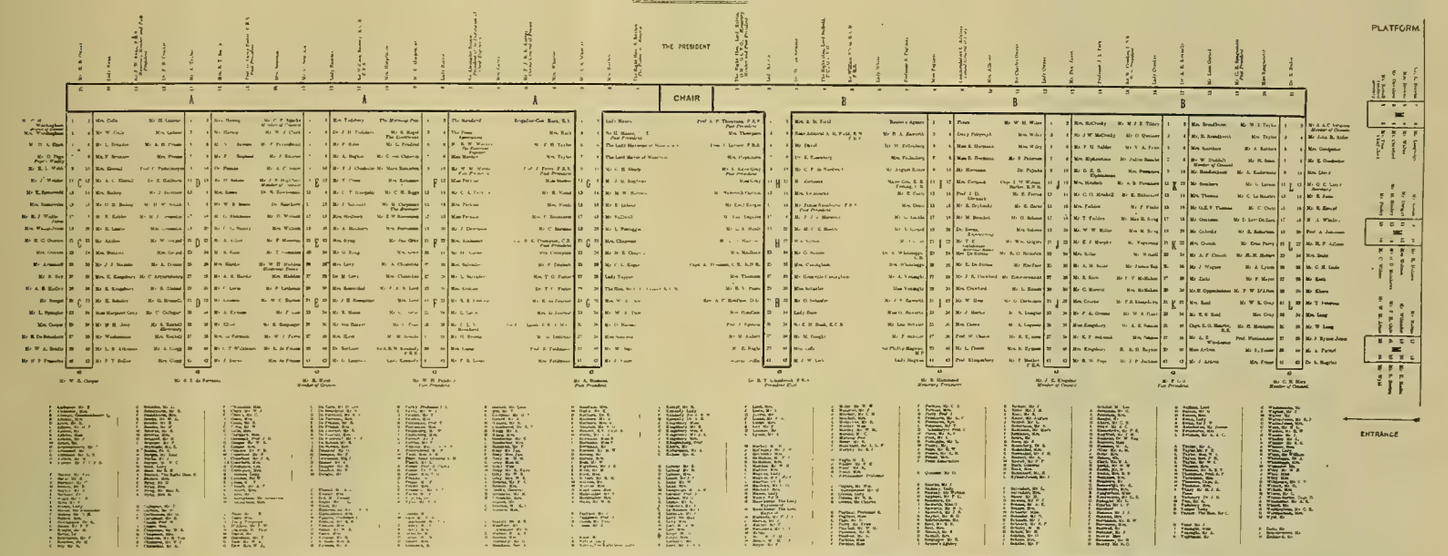
THE INSTITUTION OF ELECTRICAL ENGINEERS.

BANQUET IN HONOUR OF THE VISIT OF KINDRED INSTITUTIONS FROM ABROAD.

MONDAY, JUNE 25th, 1906,

AT THE HOTEL CECIL, STRAND

Mr JOHN GAVEY, C.B., President, in the Chair



ARRANGEMENT OF TABLES AT GRAND BANQUET OF JUNE 25TH IN HONOR OF VISITING ELECTRICAL ENGINEERS IN LONDON.

The grand starting-off banquet at the Hotel Cecil, London, on June 25th, was referred to in the Western Electrician of last week. About 500 ladies and gentlemen surrounded the tables. The dinner was given by the Institution of Electrical Engineers in honor of the kindred institutions from abroad. Mr. John Gavey, C. B., president of the Institution, was in the chair, and the arrangement of the tables and assignments to places are shown by the accompanying diagram. At the right of Mr. Gavey, it will be noticed, were placed the postmaster-general and his wife, with Dr. S. S. Wheeler, president of the American Institute of Electrical Engineers, and his wife next, and so on. At President Gavey's left were Lord and Lady Kelvin. Dr. W. von Siemens, Lord Suffield and others. At the head of each branch table sat a well-known, usually official, member of the British Institution. A finding-list of names and tables is given in small type at the bottom. The diagram here reproduced is printed on a sheet 33 by 15½ inches and is an interesting souvenir of a brilliant electrical gathering.

THE SMALL CENTRAL STATION.

Practical Hints on Its Construction and Operation.

CHAPTER IV.

Boilers and Settings.

Type of Boilers.—No one type of boiler is better than every other type for every set of conditions. Each type has its favorable conditions for the efficient production of steam. And the matter of economy resolves itself more into a question of proportions and conditions rather than one of type. Practice has shown time and again that when boilers have been suitably proportioned and worked under favorable conditions, substantially the same efficiency has been attained by all types.

There are questions which must be borne in mind, however, other than that of efficiency. Of these the readiness with which the boiler will respond to sudden demands for large quantities of steam is of vital importance to the operator of an electric-lighting and power station. Owing to the fact that water-tube boilers carry less water than the shell type, they lend themselves more readily to a fluctuating service and have so gained particular favor in electrical work. They also have a larger passage for gases than the fire-tube affords, and these gases consequently pass over the

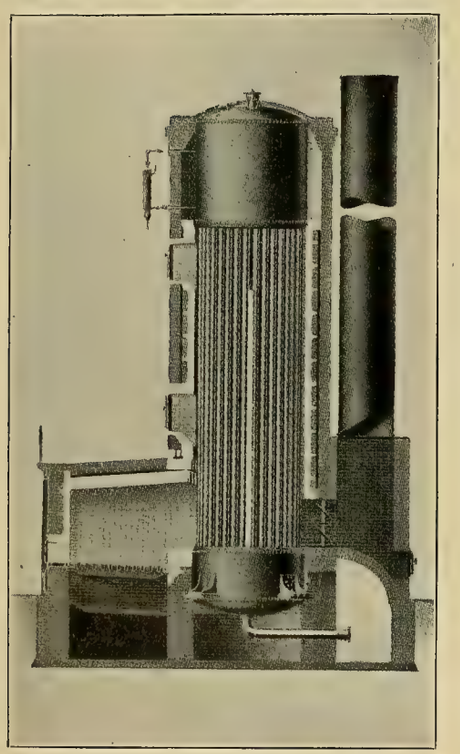


FIG. 1. A WATER-TUBE BOILER.

heating surface with a correspondingly lower velocity and lower temperature upon reaching the chimney. (See Fig. 1.)

In the matter of safety, the water-tube boiler is far superior to the fire-tube type, as the explosion of one is something which rarely occurs, while rather incomplete returns from over the United States show an average of about 300 explosions of shell boilers a year. For high-pressure steam, 150 pounds and above, the use of the water-tube is almost a necessity. The smaller diameter of drum, compared with the shell of the fire-tube boiler, permits of this higher pressure without demanding an excessively heavy plate in construction. In use with waters which are productive of much scale the water-tube has an advantage again in that it is much more feasible to clean the inside of a tube of scale, where access may be had to its end, than the outside, where it much be reached through a network of stay bars and other tubes.

On the other hand, the deposits of soot and dirt upon the outside of the tube are removable by the use of a steam jet, which would fail utterly to touch the water scale.

An outline sketch is shown herewith (Fig. 2) of typical settings of some of the water-tube boilers upon the market today. It is not the intention to present them as the standard or as superior to those of some other makers, but merely as illustrative of this type of boiler. The prospective purchaser will do well to investigate the relative merits of several different makes, and choose from among them that boiler which is best adapted to his peculiar conditions, bearing in mind always the space he has available in which to set them.

Notwithstanding the superior advantages which the water-tube boiler has over the fire-tube, and especially in the service which we are considering, the latter is still used to a very great extent. The percentage of all boilers in use throughout the

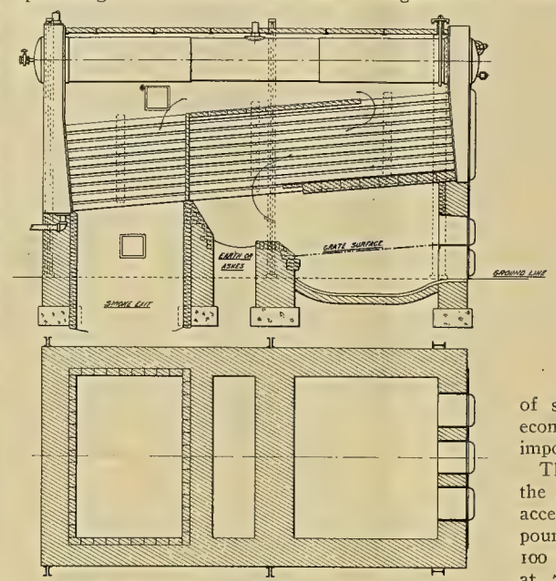


FIG. 2. SETTING FOR HORIZONTAL WATER-TUBE BOILER.

country is by far larger in the case of the horizontal return tubular boiler than with any other one style. This is due to its lower cost largely, but to a certain extent also to the attitude of certain engineers who pride themselves upon belonging to the "old school" and who resent the invasion of a practice with which they are unfamiliar. As stated in a preceding paragraph, however, the efficiency of a boiler depends more upon its proportions than upon the type, and with a proper regard for these proportions, and those of the furnace setting, quite as much steam per pound of coal may be obtained in the use of the fire-tube boiler as in any other.

The outline sketch of such a boiler (Fig. 3) and its setting is shown as being typical of its class. This setting was designed for the use of a particular coal, and the dimensions, particularly those

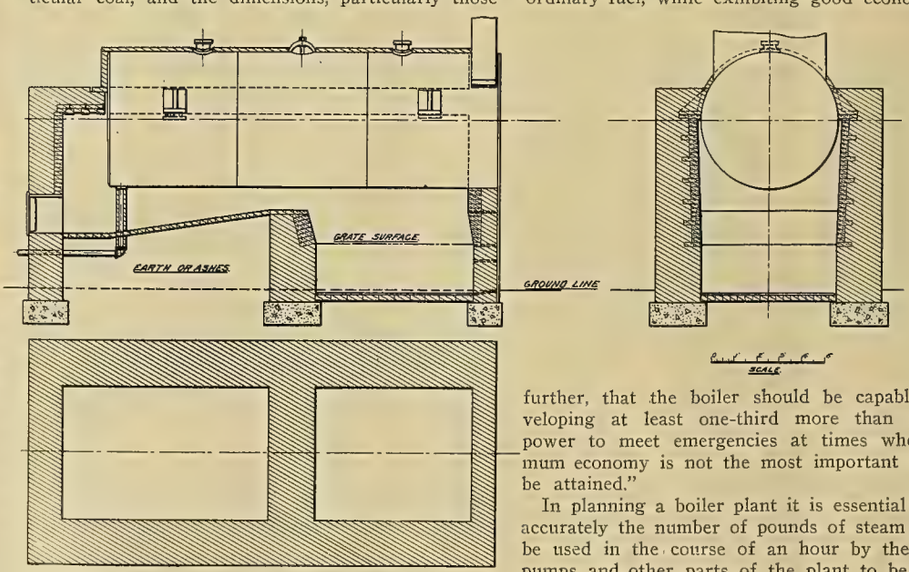
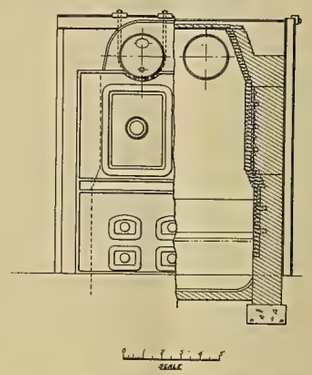


FIG. 3. TYPICAL SETTING FOR HORIZONTAL RETURN TUBULAR BOILER.

of the furnace, might vary largely from those given to meet the needs of a different fuel.

Certain advantages are possessed by internally fired boilers, such as the locomotive, the Galloway or Lancashire, the Scotch, the Manning and others. The chief of these advantages is the elimination of the costly brickwork in setting and the loss in efficiency due to leakage of air into the furnaces. But these boilers are expensive to build, and are little used in land practice. The necessarily limited size of furnace and grate area prohibits their use with bituminous coals, which require a large combustion chamber for the burning of gases before they come in contact with the cooler boiler surfaces. Their field is in consequence so restricted that they will not be alluded to further.

Boiler Proportions.—The same name is used in designating the size of a boiler as is employed in designating that of an engine—that is, the horsepower. But it is a much more elusive quantity here, and care should be taken to note the proportions of the boiler that is said to be of a certain horsepower. For, while the same quantity



of steam may be generated in a given time, the economy with which it is done is a matter of prime importance to the man who pays the bills.

The unit adopted as one boiler horsepower by the American Society of Mechanical Engineers and accepted in all practice is the power to raise 30 pounds of water per hour from a temperature of 100 degrees Fahrenheit to the temperature of steam at 70 pounds pressure and to evaporate it into steam at that pressure. The equivalent of this, and as it is sometimes stated, is the evaporation per hour of 34½ pounds of water at a temperature of 212 degrees into steam at atmospheric pressure and at the same temperature, or "from and at 212 degrees." To know that a boiler will develop so many of these units is not sufficient, without knowing also the amount of heating surface it contains. For one with less heating surface may evaporate the same amount of water as another, but will do it at an increased cost in fuel.

That the committee which recommended the adoption of the above standard appreciated this possibility of variation in the output of a boiler is shown by the statement which accompanied the report as follows: "It is the opinion of this committee that a boiler rated at any stated number of horsepower should be capable of developing that power with easy firing, moderate draft and ordinary fuel, while exhibiting good economy: and, further, that the boiler should be capable of developing at least one-third more than its rated power to meet emergencies at times when maximum economy is not the most important object to be attained."

In planning a boiler plant it is essential to know accurately the number of pounds of steam that will be used in the course of an hour by the engines, pumps and other parts of the plant to be supplied by the boilers. This steam is the amount necessary to run the plant at its normal capacity and best economy. For it the best practice allows one square foot of heating surface for every three pounds of water to be evaporated in an hour's time from and at 212 degrees, or, stating it in another way, there should be 11.5 square feet of heating surface per boiler-horsepower. This proportion permits of working the boiler with good efficiency at an increase of one-third over its normal capacity, providing there is sufficient draft and grate surface to burn the fuel necessary.

Good practice allows one-third of a square foot of grate surface to each horsepower, or about one

square foot to every 100 pounds of water to be evaporated from and at 212 degrees per hour. This matter of grate surface is one, however, which must be determined definitely by the kind of fuel that is to be used. This is arrived at by an investigation of the various kinds of fuel available, their evaporative power and cost. Bearing these two points in mind, the cheapest kind of fuel to use may be known in advance, and the number of pounds which may be burned per hour upon a square foot of grate with the draft at command can be readily ascertained from an investigation of reports of tests made with the fuel.

Conservative practice often assumes as round numbers 10 pounds of coal per square foot of grate for anthracite and 15 pounds per square foot for bituminous. But far more satisfactory results are to be obtained by an investigation of the particular fuel to be used and its requirements. Knowing them and its evaporative power, the grate surface demanded may easily be arrived at. A low grade of fuel, besides being deficient in heating power, may burn at a much slower rate than others, owing to peculiar properties which it may possess, and with its use a much larger grate area will be necessary. A change later to a higher grade of fuel can be effected most economically by bricking off part of the larger grate area provided, for, to obtain best results from such fuel, it will perhaps need to be burned at a higher rate. Too slow combustion results in only a partial burning of the gases, and a loss is consequently entailed. This larger grate area demanded by the lower grade of fuel must be considered, too, with reference to the greater expense of construction and the larger amount of land occupied. If the boiler room is limited, it may be necessary to consider only the burning of the higher grades of coal, however cheap the low-grade fuel may be.

Below are given some figures from actual tests of boilers which show results obtained with various coals under different conditions of firing and differently proportioned boilers. The ratio of heating surface to grate surface, the number of pounds of coal burned per square foot of grate surface, the number of pounds of water evaporated per square foot of heating surface and the water per pound of coal are given.

TESTS OF VARIOUS COALS UNDER STEAM BOILERS.

Coal.	Ratio of H. S. to G. S.	Coal per Sq. Ft. of G. S. Lbs.	Water per Sq. Ft. of H. S. Lbs.	Water per Lb. of Coal. Lbs.
Highland, Ind	24.5	11.3	2.1	5.2
Highland, Ind	24.5	15.8	3.1	5.2
Bethalto, Ill	26.5	26.6	5.6	6.0
Bethalto, Ill	26.5	16.4	3.4	6.0
Belleville, Ill	32.4	24.1	4.6	6.7
Pittsburg, No. 2, Pa	21.3	16.5	4.8	8.3
Pittsburg, No. 2, Pa	33.7	18.4	3.6	7.8
Pittsburg, No. 2, Pa	34.0	13.4	2.8	7.1
Pittsburg, No. 2, Pa	36.8	14.3	3.1	8.4
Pittsburg, No. 2, Pa	60.3	27.4	4.0	9.5
Lackawanna, Pa	35.0	15.1	3.6	8.5
Youghiogheny, Pa	45.5	23.5	5.1	9.9
Youghiogheny, Pa	48.0	17.2	3.1	8.7
Cumberland, Md	53.7	24.7	4.8	10.3
Hocking Valley, Ohio	45.1	20.3	3.4	7.6
Hocking Valley, Ohio	50.9	26.2	4.2	8.2
Turkey Hill, Ill	45.8	35.0	5.2	6.8
Turkey Hill, Ill	45.0	20.4	3.2	6.0
Gillespie, Ill	42.0	27.7	4.7	6.9
Collinsville, Ill	57.2	35.3	4.4	7.2
Big Muddy, Ill	44.6	20.4	3.3	7.3
Carbon Hill, Wash	59.5	34.7	4.2	7.2
Kanawha, Ky	31.7	17.8	3.5	6.5
Kanawha, Ky	41.3	17.0	3.2	7.7

Boiler Setting.—The extent of the grate area being determined, there is left only the height of the furnace and the size of combustion chamber and other passages to be settled upon. With a fuel that burns with a long flame and much smoke these spaces are necessarily larger than with a close burning coal. Also the length of time required for the perfect combustion of a fuel enters in as a prominent factor. The longer such time, the larger these passages must be. It is desirable that the gases liberated by the combustion of the fuel be consumed before coming into contact with the cooler surfaces of the boiler, for then their temperature is so lowered that combustion ceases, and they pass through the boiler and up the chimney without having given up all their heat units, and with a consequent large volume of smoke. Large passages about and through the boiler are desirable also, that the gases may have ample time to give their heat over to the production of steam and not arrive in the stack at too high a temperature.

The furnace grate bars must be adapted to the kind of fuel also, as a baking and clinkering coal requires large air spaces and fewer of them through the bars, while a dry and friable one calls for narrow spaces and many of them to supply the air necessary to combustion. The total air space should be as large as possible and maintain sufficient strength of metal in the bar.

The surface of the grate must be as even and smooth as possible and the lining of the furnace of the best firebrick obtainable, both to facilitate the use of clinker bar and other tools, and to resist their action and that of the clinkers. A cheaper grade of firebrick may be used in the lining of the combustion chamber and flue or breeching, but this lining should be of firebrick, as the cheaper way of using only common brick back of the bridge wall is poor economy.

The walls should be tied together with stout stay rods, as cracking is inevitable where such fluctuations in temperature are possible. The boiler is constantly expanding or contracting with increase or decrease of temperature, and should be left free to do so without racking the furnace walls. This may be done by leaving the wall clear of the boiler all around and filling in the space left with some flexible or spongy material. Fire clay with waste or tow to hold it together serves the purpose very well.

The ashpit is best cemented, as it is easier to clean, and will serve as a basin for water, which practice has shown to be quite effective for the prevention of clinker in coals which have a tendency that way.

[*To be continued.*]

New British National Electrical Laboratories Opened.

[From the London correspondent of the Western Electrician.]

London, July 3.—By very easy stages we are arriving at a national physical laboratory worthy of our British name. This fact has once again been borne home to us by the opening of the new electrical laboratories of the National Physical Laboratory at Teddington. Although the government has made certain grants in aid of these new buildings, it seems a somewhat undignified condition of things that the equipment and many other portions have been due to private munificence; and the donors cannot be too highly praised.

In fact, one cannot but sympathize with the position of Dr. R. T. Glazebrook, the director, whose heart is so much in the work of the laboratory, that he is bound to keep asking for further funds, which, as the government grant is so small, are eventually forthcoming at the hands of private individuals. Thus at the close of the opening ceremony above referred to Sir John Brunner made a donation of £5,000. The new buildings are planned for electrotechnical experiments, including photometric work. At the opening, however, none of the equipment was in its place. G.

Another Waterpower Plant for Colorado.

It is reported that the Electric and Hydraulic Company of Glenwood Springs, Colo., has recently purchased the property of the Colorado Power and Irrigation Company of Shoshone Falls, nine miles above Glenwood, where it will soon erect a power plant which will supply electric light and power to many cities all over the state, and furnish water for many hundred acres of now arid land. J. R. DeReamer of Glenwood Springs is one of the principals in the deal, and it is said to be assured that the first installation of 16,000 horsepower will be completed and ready to supply power by September 1st.

A tunnel, 10 by 16 feet, will be driven for 9,800 feet. After the installation of the first plant, work will be prosecuted with the same energy to the installation of the final and main power plant at Glenwood Springs, at which time all the equipment of plant No. 1 will be transferred to the main power house. To complete the power system now outlined for the Grand River above Glenwood Springs, with its network of transmission lines to various cities and towns in the state, over $11,000,000 will be expended, it is said.

Merger of Railway and Light Companies in the South.

The America Cities Railway and Light Company, organized recently and incorporated in New Jersey, has merged six large railway and lighting properties. It is the intention to increase the capital to $27,000,000, of which $10,000,000 preferred and $15,000,000 common shares are to be exchanged for stock of the following companies interested: Birmingham Railway, Light and Power Company; Memphis Street Railway; Nashville Railway and Light Company; Little Rock Railway and Electric Company; Knoxville Railway and Light Company, and Houston Lighting and Power Company. J. K. Newman of Isodor Newman & Sons, New York and New Orleans, will be president of the new organization. Gross earnings of the six properties mentioned for this year are estimated at over $6,000,000.

Some Features of the "Steel City" of Gary, Ind.

Since mention was made in the Western Electrician of May 5th of the first work in connection with the building of the new city of Gary, Ind., some interesting features of the plans have been developed. Simultaneously with the building of the town the United States Steel Corporation will build for the Indiana Steel Company probably the largest single steel plant in the world. The site of the new town and plant is on Lake Michigan 10 miles east of Hammond, Ind., and 26 miles southeast of Chicago. The steel corporation has secured about 6,000 acres, approximately 1,280 acres of which, lying north of the Grand Calumet River, will accommodate the steel plant, and on the remainder, lying south of the river, will be built a model town and homes for the workmen and their families.

Both the steel plant and the town will be built to permit indefinite expansion, and construction will be on a unit plan. For the fulfillment of the plans at Gary the steel corporation has set aside $75,000,000. The intention is to embody in the enterprise all that modern science knows of the production of steel and in the building of a perfect American city, to include water, sewers, electric lights, docks, libraries, theaters, parks, playgrounds, etc.

Practically all of the machinery will be electrically driven, and it is interesting to note that blast-furnace gas will be used to the largest extent possible in a central power house on the steel-plant side of the river to generate the electric current needed. Already some contracts have been let for the power equipment.

Nine large Allis-Chalmers gas-engine generator units have been ordered, each with a normal rated capacity of 2,000 kilowatts, to be installed in the central power plant, and to be operated from blast-furnace gas. These engines are standard Allis-Chalmers design, horizontal twin tandem, direct connected to Allis-Chalmers alternators, 25 cycles, three-phase. It is expected that ultimately 15,000 men and boys will be employed in the works and that the population of the town will grow to 100,000. Both the gas engines and the generators will be furnished by the Allis-Chalmers Company, Milwaukee, the gas engines being built at the West Allis (Milwaukee) works and the generators at the company's electrical works at Cincinnati, Ohio. The contract for the Gary engines covers one of the largest single orders ever placed in this country or abroad for gas engines, to be used either in blast furnaces or as prime movers for electric generators.

Most of the lots for residences will be 30 by 125 feet and business lots will be five feet narrower. The alleys are to be 20 to 30 feet wide, because of the fact that all sewers, water and gas pipe, as well as electric-light, telephone and telegraph wires are to be placed in the alleys. The town is being built from the center, and all sewers and water pipes and other service pipes and wires are being installed with a view to expansion. The steel corporation will not own stores, banks or other enterprises, but will insist on the best class of men to conduct these institutions. The desire is to build a city free from the poverty and squalor usually prevalent in iron and steel towns, due to the existence of too many low drinking places.

Boston Illuminating Engineers' Meeting.

At the last meeting of the New England Section of the Illuminating Engineering Society a question box was considered, the questions for discussion having been submitted by the members and printed previously to the meeting. A large number of questions were presented, but only a few could be taken up in the limited time.

President Marks spoke on some particular applications of the semi-concealed methods of lighting, and described in detail the lighting of a church where a very good illumination was obtained at a reasonable cost. Dr. Louis Bell commented on the colors of some of the common forms of illuminants, and also mentioned some of the commercial difficulties in obtaining good illumination. Mr. Cummings of the Boston Consolidated Gas Company spoke on the distribution curves of various lamps and the value of reflectors from a photometric point of view. Mr. Allen of the General Electric Company gave a brief description of some diffusing devices which are being used with good results in store and factory lighting. The subject of concealed lighting in halls, auditoriums, etc., was discussed freely by Messrs. Marks, Gardner, Cummings, Robinson and others. The next meeting of the society will be held in the fall.

The Paxtang Electric Company of Harrisburg, Pa., contemplates enlarging its capacity 50 per cent. A 500-kilowatt generator, new engine and boiler will be installed. The plant was built in 1902.

Water Diversion and Power Development Hearing at Niagara Falls.

On Thursday, July 12th, Secretary of War W. H. Taft held a hearing in Niagara Falls on the questions of the diversion of water from the Niagara River for power purposes and the transmission of electric power from the Dominion of Canada into the United States. The hearing was originally set for Washington, D. C., on July 13th, but as so many interests were likely to be represented, the secretary went to Niagara, as a visit to that power center would naturally aid him in ascertaining the true condition of the power development at the present time. The hearing was held in one of the parlors of the International Hotel, and opened at 10:15 a. m.

Judge David Millar of Lockport was first heard. He represented clients interested in the diversion and use of about 500 cubic feet of water per second from the upper level of the Erie Canal at Lockport, N. Y., one using it after the other. Hon. John A. Merritt, collector of customs at the port of Niagara Falls, also spoke on the use of canal water in Lockport, his home city, and he aided the secretary in getting a clear idea of the situation in Lockport. The secretary expressed the belief that this use of water came within the provisions of the Burton bill.

Herbert P. Bissell of Buffalo appeared for the Niagara Gorge Railroad Company and the Niagara Gorge Power Company, this latter company having, he stated, been organized by the railroad company. This power company contemplates a diversion of water from the lower river below the falls to the extent of 10,700 cubic feet per second, returning it to the lower river again, near the Devil's Hole. The company is not using the water at the present time, and so will come under the clause of the Burton bill providing for permits in the future.

Alfred W. Gray of the law firm of Dudley, Gray & Highland, Niagara Falls, represented the Albion Power Company, which company has a power development at Oak Orchard Creek, Orleans County, using some canal water. Attorney Gray also represented the estate of the late Henry E. Woodford of Niagara Falls, of which the Niagara Falls Trust Company is the executor. This latter is a development of about 100 horsepower at the head of the Whirlpool Rapids on the New York side.

J. M. Hansen of New York appeared for the Niagara County Irrigation and Water Supply Company. This company was organized in 1883, and is known as the Love scheme. Mr. Hansen referred to it as the General Electric Company, stating it was so referred to in Washington. The company's franchise gives it unlimited rights to the use of Niagara water. But Mr. Hansen stated at the hearing that he was ready to file plans for the diversion and utilization of 17,000 cubic feet per second, the plan being to tap the upper Niagara at a point near LaSalle, with a canal that would carry the water to the lower river at a point near the Devil's Hole, north of the city of Niagara Falls, the company's charter providing that its development must be in the town of Lewiston. In Niagara Falls great interest has been aroused in the General Electric interest in this franchise. As the company is not using water at present, it is understood it will come under the permit clause.

Secretary Taft at this point remarked that there was also a public side to the questions under consideration, and he decided to hear those who cared to speak for scenic Niagara. There was but one voice raised on this side of the question, and the speaker was J. Horace MacFarland, president of the American Civic Association, whose home is in Harrisburg, Pa.

In opening his remarks, Mr. MacFarland called attention to the fact that the act of Congress was passed primarily by reason of an insistent demand coming from many millions of American citizens for the preservation of Niagara Falls. None of those interested in power development, he said, has sought national regulation, and there was presented to Congress no demand for legislation to protect Niagara Falls, either as a boundary stream or as a navigable river. An insistent demand was made upon Congress for an entire prohibition of the use of Niagara water for power production. The modified enactment, giving authority to assign a certain percentage of Niagara water for the production of electric power, and to permit the introduction of electric power generated in Canada from Niagara water, was so modified because of the commercial interests of a comparatively few persons. It is probably the first legislation ever enacted in the United States for the protection of a scenic feature of which commercial use is being made. "Those who are deeply interested in the preservation of Niagara Falls have not thought it expedient to suggest for the present any disturbance of existing use of the water," he said.

Mr. MacFarland likened the development of Niagara power to the destruction of the American forests. "It is a lamentable fact," said he, "that a century ago the forests of America were apparently as illimitable to the minds of many as is now the power of Niagara Falls." He asked that careful inquiry be made as to the effect of the diversion of water upon the falls, taking no account of the impressions and observations of those whose whole interest is in the diversion of water. He advocated restricting the diversion of water on the American side to the lowest possible amount "consistent with actual present and preceding use," pointing out that the refusal to admit any large quantities of power from the Canadian side would discourage the diversion of water on that side of the river, as such restriction of importation would automatically work a restriction of Canadian production. He cited the report of Ontario's Hydro-electric Commission as authority for the statement that only from 50,000 to 100,000 horsepower would be used within a reasonable radius of Niagara Falls on the Canadian side, and he said it was evident that the balance of the 415,000 horsepower to be developed in Canada was for transmission to the United States, "more than three and fully seven times the possible use within its own borders of Canadian-made power." Mr. McFarland seemed quite wrought up over the appearances of the power lands about the falls, and he begged the secretary to have them cleaned up. "They have made back yards, slums and filth," he said, "to take the place of scenic glory." To admit Canadian power was simly chasing the devil around the stump. He referred to the annual jaunt of about 800,000 people to the Falls, saying they spent from $16,000,000 to $20,000,000, and more "when the hackmen are particularly vicious." He advised the use of every drop of water, so that none might go to waste. He seemed to think scenic features had been better protected on the Canadian than on the New York side.

Mr. F. Howard Mason, secretary of the Chamber of Commerce of Buffalo, spoke next, making reference to the transmission lines, and to the increase in the nation's wealth by the Niagara power development. To Mr. Mason, the question seemed one of having industries on the American side of the river or advancing the interests of Canada.

Hon. Peter A. Porter was heard in regard to a small development of about 300 horsepower in connection with the Cataract House property, a few hundred feet up from the American Fall. Secretary Taft told Mr. Porter he needn't lay awake nights over his rights.

John L. Romer of Buffalo and John G. Milburn of New York represented the Niagara Falls Hydraulic Power and Manufacturing Company, and asked that that company be permitted to divert 6,400 cubic feet of water per second, which amount would be sufficient for present use and contracts already made. They told that the canal enlargement had cost about $500,000 to date, and that about $400,000 had been expended on a new power house in course of construction. In November, 1905, before Congress met, the company had contracted with the Pittsburg Reduction Company to deliver 36,000 electrical horsepower for the operation of a new aluminum works now being built.

Francis Lynde Stetson of New York and F. L. Lovelace of Niagara Falls appeared for the Niagara Falls Power Company. They asked that the Niagara Falls Power Company be allowed to divert 8,600 cubic feet of water per second, the amount now being diverted, every drop of which, they stated, is being used. They also asked that a permit be granted the company for an additional 8,600 cubic feet for the operation of stations to be connected with a proposed second tunnel. The Burton bill provides for a first diversion of 15,600 cubic feet of water per second, and the combined requests of the Niagara Falls Hydraulic Power and Manufacturing Company and of the Niagara Falls Power Company are for 15,000 cubic feet per second, only 600 cubic feet less than the total. The bill also provides that after this 15,600 cubic feet per second has been in use six months the secretary may issue revocable permits for additional amounts. The bill is interpreted to mean that six months of experiment or experience must have been obtained as to the effect of the diversion on the falls before revocable permits can be granted. It was stated that it would be January, 1907, before the Niagara Falls Hydraulic Power and Manufacturing Company had its full requested allowance in use. Thus, it might be six months after that date before a revocable permit could be granted.

Francis Lynde Stetson expressed the belief that fairness and honesty of purpose should be attributed to the power companies. He stated that the expenditures of his companies at Niagara equaled those of all the others, amounting to $19,000,000, on which investment not a cent of dividends had been returned. He invited Secretary Taft, when visiting the stations of the Niagara Falls Power Company, to look around and see what that company had done to make the surroundings beautiful, they having spent over $1,000,000 in beautifying their surroundings. He told how his company had bought the charter of the Lewiston Water Supply Company and had allowed it to lapse; how they had invested in a charter on the Canadian side for which they paid $25,000 a year for 10 years.

Referring to the rentals paid for power privileges on the Canadian side, Mr. Stetson stated that no rental there paid equaled the interest on the investment to which his company had gone in the construction of a tunnel a mile long, in order that the power houses might be kept back from the falls on the New York side. He told how his company had purchased the lands along the river for two miles and a half, and he wondered if they weren't to be allowed to use the water that was theirs through their riparian rights. He said seven acts had been passed by the New York State Legislature giving them rights before other franchises were allowed, and for this reason they were pioneers. He told how his company had spent $50,000 for the International Niagara Commission. How at that time there was not a waterwheel maker in the United States that would make a wheel of more than 500 horsepower, but how they had gone to Switzerland and had wheels of 5,000 horsepower made for Niagara. He told how his company was first to apply the alternating-current system, and how it was first to transmit electricity in bulk, meaning large quantities.

"Is there anyone," asked Mr. Stetson, "who will not say we are not entitled to the harsh criticism, but to the thanks of the world for the application we have made of electricity? If the falls attract 800,000 visitors annually, go to the power houses and see the book of visitors there. Note the names of the eminent men, Lord Kelvin, the lamented McKinley, the viceroy of China, people from all sections, and you will agree that the power houses attract the enlightened people of the world. No longer do we care to stand as targets for an irresponsible association. Such criticism is not honest criticism."

The question of the transmission of power from the Dominion of Canada to the United States was next taken up. The Burton bill provides for a minimum transmission of 160,000 horsepower and a maximum of 350,000 horsepower.

C. A. DeGersdorff of New York appeared for the Niagara, Lockport and Ontario Power Company, asking that his company be allowed to transmit 90,000 horsepower from the plant of the Ontario Power Company. He said his company had contracted for 60,000 horsepower and could buy 120,000 horsepower additional, or 180,000 horsepower in all. They had contracted to deliver 35,000 horsepower, while contracts for between 50,000 and 60,000 horsepower were pending. They had constructed over 400 miles of transmission lines, issued $500,000 in bonds, of which $300,000 had been sold, and had spent $1,250,000 for land. He stated they could not get a fair return on their investment on less than 90,000 horsepower. He hoped the secretary would designate an officer to investigate and examine all plants. The plant of the Ontario Power Company was described by an officer of that company. Mr. H. H. Macrea told of the development of the Electrical Development Company of Ontario, Limited, saying if they were shut out of the American market it would mean disaster to the whole enterprise.

Hon. Frank A. Dudley of Niagara Falls appeared in the interest of the Niagara Falls Transmission Company. He told of the extensive holdings of this company throughout Western New York, his recital leading Franklin D. Locke of Buffalo, attorney for other interests, to object, expressing disbelief, but Mr. Dudley was able to convince his hearers of the reliability of his statements, and later it was his pleasure to exhibit deeds of property holdings that surprised the competitors of his company. The Niagara, Lockport and Ontario Power Company and the Niagara Falls Transmission Company will cater to pretty much the same field in Western New York, and the hearing developed that there is an apparent keen feeling already existing between the two companies. The Niagara Falls Transmission Company will distribute electric power generated in the station of the Electrical Development Company of Ontario, Limited, on the Canadian side of the river. Mr. Dudley asked permission to transmit 65,000 horsepower.

Francis Lynde Stetson also appeared for the Canadian Niagara Power Company, applying for permission to transmit power over transmission lines to Niagara Falls and Buffalo. The Canadian Niagara Power Company is allied with the Niagara Falls Power Company, and Mr. Stetson explained the cable connections between the great power houses of these two companies.

The International Railway Company's interests at the hearing were looked after by President Pierce and Attorney Frederick Chormann. This company has a franchise which enables it to develop power in Victoria Park, Canadian side. The machinery is installed for a development of 3,500 horsepower, and this is to be increased to 8,000 horsepower. This block of energy is sufficient to run the company's lines in the cities of Niagara Falls on both sides of the river, and the company would like to transmit the necessary amount to operate the lines in Niagara Falls, N. Y.

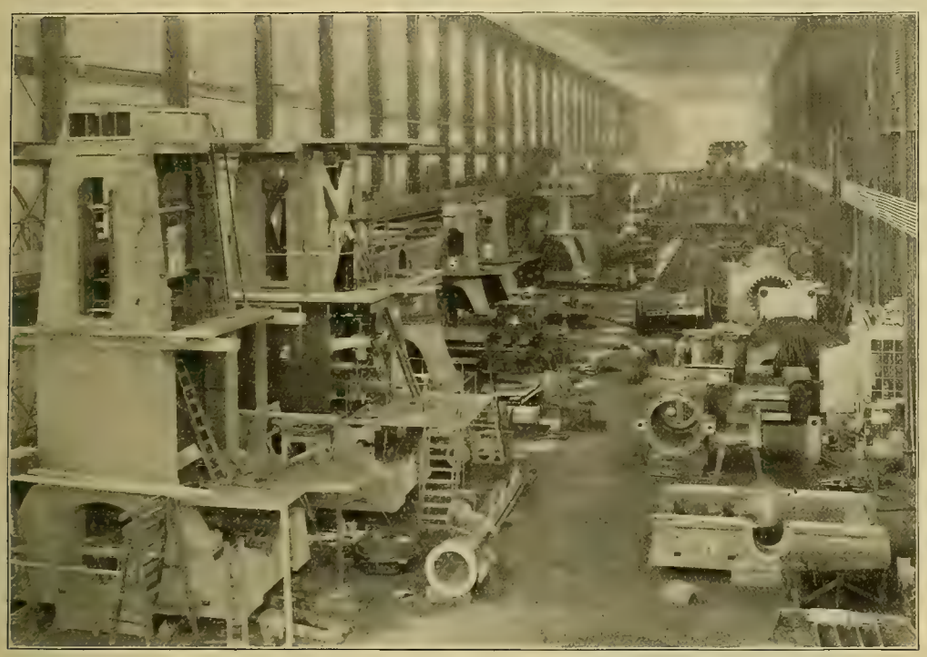
On Thursday afternoon, after the hearing, Secretary Taft paid a personal visit to and made an inspection of all the Niagara power plants on both sides of the river. It was evident that he was greatly impressed by the wonderful works, of which he was shown all features. The secretary may appoint an engineer to verify some things for him; also to report on various matters relating to the power development.

Among those present at the hearing were General

Ernst, Commissioner George Clinton and L. C. Sabin of the International Waterways Commission; General MacKenzie, chief of the board of engineers, Washington, D. C.; Congressman James W. Wadsworth; Francis Lynde Stetson, C. A. De Gersdorff and Hon. John G. Milburn of New York; General F. V. Greene, John L. Romer, Edmund Hayes, F. Howard Mason, George B. Matthews, Jacob F. Schoellkopf, George B. Sawyer, Herbert Bissell, Bert L. Jones, Franklin D. Locke, Henry J. Pierce, W. D. Olmstead, George A. Ricker, George Urban, Buffalo; A. Monro Grier, Fred W. Hill, B. R. Paine, V. G. Converse, R. B. Conquest, Niagara Falls, Ont.; John L. Harper, A. H. Van Cleve, A. C. Douglass, A. W. Gray, F. L. Lovelace, Philip P. Barton, Arthur Schoellkopf, H. W. Buck, Edward H. Perrey, Arthur C. Hastings, John A. Merritt, Hon. Frank A. Dudley, J. A. Montague, Alexander J. Porter and others of Niagara Falls.

A Busy Erecting Shop.

Probably the greatest number of large steam-driven units in process of erection ever assembled under a single roof is shown in the accompanying picture of the erecting shop of the West Allis (Milwaukee) works of the Allis-Chalmers Company. The view is taken from the south end of the building in such a way that the new extension, 589 feet in length, to the present shop may



VIEW IN WEST ALLIS ERECTING SHOP.

be seen beyond the temporary partition which marks the north boundary of the older structure. The entire building is 1,155 feet long, 113 feet wide and 72½ feet high to the roof trusses. The figures shown in the view, and which correspond with the following list, will furnish some idea of the magnitude of most of the engines which are being erected there.

Nos. 1 and 2 are two vertical long crosshead type blowing engines for the Republic Iron and Steel Company, 52 and 96-inch cylinders by 96-inch stroke, with a capacity of 45,000 cubic feet of free air per minute. No. 3 is a vertical steenle cross-compound blowing engine, ordered by the Jones & Laughlin Steel Company.

Steam ends of two horizontal cross-compound vertical-shaft centrifugal pumps for the Lawrence Avenue station of the city of Chicago are shown at No. 4, while No. 5 is a Reynolds vertical cross-compound engine, 34 and 72 inches by 60-inch stroke, for direct connection to a 2,000-kilowatt generator being built for the Memphis Street Railway Company of Memphis, Tenn.

Nos. 6 and 7 are two vertical cross-compound Reynolds-Corliss engines aggregating 2,700 indicated horsepower for the Hecker-Jones-Jewell Milling Company. No. 8 is one of four horizontal non-condensing air compressors for the Buffalo-Susquehanna Coal and Coke Company; capacity, 5,000 cubic feet.

A double drum duplex direct-acting Corliss hoisting engine for the Shattuck (Ariz.) Mining Company, and designed to carry continuously an unbalanced load of 15,000 pounds at a speed of 2,000 feet per minute, is shown at 9. No. 10 is a blowing-engine bed for one of several heavy furnace-blowing engines recently ordered by the Carnegie Steel Company. No. 11 indicates the high-pressure cylinder for one of seven pairs of vertical long cross-head type furnace blowing engines ordered by the Edgar Thomson Steel Works, and No. 12 is a vertical slide for heavy blowing engine being built for the Carnegie Steel Company, Carrie furnaces.

The famous 105-ton single casting, the largest ever poured by the Allis-Chalmers Company, for the frame and slide of a rolling-mill engine, to be installed at the Sharon (Pa.) plant of the Carnegie Steel Company, is indicated by 13. No. 14 is two of the Gillespie pumping engines, with a capacity of 30,000,000 gallons per 24 hours, for the city of Pittsburg filtration plant.

In addition to the heavy units visible in the picture, there are a number of others which are hidden from view, including a triple-expansion vertical pumping engine for the Newport waterworks. The addition to the erecting shop will be in readiness for use within a few weeks' time, as will also the added machine-shop units Nos. 4, 5 and 6, which open into the extended portion of the building.

The Reliance Works of the Allis-Chalmers Company, Milwaukee, presents another scene of unusual activity in the manufacture of hydraulic turbines by an American company. There are at the present time under construction and in various stages nearing completion no less than 43 hydraulic-turbine units, aggregating 166,000 horsepower, for shipment to various portions of the United States, Canada and Mexico. This is significant of a change which has gradually taken place of late with reference to the design and manufacture of hydro-electric machinery.

The marvelous electrical development of the last few years has been accomplished almost entirely by electrical engineers and principally in conjunction with the steam engine as prime mover. That fact has in itself been a serious drawback to the development of proper designs for hydro-electric installations, as it has too often led the electrical engineer to call upon the hydraulic engineer to fulfill requirements which were arbitrarily fixed and not consistent with the highest efficiency obtainable under given conditions. On the other hand, water turbines were formerly built in catalogue sizes, from certain standard designs, and their development often failed to keep pace with that of the generators. Now, in hydraulic power plants of any importance, each piece of apparatus is constructed to suit the particular conditions under which it must operate. This practice insures a superior quality of machinery, reduces the cost of maintenance, and at the same time insures greater regularity in operation; yet it does not wholly solve the problem of efficiency, for, upon being assembled, the various parts, separately designed, may not be found to work in complete harmony.

Manufacturers of turbines only are interested in selling turbines and are not interested in electrical specifications or requirements. Manufacturers of generators only are not interested in the difficulties of the turbine manufacturers. If the plant as a whole fails to produce the desired results, each has an opening to shift responsibility; whereas, if the manufacturers were equally iterested with the consulting engineer and the purchaser in the actual results of the installation as a whole, the results achieved would be easily determined and responsibility fixed. Where the entire installation is designed, manufactured and guaranteed by one manufacturer as a whole, the difficulty of determining results is practically eliminated. There is no further necessity for determining the efficiency of the generator, turbine, exciter and exciter turbine separately, with the necessary allowance for thrust bearing friction, governor drives, etc. The same efficiency will be required, but is readily measured by actual electrical output, and, once determined, there would be no shifting of responsibility in case of failure.

Allis-Chalmers hydraulic turbines, turbine governors and generators are designed to meet specific natural conditions. In addition to the work now in the shops, Allis-Chalmers hydraulic engineers are daily designing plants for newly developed water-powers. Following the removal of the general offices from the Reliance to the West Allis (Milwaukee) works, the entire north section will be devoted to the building of hydraulic turbines, governors and auxiliary equipment.

Watertight Telephone System for Warships.

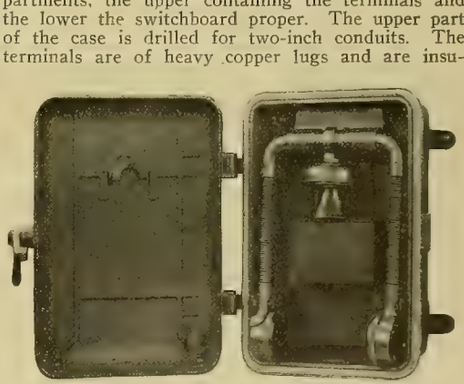
The accompanying illustration shows a watertight telephone station to be installed on the U. S. S. California, South Dakota, Milwaukee, Indiana and Connecticut. It was especially desired that the instruments be unaffected by the action of the air, the movement of the vessel, or the concussion of heavy guns, and the switchboard and exposed stations were to be absolutely watertight. The picture represents one of the watertight stations.

The operating parts are mounted on a frame plate which can readily be removed from the case without the use of tools and without disturbing any of the connections. One of the distinctive and original features of this station is the double receiver, the two receivers operating independently of each other so that either or both may be used. The act of raising one of them to the ear brings the transmitter into the proper position for talking, and signals the switchboard. When released all parts return to their normal condition, making it impossible for any user to leave the telephone connected to the line. The receivers are of the watch-case type, double-pole, with metal cases, the coils being specially treated to make them waterproof. The transmitters are of the solid-back type, the chamber being hermetically sealed, there being used nothing that will be affected by the moisture. The arms will support a weight of 200 pounds. The case which encloses the station is of composition, polished and oxidized and provided with a channel into which is fitted a molded gasket of pure rubber.

Non-watertight stations are also provided. They are interchangeable with the water-tight telephones, the operative parts being mounted upon a mahogany base instead of in a metallic case.

With each station there is furnished a separate watertight vibrating call-bell. The design of the mechanism of this bell is novel, the blow being delivered to the gong through a phosphor bronze diaphragm, which is reinforced so that there is no danger of its being worn through by use. The parts of the bell are made of non-oxidizable metal with the exception of the iron and steel parts, which are copper-plated and lacquered to prevent corrosion.

The operative parts of the switchboard are mounted in a heavy brass case. This is gasketed, so that when the cover is closed it is absolutely water-tight. The case is divided into two compartments, the upper containing the terminals and the lower the switchboard proper. The upper part of the case is drilled for two-inch conduits. The terminals are of heavy copper lugs and are insu-



WATERTIGHT TELEPHONE STATION FOR WARSHIP.

lated with mica. A distinguishing feature of the board is that the connections are made without cords, there being used specially designed keys instead. The front of the switchboard is subdivided into vertical strips, each holding four keys. By taking out two screws any one of these strips may be removed, exposing for examination every contact and connection on the strip. The whole front, which supports the case and signals, is hinged at the bottom so that it may be readily let down, allowing the cables to be examined. A supervisory signal is provided with each connecting circuit, the purpose of which is to indicate when the conversation has been finished.

Provision is made for connection with shore exchanges, the signaling current being obtained from a handpower generator. The system will work in connection with either a common-battery or magneto exchange.

Current for the transmitters is taken from a Holtzer-Cabot motor-generator of the noiseless type. These circuits draw their current directly from

the motor-generator, there being no storage batteries. The ringing current is obtained from the ship's ringing dynamotor, or, in case of disability, from an emergency set of dry batteries. The system operates on a three-wire circuit, and five conversations can take place at the same time, or any number of stations can be connected and an order transmitted simultaneously to them from any other station. The system as a whole has been built by the Holtzer-Cabot Electric Company with a special view to ruggedness, so that nothing short of actual violence can cause injury.

Indiana Telephone Items.

The Southern Indiana Telephone Company of Aurora has been incorporated to build telephone lines in Dearborn, Ohio and Ripley counties. The capital stock is $10,000. Ernest W. Swarthout, F. B. Shurtts and William H. O'Brien are the directors.

C. H. Brownell, telephone manufacturer of Peru, is preparing to increase his output 50 per cent. New factory buildings are being built which will be equipped with the latest machinery.

The Home Telephone Company of Fort Wayne is installing a new toll board of increased capacity.

A mortgage for $30,000 given by the Farmers' Mutual Telephone Company of Whitley County (Columbia city) in favor of Robert R. Scott, receiver, covering all their property holdings, was filed for record July 9th. The money derived from the sale of bonds is to be used in the liquidation of outstanding debts and for contemplated improvements to the plant. The Farmers' Mutual has been in existence four years and has over 1,000 subscribers in the county.

The Merchants' Club and Business Men's Association of Sullivan have agreed to support the service of the Independent company, which is extending its lines into all parts of the county.

Business men of Princeton are making a vigorous protest against the granting to the Cumberland Telephone Company of a franchise which provides for a sliding scale of prices that will increase as telephones are added.

The Cumberland Telephone Company of Evansville has entered upon the work of putting in a conduit system. The company expects to complete the work in three months.

The Indianapolis Telephone Company has ordered a new Central office switchboard of the latest type, having a capacity of 17,600 lines with 800 lines installed. This with the present North and South offices having 6,000 lines will total 14,000 lines installed and a capacity of 23,600. In addition the New Long-distance Company has put six gangs to work making new copper circuits in many parts of the state. The company is also building exchanges in Shelbyville, Spencer and Frankfort, with a view of re-establishing purely Independent exchanges in these cities, which have during the last year come under the control of the Bell company. S.

Telephone News from the Northwest.

The Sykeston New Home and Roosevelt Telephone Company has been formed at Sykeston, N. D., with a capital of $10,000.

The recent consolidation of Independent telephone lines in North Dakota is said to have been engineered by the Tri-State Telephone and Telegraph Company and will afford that company connections with about 1,000 miles of toll lines.

The Wisconsin Telephone Company at Green Bay, Wis., announces that telephone service for city offices must be paid for.

B. W. Moore of Stewartville, Minn., has gone to Chatfield, Minn., where he becomes assistant manager of the People's Telephone Company.

The Hughes Electric Company of Bismarck, N. D., has sold its telephone lines from Bismarck to Dickinson and Glendive to the North Dakota Independent Telephone Company.

The Iowa Telephone Company has applied for a franchise at Valley Junction, Iowa.

C. G. Munsell has purchased the City Telephone Company's system at Tabor, Iowa, and will consolidate it with his system at Sidney, Iowa. R.

Ohio Telephone Notes.

The new owners of the United States and Cuyahoga Telephone companies are engaged in a reorganization of the operating forces. The reorganization will not reduce the value of the service, but will rather make the operation more uniform and economical in all departments. C. Y. McVey, general manager of both companies, is engaged in the reorganization work. Such extensions will be made to the lines as are needed at this time, but otherwise no extensive additions have been planned for the present. The preferred stock of the Cuyahoga Telephone Company has been increased $300,000, and this has been sold in the various towns over the Central states. The proceeds will be used to lift a portion of the floating debt and make such improvements as are necessary. The remainder of the floating debt will be taken care of as soon as possible, the policy of the company being to wipe it out. The main portion of the $200,000 that will be spent for improvements in the United States Telephone Company lines will be between Cleveland and Columbus, Toledo and Columbus, and Cleveland and Lorain, it is said.

After a conference the construction foremen of the Central Union Telephone Company were entertained at dinner at the Chittenden Hotel, Columbus, a few days ago. Various questions regarding constructions were discussed.

The Brunswick Independent Telephone Company of Brunswick has increased its capital stock from $5,000 to $20,000. C.

Southeastern Telephone Developments.

Papers of incorporation have been filed for the Home Telephone Company of Jasper, Ala. E. M. Cranford is named as president, J. N. Odum and William Gurganus vice-presidents, and J. A. Coleman secretary and treasurer.

C. B. McMillan of Fayetteville, N. C., has sold a large tract near the city on which a plant will be erected by the purchasers for the manufacture of telephone and telegraph cross-arms.

The Southern Bell is expending about $3,000 per month in Birmingham, Ala., for improvements. W. T. Gentry, vice-president of the company at Atlanta, says that the tardiness of the arrival of material has been a considerable drawback to the work now in progress.

The Southern Bell has purchased a site at Statesville, N. C., for a new exchange building and the sum of $30,000 will be expended in this way and in making improvements, including the common-battery system and the metallic circuit for those now in use. The new system will be altogether up to date.

The Moultrie Telephone Company of Moultrie, Ga., will install an improved and larger system with a capacity of 400 telephones to meet the growing demands.

The Chamber of Commerce and patrons of the Southern Bell at Greenville, S. C., are seeing a contract with the telephone people for a better service with improvements that will likely be granted in a few days. There are seven tributary exchanges in surrounding towns to which a better service and connection are also promised in the near future.

The Iredell Telephone Company, organized in Statesville, N. C., in opposition to the Bell Company, has let the contract for about all of their material, and the fight between the two companies is thus made more strenuous. L.

Blake Compressed Cleats for Wiring.

The cuts show examples of the compressed cleats made by the Blake Signal and Manufacturing Company of Boston. These cleats are designed for use with low-voltage wiring, such as that for telephones, telegraphs, annunciators, bells, etc., where such circuits are run over plastering or in

BLAKE COMPRESSED CLEATS.

other places where staples cannot be used. They are treated to be impervious to dampness, and it is pointed out that there is no breakage under the blows of a hammer or otherwise. Wire nails can be used as well as screws, and these cleats cost much less than porcelain. When stringing long runs of wire, the end cleats will hold the slack until the wire is secured at intermediate points. Large quantities of these cleats are sold to telephone and telegraph companies, bell-hanger, automobile and motor-boat builders and the like.

GENERAL TELEPHONE NEWS

The Muellersville-Brenham (Tex.) Telephone Company has been incorporated by W. F. Mueller, Otto Zander and others, all of Brenham.

The Home Telephone Company of Joplin, Mo., will improve its telephone plant to the extent of $20,000. New switchboards will also be installed.

The annual convention of the Association of Independent Telephone Companies of New York State will be held in Niagara Falls on August 26th, 27th and 28th.

The Beatyville (Ky.) Home Telephone Company has been organized with a capital of $5,000, which may be increased to $10,000. G. W. Cann, J. C. Richardson and others are the incorporators.

Among the recently incorporated telephone companies are the following: Preston Telephone Company, Preston, Iowa; Kimball Telephone Company, Kimball, Kan.; Kendrick and Avery Telephone Company, Kendrick, Okla.; Platte Valley Telephone Company, Scott's Bluff, Neb.

CORRESPONDENCE.

Great Britain.

London, July 3.—It is to be regretted that the decision of the committee which has been considering the question of the supply of electric power to London has been given largely from a political point of view. At the outset the bill of the London County Council is rejected, the reason being that it is not sufficiently comprehensive to meet the needs of the case, the point of view which all the opponents took from the beginning. The committee lays stress upon the fact that the bill is merely permissive in its character and that, in fact, no obligation is imposed on the council to carry into effect any of the powers sought by the bill; neither is there a prescribed time either for beginning or for carrying out the work. The committee considers that the council should be under such obligations and that under fair and reasonable terms and conditions any company or local authority should have the right to require a bulk supply. With regard to the scheme generally, the committee expresses the opinion that further consideration should be given to many matters pointed out during the course of the inquiry with a view to amending and improving the scheme. The distribution scheme proposed by the council is disapproved, attention being called to the absence of duplicate routes.

Up to this point the decision is clearly on the merits of the bill, but the committee continues by first saying that, whereas the scheme of the administrative County of London and District Electric Power Company is based on scientific lines and is calculated to afford a cheap supply of electrical power at private risk, yet it recommends that the County Council should be the controlling authority. In other words, this is a practical invitation to the London County Council to come forward next year with a proposal based on the lines of that provided this year by the Administrative company, thus once again delaying the supply of cheap power to London purely on political grounds, for it was equally open to the committee to recommend Parliament to allow the company's bill to proceed this year. Already two years have been wasted in the matter by the influence of the municipal authorities of London and suburbs.

In conclusion, the committee points out that the London County Council has it within its power to either (1) undertake the whole work, (2) retain for itself one part of the undertaking while permitting a private enterprise to undertake another part, (3) to lease for a substantial consideration the whole enterprise to a private company and to resume possession of it when the initial stages are over. The adverse report of the finance committee renders careful consideration to the latter two alternatives imperative. The committee considers that the provision of cheap electric power for London is so important and pressing that it does not view with favor the possibility of the question being indefinitely hung up, and it urges that the council should be prepared to make a decision as to its future action early enough to allow other bills to be presented next session. Some proposals that were made for a high-tension transmission scheme from the coal mines are dismissed as impracticable, and the final words of the report are that no other power bill should be proceeded with this year.

The foreign engineers and scientists who are visiting Great Britain as the guests of the Institution of Electrical Engineers have been confining their attention to the provinces and Scotland since my last notes. Birmingham, Manchester, Liverpool, the Lake District, Glasgow, Edinburgh, Newcastle-on-Tyne and Leeds will all have been visited—and numerous works inspected—by the end of this week, the survivors, if any (as one scribe has put it), then returning to London. Sir Oliver Lodge welcomed the visitors to Birmingham at a luncheon given by the members of the local section of the Institution of Electrical Engineers. The programme in all the towns has been the same, an official welcome and lunch, then visits to the important engineering works. The interest in these latter has been greatly facilitated by the admirable guidebooks that have been prepared for each town, giving a technical description of the works to be visited.

Within the last week or two there have been no less than five serious tramcar accidents, due to the failure of the brakes to act. In almost every one there has been a fatal result and the government is being urged to order an inquiry into the particular accidents and also a general examination of the whole question of tramcar brakes. The most violent accident of all was in London, where a car had a clear run of nearly a mile, during which it was completely out of control, although fitted with electromagnetic wheel and track brakes. Three persons were killed and over 20 injured, while among the vehicles demolished en route was a motor omnibus which was smashed to atoms. In nearly all the accidents the rails were greasy and the wheels seem to have become locked when the brakes were applied. A special

inquiry is to be held into the whole question at the instance of the Board of Trade.

The English house of J. G. White & Co. has had a most successful year's trading. The net profit was $180,000, which is in advance of any previous year. A feature of the firm's progress is the large amount of foreign and colonial work that is being carried out, while advantage has also been taken of favorable opportunities to assist in the financial development of enterprises having relation to its own line of business.

Quite an amused interest is being manifested in the controversy between the London County Council and the Greenwich Observatory authorities with regard to the alleged interference from the council's generating station to the measurements, etc., carried on at the observatory. One can hardly conceive the generating station—which has cost some $4,000,000—being shut down, while on the other hand it has been officially announced that there is no intention of removing the observatory. There is some talk of the appointment of a special committee of investigation. G.

Dominion of Canada.

Ottawa, Ont., July 14.—The Dominion Coal Company of Nova Scotia, in order to largely increase its output of coal, has ordered three Westinghouse generators of 500 kilowatts capacity, together with exciters, transformers and motors. This apparatus is to be used for pumping, ventilating fans, hoisting, lighting and general work.

Mackenzie & Mann, the Canadian railway magnates, are the principals in a company just incorporated by the Dominion government, to be known as the Port of Para Docks Company. The capital stock of this new concern is placed at $17,500,000, with headquarters at Toronto, Ont. The powers granted include the operation and construction of railways, docks, and to generate electric power for heat, light and other purposes. The field will be confined exclusively to operations in Brazil, South America.

The Pueblo Tramway, Light and Power Company, recently formed by Canadian capitalists, has taken over the lighting and power companies in the city of Pueblo in addition to the tramway lines. The latter were secured from the Werhner Beit Company, which also owned the Mexican tramway lines, while the lighting and power companies were acquired from other English capitalists. The Pueblo company will have a capital of $5,000,000 of bonds and $3,500,000 of stock.

The Electrical Development Company and the Cataract Power Company have, it is understood, come to an agreement concerning the territories to be respectively occupied by each. This will tend to prevent undue competition. E. R. Wood, W. R. Brock and A. M. Grenfell, London, England, have become directors of the Electrical Development Company. A meeting of the shareholders will be held August 7th to authorize the purchase of bonds and stocks in the Niagara Falls Transmission Company, a subsidiary company organized to transmit power to New York state. A controlling interest will also be acquired in the Albion Power Company and the Niagara Falls Gas and Electric Company which will give the company the right to sell current for light, heat and power in 27 towns and villages in New York state.

A. B. Smith of Montreal, general manager of the Grand Trunk Pacific Telegraphs, has left for the West to look over the ground for the line which will, in a short time, reach Winnipeg, Man. This company works under a Dominion charter which gives it the right to use telegraph, telephone or space telegraphy as it chooses. The company is capitalized at $5,000,000 and is entirely independent of the Grand Trunk Pacific Railway, except that it is under contract to use the new railway's lines whenever possible. In addition to this the company purposes to do business apart from the railway lines and to run wires across country. These lines, when completed, will be the greatest in the Dominion, it is said.

A big merger has been put through which will bring under one management the Montreal Park and Island Railway, the Terminal Railway and the Montreal and Suburban Railway. This combine, it is stated, will be leased to the Montreal Street Railway Company on a basis that will yield a guaranteed dividend on the stock of the leased company. Whether the combine will adopt the name of the merging companies or whether it will be in the control of a new directorate has not yet been disclosed, although in all probability it will be known as the Montreal Park and Island Railway Company. W.

New England.

Boston, July 14.—The Boston Elevated Railway Company's officials have accepted the Cambridge subway bill passed by the recently adjourned Massachusetts Legislature. The bill provides for a subway between the new Cambridge Bridge, which connects Boston and Cambridge, and Harvard Square in Cambridge, and a later built subway between Craigie Bridge and Harvard Square, via East Cambridge.

Governor Guild of Massachusetts has nominated Alonzo R. Weed of Newton, Mass., to succeed Samuel W. George as gas and electric-light commissioner. The Executive Council will not act on the nomination until next week. Mr. George's term has expired.

The Massachusetts gas and electric-light commissioners have given a hearing on the Beverly Gas and Electric Company's petition for authority to increase its capital by an issue of new stock amounting to $200,000. There was no opposition to the petition. Andrew W. Rogers, treasurer of the company, explained that the proceeds from the new stock were needed on account of the rapid increase in the company's output, due to the United Shoe Machinery Company having located its plant at Beverly. The company's capital is $194,000.

The Haverhill Electric Company has petitioned for the Massachusetts gas and electric-light commissioners' authority to issue capital stock amounting to $120,000, the proceeds to be used for new power houses and distributing system.

The New England Telephone and Telegraph Company has reduced its charge for an extension to a measured-service instrument from $12 to $6 per year, and the price of a receiving set, in Boston, from $45 to $36.

Samuel G. Colt, an electrical engineer of Pittsfield, Mass., has bought the Richmond Iron Works at Cheshire, Mass., and the mining rights of an adjoining farm and will manufacture high-grade charcoal iron.

The Pensacola Electric Company of Portland, Maine, has filed its certificate of organization. It proposes to build and operate railways operated by electricity, steam or other power. It has a capital of $1,300,000. Charles M. Drummond of Portland is president and John C. Rice of Boston, Mass., is treasurer.

The New York, New Haven and Hartford Railroad Company has substituted steam for its third-rail electric system between Hartford and Bristol, Conn., via New Britain. The company will install electric power on its line between Middletown and Berlin, Conn., as soon as possible, and establish a fast electric service between Meriden and Middletown. It will also put electric power on its Northampton division out of New Haven and on its steam road between New Haven and Waterbury, via Cheshire. President Mellen has formulated plans for elaborate experiments in combined steam and electric service out of Hartford.

The American Steel and Wire Company is building an addition to the power house at its Worcester (Mass.) plant, in which will be installed an 800-horsepower gas engine with a direct-connected generator. The steel fence factory is to be used for making a rail bond for third-rail electric railways. The company is also building an addition to building No. 40, to be devoted to the manufacture of electric cables. This addition will be 202 by 102 feet. B.

New York.

New York city, July 14.—Statistics of manufacturing industries of this city for the year 1904 have been given out by the director of the census. The statement shows 20,839 establishments with an output of $500 or more, an increase of over eight per cent. since 1900, with a capital of $1,042,946,487, an increase of over 22 per cent. The cost of materials used was $818,029,267, an increase of 29 per cent., and the miscellaneous expenses were $206,825,065, an increase of 60 per cent. The value of the products was $1,562,523,006, as against $1,172,870,261 for 1900, an increase of over 30 per cent.

The scheme for a municipal lighting plant in this city, for which sites have already been purchased, will probably be abandoned. Acting on a report prepared by Chief Engineer Chandler Withington of the Finance Department, the Board of Estimate has refused to appropriate $25,000 to pay the expenses of continuing the mayor's special lighting commission, on the theory that as conditions have changed in regard to the cost of lighting there is no further need at present for the commission. The abandonment, for the present at least, of the plan is due to the greatly reduced bids for lighting which were submitted by the lighting companies last spring. They brought the cost of lighting down so low that the city officials immediately began to inquire whether or not it would pay the city to erect its own plant at a cost of $7,500,000.

The "Real Rapid Transit Association of Brooklyn" was organized this week with Judson Wall as president. The association at once laid out a tentative route for its proposed Behr monorail line. It starts at the Williamsburg Bridge, goes through Williamsburg, Flatbush, Bensonhurst, and to Coney Island, there making a loop and coming back through South Brooklyn, along Third Avenue to Flatbush and Atlantic avenues, there connecting with the Interborough Subway, which is now building. The monorail system would be partly subway and partly elevated. Mr. Behr said the speed of the trains could be a mile a minute with safety. The new organization purposes to get the consent of 60 per cent of the property owners along the proposed route, lay the matter before the Rapid Transit Commission, and if possible get a franchise for the building of the new system.

Writing to the New York Times, O. L. Hollander makes a plea for street cars for women only during the rush hours. He says: "That would do away with a great deal of the rough handling the women get at the hands of the rougher element of men. There are special smoking cars for the men; why not cars for the women only?"

The Erie Railroad announced to-day that it has just ordered five new electric cars, intended for service on its Rochester Division, the work of electrifying which is now under way.

There promises to be a renewal of the local telephone fight next week. Today was the last day allowed by the Board of Estimate to the New York Telephone Company and the New York and New Jersey Telephone Company, in which to submit an offer to the city for a franchise along the lines laid down by the Bureau of Franchises for the Atlantic Telephone Company (Independent). The Atlantic application was laid aside by the board on June 13th. At that time the board, on the recommendation of the Bureau of Franchises, called on the Bell companies to enter into the same sort of an arrangement with the city as that proposed for the Atlantic. The understanding was that if the existing companies would do this, the Atlantic company would be turned down on its application for a franchise. Controller Metz said that he had not received an answer, and that he did not believe an answer would be sent.

All the 19 new subway routes laid out last year by the rapid-transit commissioners were approved by the Appellate Division of the Supreme Court for the First Department on Thursday, including the Third Avenue route, over which litigation has been begun. The court, however, imposed the condition that the board should select and contract for the construction of all desired routes within two years, as the approval will be withdrawn from all routes not under contract within that time.

Two large electric locomotives arrived here on Wednesday from Schenectady and were placed in the new pit shed near the Highbridge station of the New York Central lines. They are to make experimental runs on the track from Highbridge to Kingsbridge. They weigh 175,000 pounds each and are the first of the order for 35 electric locomotives given by the New York Central Railroad to the American Locomotive Company to be delivered. There are 18 more nearly completed and due to arrive here before September 1st, the day set for the opening of electrical service on that railroad from the Grand Central Station to Highbridge on the main line and Wakefield on the Harlem division. At the offices of Edward B. Katte, the well-known electrical engineer of the railroad, it was stated that the first one of the 125 steel electric motor cars for the suburban service had started from Berwick, Pa. While the big electric locomotives are to draw the through trains to and from Highbridge until the main-line service is finally extended to Croton, the motor cars running in five and seven-car trains, together with steel trailers, are to care for the suburban service. Fifty-five trailers have been ordered from a St. Louis car-building company, and the first lot will soon arrive.

Power in the first turbine-driven generator in the Port Morris power house has been turned on to a portion of the line equipped with the third rail nearest the power house. Another of the turbine generators is nearly ready, and before the service is opened the entire plant of four generators, with a capacity of 40,000 horsepower, sufficient to operate the traffic of the road to Croton, will be in operation. The power house in Glenwood, designed to take up one-half of the burden, is as yet uncompleted. C. I. C.

Ohio.

Cleveland, July 14.—The Indiana, Columbus and Eastern, which has just completed its organization for the purpose of operating the lines in Ohio included in the purchases of the Schoepf syndicate, will make a strong bid for local passenger business in the territory through which it passes, as well as express and light freight. It is stated that the company has no intention of competing with the steam roads for heavy or through business at this time. The company is gathering a staff of experienced operatives to look after the business.

The Forest City Railway Company of Cleveland has made application for franchises on 12 streets in the city. Should the Cleveland Electric Railway Company desire to bid on any of these routes it will have to make a bid on all, as there is no way to find out what ones the new company really wants.

For the last week or two organizers have been in Cleveland endeavoring to form a union among the conductors and motormen of the Cleveland Electric Railway Company. There has been no union among the men for years, and they have enjoyed as high wages and as many privileges as the employes of any other system. The officers object to their men being bothered by outside people who have no interest in the matter other than to strengthen their organization. The company has had no trouble with its men. The management of the Cleveland Electric Railway Company

has found it best to discharge something like 100 of its men within the last few days, and they happen to be among the number who have enrolled themselves with the union. There is a strong division of opinion among the men as to the advisability of a branch of the organization among them.

The Lake Shore Electric will shortly ask the council of Sandusky for a franchise for its line running to Tiffin and Fostoria. It is possible that the company will put Sandusky on the main line from Cleveland to Toledo.

At Lima a few days ago the contract for the new executive building and car shops of the Schoepf roads was let to Val Heil of that place. The buildings will cost about $100,000. Some other contracts for increasing the power and other work were also let.

The Cleveland city authorities will take up the plan of furnishing light for the federal building from the plant that will light the new city buildings when they are completed. It is the intention, if possible, to have one plant light the city, county and federal buildings and furnish power for the proposed high-pressure water system, in order to do away with smoke as far as possible.

The Electric Sterilized Milk Company of Columbus has increased its capital stock from $10,000 to $25,000. C. B. Wolfe is president of the company.

Depositions were taken in Cincinnati a few days ago in the receivership case against the Henderson City Railway Company of Henderson, Ky., which was largely owned by A. L. Rich, the defaulting Cincinnati banker. It is said that Rich is in Honduras. O. M. C.

Michigan.

Grand Rapids, July 14.—The Board of Supervisors of Midland County have given permission to Frank B. Wixom and others of Detroit to dam the Tittabawassee River at Edonton and other points for electric lighting and other purposes, costing from $800,000 to $1,000,000.

The H. M. Loud Company has obtained by lease and by purchase 100 miles of land lying on each side of the Au Sable River and branches from Au Sable and Oscoda up the stream, and will furnish these towns and others along the Lake Huron shore with electric power.

The Rifle River Improvement Company at Standish has secured permission from the board of Supervisors to build a dam along the Rifle River to furnish power to Bay City, Saginaw and other points.

In a recent interview President M. W. Mills of the Michigan United Railways Company said that the interurban road from Lansing to Jackson would be in operation next spring. Mr. Mills admitted that no work was being done on the proposed railroad at present, but his reasons for this were that there was other work that had to be taken up which would bring better financial results more quickly. Mr. Mills said, however, that as soon as the work now being done on the Lansing and Suburban and other divisions is completed the construction of the Jackson road will be started.

An extension of its franchise in Durand is asked by the Owosso and Corunna Electric Company until December, it being probable that Corunna will know by that time what it will do in the matter of the franchise asked for there. L. W. B.

Indiana.

Indianapolis, July 14.—Progress during the last six months in the interurban industry in Indiana is illustrated by a map just issued by the American Engineering Company of Indianapolis. Compared with a similar map issued by the same company six months ago the new map shows that 220 miles of electric road have been put into operation since January 1st, and that construction work has been begun on almost 400 miles additional.

The Louisville, New Albany, West Baden and Frenck Lick Railway Company has increased its capital stock from $10,000 to $250,000.

Frank G. Norveil, assistant general passenger and freight agent for the so-called merger traction lines in Indiana, has completed arrangements with various steam roads whereby joint excursions may be run periodically during the summer to St. Louis, Chicago, Toledo, Detroit and other cities. The traction lines will run excursions into Indianapolis and then carry the excursionists to outside points and turn them over to the Wabash, Clover Leaf or C. C. and L.

Murdock & Marshall, the new owners of the Evansville and Princeton traction line, have removed the offices of the company from Princeton to Evansville. This line is to be greatly improved and gradually extended up the Wabash to make connection with the Wabash.

The electric railways in this state are now occupying the attention of the State Tax Board, and representatives of these lines are furnishing evidence of the valuation of their property. The board requires a detailed statement showing just what items were included in the operating expenses. The representatives of the companies that have thus far appeared before the board stated that their property was in better condition than last year and their earnings also a little better. Except in one case, no reduction in the rate of taxation was asked, which shows that the Indiana electric roads have been prosperous during the year.

The Fort Wayne and Wabash Valley Traction Company has ordered plans for the erection of a new terminal station, which is to be similar to the Indianapolis Traction and Terminal station.

An electrical supply company has asked for the appointment of a receiver for the Andrews Light and Water Company, a corporation organized this year, to furnish light and water for the town of Andrews. A plant to furnish street and commercial lighting was installed and the company is promoting an electric line between Monon and Andrews. Indianapolis men are interested in the venture.

It is stated that Indianapolis capitalists have purchased canal rights at Connersville with a view of converting the waterpower to some use.

The Columbus Electric Street Car and Light Company has secured a new 50-year franchise to operate an electric railway and lights in the city of Columbus.

The Fairbanks-Morse Electric Manufacturing Company of Indianapolis has been incorporated to do a general electrical manufacturing business. The capital stock is $150,000 and the directors are C. H. Morse, Walter E. Miller and S. L. Hadley.

The Worth Manufacturing Company of Evansville has been incorporated to manufacture automobiles, motor vehicles, motor cars, motors motor appliances and electrical supplies of all kinds. The capital stock is $100,000. James W. Worth is president and John C. Zutt secretary. S. S.

Illinois.

Peoria, July 14.—The transfer of the property of the Central Railway Company with all its holdings, cars and valuable franchise privileges has been made to the Peoria Railway Company, a corporation organized to take over the interests for the McKinley syndicate, by whom the property was purchased last fall. The new company has executed a trust deed to the Chicago Title and Trust Company for $3,600,000. Part of the money will be used for paying off $560,000 of an outstanding bond issue of the Central Railway Company, while the stockholders of the old company will receive $1,000,000 for their holdings. The remainder of the money, it is thought, will be used to finance the numerous interurbans now being built by the syndicate.

Another deed was filed for the transfer of the site of the new power house to the Peoria, Bloomington and Champaign Railway. With the transfer is an agreement that the new power house will supply power for the street-railway lines as well as the interurban. This will allow the power house of the old Central Railway Company to be dismantled.

Work on the Bloomington line is progressing at a rapid pace, the contract for the bridge over Farm Creek has been let to the Crescent Stone Company of this city. On the river bridge, Cullon & Co., who have the contract for building it, have started the laying of concrete in the second pier.

The plan of the Illinois Traction Company to cross the Mississippi River at St. Louis by ferry has resulted in the formation of a $1,000,000 boat company to handle the business. Joseph Clarke of New York, who is the head of several electric roads in Northern Missouri, is organizing the company to operate steel passenger steamers on the Mississippi between St. Louis and New Orleans and between St. Louis and St. Paul.

The new 2,000-kilowatt turbine generator at the Riverton plant (Springfield) is now running.

M. L. Harry has been appointed general superintendent of the McKinley system, with jurisdiction from Clinton to St. Louis, with headquarters at Decatur. A. V. Schroeder has been appointed superintendent of the Decatur Railway and Light Company and also of the Springfield-Decatur and Decatur-Clinton lines. L. O. Williams is made superintendent of transportation on the same division. Thomas Wood will be superintendent of the Springfield-St. Louis line, and W. H. Owen superintendent of the Madison County Light and Power Company. All of these will report to Mr. Harry.

Emil G. Schmidt, general manager of the Springfield Consolidated Railway Company and the Peoria Gas and Electric Company, has rejected the franchise ordinance permitting the company to lay tracks on some of the more important streets in that city. The rejection was caused by a clause permitting the city to retain the right to purchase the physical properties of the company at the expiration of the franchise.

The capital stock of the Alton, Jacksonville and Peoria Railway Company has been increased from $10,000 to $300,000. The road was incorporated by St. Louis capital, but active operations were suspended, owing to difficulty in securing the right-of-way. Jacksonville held out for some time, but has finally granted a franchise.

Work has commenced on the new electric railway between Kewanee and Galesburg. W. T. Brennen of the Electric Contract Company of Chicago is in Kewanee and will superintend the construction. The line will first be built to Galva and later extended to Galesburg.

The Chicago and Alton's motor car, which has been tried and is designed for interurban work, is to have some radical changes made.

The Carson-Payson Company of Danville has been incorporated, capital $25,000, to conduct a heating, lighting and plumbing business. Incorporators are E. E. Payson, W. H. Carson and H. E. Callahan. V. N.

Southeastern States.

Charlotte, N. C., July 14.—The city of Winston, N. C., has granted a franchise to the Winston-Salem Southbound Railway, a steam road, to build an electric line in the city. Judge E. B. Jones acted as counsel before the city board in making application, and set forth that the system would take in many of the business streets of the city.

The electric-light plant at Eminence, Ky., was sold on July 2d at public auction under order of the Circuit Court, to T. D. Cole, who paid $4,000.

The Schofield Construction Company of Philadelphia has been awarded the contract for constructing the power house for the Norfolk and Portsmouth Traction Company. The bid of the Philadelphia company was $190,000. The power house will be located on Reeves Avenue and Mills Street. The building will be 168 by 157 feet, of brick and concrete construction. There will be two stacks costing $25,000.

Mayor J. P. Young, W. H. Gaither and associates are behind a movement to give Newton, N. C., a modern water and electric-light plant. To date $50,000 is in sight and will be available when called for. The town will later issue bonds to take up the notes made in building these municipal plants.

The Bristol (Va.) Belt Line Railway has begun work on a line into the city, which will eventually be carried to the Virginia Institute and City Park.

Arrangements are in progress for the financing of the Baltimore Terminal Company, which will give entrance into the city to the Washington, Baltimore and Annapolis electric railway, which is building a line between Washington and Baltimore. L.

Northwestern States.

Minneapolis, July 14.—Plans for the erection of the dam at Kilbourn, Wis., have been completed. The dam will be 800 feet long, of crib and concrete construction. Four sets of wheels of 2,200 horsepower each will be installed and so arranged that the capacity may be increased later.

The city of Eau Claire, Wis., is considering the advisability of building a dam at Shawtown across the Chippewa River for power purposes.

J. G. White & Co. of New York have begun work on the new power house at Fraser, Iowa, for the Newton and Northwestern Railway Company. The work of electrifying the road will proceed rapidly.

The Fort Dodge, Des Moines and Southern Interurban has negotiated a loan of $2,150,000 and has filed a mortgage of 4½ per cent. for that amount with the Old Colony Trust Company of Boston.

The Northwood (Iowa) Electric Light and Power Company has filed articles of incorporation with a capital of $25,000. L. Dwelle heads the list of incorporators.

The Grand Forks (N. D.) Gas and Electric Company has let the contract to Dinnie Bros. for the erection of a new power house. It will be 100 by 110 feet, two-story, and will cost about $40,000.

The Stillwater Gas and Electric Company will put its high-tension wires underground, build a new sub-station and make other expensive improvements to its plant at Stillwater. Minn.

Tyndale Palmer of New York has made arrangements with terminal companies at Des Moines and Council Bluffs, Iowa, for his proposed electric railway between those places, to enter both cities. He will make his headquarters at Greenfield, Iowa.

The contracts have been let at Williston, N. D., for the construction of an electric-light and waterworks plant.

A company of local capitalists has been organized at Belle Plaine, Minn., with a capitalization of $10,000, for the purpose of putting in an electric-light system. R.

Mexico.

Mexico City, Mexico, July 11.—Telephone systems are being installed in many of the mining camps of this country, many of the larger mines having their individual systems. It is stated that not only does a full telephone system insure greater economy by providing a means of instant communication between all parts of the works, but it is a safety appliance as well. The Vallecillo mine in the district of the same name is one of those that has adopted the telephone in Northern Mexico.

Mechanical difficulties present themselves in installing underground systems, but recent inventions have practically obviated these and a proper installation will insure a practical working system. Many mines find it a consideration of value to extend their lines to the nearest town at which there

is a telegraph station so that messages can be sent and received direct from and to the mine.

Both galvanized and copper wire are used, but the latter is considered the better of the two, as it is not so readily affected by the water and mine gas. Glass and wood are not as good as porcelain for supports, and the telephone, if much moisture exists, should be encased in a metal box with an air-tight door kept shut except when the telephone is in actual use. Universal attention is being attracted to the telephone as a mining accessory and manifold uses are being noted all the time. The matter is one inviting careful study as to details, making such systems possess the highest efficiency. Mining experts in the United States and Mexico are devoting much time and attention to this study. W. D. H.

Pacific Slope.

San Francisco, July 12.—The Pacific States Telephone and Telegraph Company is spending a great deal of money in rehabilitating its system in San Francisco and vicinity and has accomplished a great deal. The service, however, is still far from satisfactory in many respects in some extensive districts. Subscribers often have to wait nearly an hour to get a long-distance connection with Oakland, Cal.

Plans have been prepared by the company's architect for a fine building on the site of the executive offices building which was destroyed by the great fire. The new structure will be made almost fireproof and will be taller than its predecessor. The rehabilitating of the three other large new buildings that were burned out by the conflagration is progressing steadily and more or less operating is being done from each. Park Station is also in operation again. At the main office, on Bush Street, near Grant Avenue, quite a force of operators is on duty using a temporary switchboard on the ground floor. Business was resumed there on May 27th with one subscriber, and 1,097 lines are now connected, serving 1,700 stations. The new switchboard for this office was built in the East in record time to replace the one which was burned when just about ready for use. The new board, which is said to be the largest of its kind in the world, is expected to arrive any day and it will be installed with all possible haste. The company is installing many new telephones every day, but it will take a long time in all probability to reach the 50,000 mark again with such an extensive burned district.

There has been a great increase of business with the Pacific States Company on the Oakland side of the Bay. A new office is nearly completed on Twelfth Street at Seventeenth Avenue. A handsome two-story office has just been constructed at Berkeley.

The Oakland Consolidated Traction Company has a large gang at work in Oakland laying tracks along Water Street to Broadway from Webster Street. It is the intention of the company to run its Alameda cars to Seventh and Broadway in Oakland until the broad-gauge tracks are laid on Washington Street.

It is stated that a private right-of-way has been secured by the Los Angeles Pacific line, extending from Fourth and Hill streets, Los Angeles, Cal., to Venice, and a four-track road will be started immediately. It is possible that Mr. Harriman will build a tunnel at Fourth and Hill streets.

It is rumored that the Huntington lines will be constructed to La Habra, Cal. The route will diverge from the Whittier line at Los Nietos, running through the La Habra Valley and Randolph to Yorba, thence through the River Cannon to Riverside.

An assessment of $10 per share has been levied upon the capital stock of the North Shore Railway Company, payable immediately to F. B. Latham, the secretary of the corporation, at its office in the Ferry Building, San Francisco, Cal.

Articles of incorporation have been filed by the Grays Harbor and Columbia Railway Company of Tacoma, Wash.

The Pacific Gas and Electric Company is to put up a $250,000 building to house its general offices in San Francisco, Cal. A.

PERSONAL.

V. C. Gilpin of New York has recently been appointed general sales agent for Keough Bros. & Co., dealers in electrical specialties.

Harry M. Hope, who has been the electrical engineer for the North Shore Electric Company of Evanston, Ill., will leave that company and enter the employment of the J. Lang Electric Company of Chicago, as manager of its switchboard department, on August 1st.

Thomas A. Edison has come into possession of the old Edison family home in Milan, Ohio, in which he was born on February 11, 1847. The deed transferring the property from a granddaughter of Mr. Edison's sister was recently recorded at Sandusky. The house stands on a beautiful eminence overlooking the Huron River. It is a story and a half structure and is built of red brick, surmounted by two wide old-fashioned chimneys. The house has been modernized in recent years and is a comfortable dwelling place and the object of much interest to visiting strangers.

Bernard V. Swenson, secretary of the American Street and Interurban Railway Association, and J. D. Keegan of New York, inspected the state fair grounds at Columbus last week in preparation for the exhibits that will be made during the big convention to be held there in October.

Prof. C. L. Cory, head of the deaprtment of mechanical and electrical engineering at the University of California, Berkeley, Cal., is to be professor of electrical engineering at the university. A separate chair of electrical engineering will be created at the university by the recent $100,000 endowment of Clarence H. Mackay for the purpose.

Clarence H. Mackay, who has given $100,000 to establish a chair of electrical engineering at the University of California, as a memorial of his deceased brother, John W. Mackay, Jr., is the only living son of the late John W. Mackay. Upon the death of his father, four years ago, he undertook the care of the immense estate, and has earned a reputation for business capacity.

J. W. Christie of the Northwestern Telephone Exchange Company, Minneapolis, Minn., has been advanced from the position of general superintendent to that of treasurer, with headquarters in Minneapolis. Heretofore the treasurer has been in Boston, but President Pettengill recently changed his headquarters, and now the treasurer is also located in Minneapolis. Mr. Christie has been with the company for 22 years.

ELECTRIC LIGHTING.

The North American Company has purchased the Laclede Power Company of St. Louis for $3,000,000. The company now owns practically all of the public-utility companies in that city.

The city of McComb, Miss., has decided to hold an election on August 4th and let the citizens vote on the proposition of the city issuing $25,000 for the purpose of putting in a municipal electric-light plant.

A citizens' meeting has been held at Salt Lake City, Utah, to consider the matter of street lighting. A motion was carried that the city should own and operate an electric plant and that the council take steps for a temporary lighting of streets, pending the erection of a municipal plant.

There is talk in Richmond, Va., of establishing a municipal lighting plant. The contract of the Virginia Passenger and Power Company for lighting the city expires soon and in view of the agitation for a municipal plant a committee of aldermen and business men has been selected to look into the subject.

Edward M. Deane & Co. of Grand Rapids, Mich., together with the Boston banking house of E. H. Gay & Co., have purchased the Tacoma Gas and Electric Light Company of Tacoma, Wash. The price paid for the property, together with improvements to the plant, will make an investment of nearly $1,500,000.

Surplus earnings of the constituent companies of the United Gas and Electric Company of New Jersey for the year ended May 1st last are reported at $443,573; increase, $87,598, or nearly 25 per cent. The company owns about 95 per cent. of its constituent companies, or practically all, which includes gas and electric properties in 13 different cities in the United States. Its preferred stock outstanding is $1,261,170, and its common $1,647,320. There are $1,594,500 first-mortgage five per cent. bonds outstanding.

In order to make Fisk Lake more attractive to Grand Rapids (Mich.) residents, General Manager Hanchett of the Grand Rapids Railway Company proposes to create a permanent Venetian night effect on the lake. Electric lights are being placed about the west and south shores and along the channel connecting Reed's and Fish Lake. These lights are being placed among the trees that line the channel, and it is expected that the effect will be picturesque and pleasing. The poles for the lights have been installed and the wire is being strung.

The Public Service Corporation of New Jersey has recently placed orders with the Westinghouse Machine Company of East Pittsburg, Pa., for two 1,000-kilowatt and one 500-kilowatt Westinghouse-Parsons steam turbines, the first two to be installed in the lighting plant at Cooper's Creek, Camden, N. J., and the latter at Cranford, N. J. The new station at Cooper's Creek will contain three turbines of 1,000-kilowatt capacity, the first one having been ordered some time ago as an extension to the old Corliss-engine equipment. These turbines will operate under 150 pounds steam pressure, 28-inch vacuum and 100 degrees superheat, and will be direct connected to 1,000-kilowatt Westinghouse enclosed-type turbo-generators delivering 2,400 volts to a two-phase 60-cycle distribution system. This plant will burn soft coal under six 500-horsepower Sterling consolidated water-tube boilers of the Babcock & Wilcox type, and will use Foster superheaters and the Williamson condensing system. The Cranford turbines will also deliver 2,400-volt current at a frequency of 60 cycles to a two-phase distribution system. The turbine will operate under a steam pressure of 125-140 pounds and 26-inch vacuum. The Wheeler surface condensing system will be used.

The mayor and Board of Aldermen of Harriman, Tenn., have decided to install a new lighting system for the city. The present system is antiquated and it is impossible to purchase repairs, especially for the street lamps. Modern equipment in every detail will be installed and the present number of street lights greatly increased.

Articles of incorporation of the Zanzibar (Africa) Electric Light Company have been filed in Jersey City. The company proposes to erect and maintain a plant on the Island of Zanzibar, off the east coast of Africa, for the generation and distribution of electric current for heat, light and power. The capital stock is placed at $100,000. The incorporators are B. S. Mantz, Thomas F. Barrett and Felix Ingold, all of Jersey City.

The state fair officials at Fargo, N. D., have decided to install an electric-light plant on the state fair grounds. It was the original intention to string a special wire to the grounds, but after a careful investigation it was decided that it would be more satisfactory to install a plant. The contract for wiring the grounds was let to the Fargo Electric Company. It is the intention of the fair officials to have the state fair grounds lighted as perfectly as possible. The street-railway line to the fair grounds will be in operation in a few days.

ELECTRIC RAILWAYS

The Benton Harbor-St. Joseph Railway and Light Company will extend its trolley line from Benton Harbor to Kalamazoo, Mich.

The Denver and Interurban Street Railway Company has been granted a franchise to operate an electric street-railway system in Fort Collins, Colo.

The Muskogee (I. T.) Electric Traction Company will construct a large power plant for its own use. The new plant will cost $100,000. I. N. Ury, T. H. Martin and M. R. William are interested.

The Chippewa Valley Electric Company will extend its Eau Claire (Wis.) trolley line to Menominie. It is the purpose of the company to connect all neighboring towns in this section, with Eau Claire as the central point.

A movement has been started by the people of the vicinity of Protivin, Iowa, to build a new electric road which will run through the southern part of Howard County and connect with some of the stations along the Chicago, Milwaukee and St. Paul Railroad.

The Greensburg (Pa.) and Latrobe Street Railway Company has been incorporated, capital $60,000, to construct and operate a line from Latrobe to Greensburg. Stephen Stone is president. Ex-Governor William A. Stone of Pittsburg is among those interested.

An interchangeable mileage book is in use on a number of Illinois interurban electric railways. The roads included in the agreement are the Illinois Traction System, the Chicago and Joliet, the Joliet, Plainfield and Aurora, and the Elgin, Aurora and Southern. The plan is a great convenience to extensive travelers.

The Oregon Electric Railway Company has been organized and taken over the Salem (Ore.) line built by the Willamette Valley Traction Company. The directorate follows: George Barclay Moffat and William A. White of New York, Harold B. Clark of New Jersey, Franklin T. Griffin of Oregon City, A. N. Bush of Salem, and Thomas Scott Brooke and Henry Ladd Corbett of Portland.

The fast service recently inaugurated by the Detroit United Railways Company between Mt. Clemens, Mich., and Toledo, Ohio, is proving popular. The service is made possible through arrangement with Western Ohio interurban lines. At Toledo connection can be made for Cleveland, Lima and Dayton. Through service will be given in a short time, it is said, between Detroit and Cleveland.

The Norfolk and Jamestown Exposition Railway Company of Richmond, Va., has been incorporated with a capital stock of $300,000 to build electric lines from points on the Norfolk and Atlantic Terminal in Norfolk, Va., to the Jamestown Exposition and to points in the neighborhood of Sewall's Point and Norfolk. John I. Rowe, Irving E. Campbell and William L. Royall are among the incorporators.

An electric railway from Marshalltown, Iowa, to either Ferguson or Haverhill, making connection between Marshalltown and the Milwaukee system, is assured. The Retail Merchants' Association of Marshalltown has entered into a contract with Hamilton Browne of Chicago to build the road. A special election is to be held to vote on a proposition for a three per cent tax to aid the constructing of the line. Ultimately it is the intention to connect with the line running from Colfax to

Des Moines, but this is not included on the contract just entered into. It is said to be the intention of the promoters to build to the northeast to Waterloo, by way of Grundy Center, some time in the future.

Certain directors of the Brooklyn Rapid Transit Company, with men of local prominence along the south shore of Long Island, are backing a new trolley enterprise, to be called the Suffolk Traction Company, capitalized at $1,200,000, which will construct a surface street railroad 28 miles long between the town of Brookhaven and the village of Babylon. It will run through Brookhaven, Bellport, Patchogue, Blue Point, Bayport, Sayville and Islip.

The Manila Suburban Railways Company of Hartford, Conn., has filed its certificate of incorporation. Its franchise provides for the building and operating of various classes of railroads in and about the city of Manila, P. I., and for the operation of telegraph and telephone systems. The company's capital is $500,000 and its incorporators are Arthur L. Shipman, Charles Willis Gross and Alvan Waldo Hyde of Hartford, who are acting for a syndicate.

The Fort Dodge (Iowa), Des Moines and Southern has secured the money necessary to connect Fort Dodge and Des Moines by an electric railway. The mortgage showing that the Old Colony Trust Company has agreed to take bonds for $12,150,000 for the immediate construction of the line to connect with the Newton and Northwestern and the Ames and College Railroad has been filed. Homer Loring, as president, signed the papers for the electric line. The bond issue shows that the last obstacle in the way of the new road is now removed, as the road can be completed at once with the funds to be thus obtained.

The Philadelphia Rapid Transit Company has leased for a long term the Philadelphia, Morton and Swarthmore and the Media, Middletown, Ashton and Chester Electric Street Railroad lines. While the terms of the leases have not been disclosed, they are said to be based upon a sliding scale of earnings. The stock of both companies has been held principally by an English syndicate engaged in street-railway building. That of the Philadelphia, Morton and Swarthmore line is $600,000, of which $250,000 has been issued, and the funded debt is $500,000. The Media, Middletown, Ashton and Chester company has an authorized capital of $250,000, of which $205,300 has been issued, and a bonded indebtedness of $210,000.

The new power house for the Winona interurban railway—one of the largest buildings of its kind in Indiana—is rapidly nearing completion. In the boiler room are four large 500-horsepower boilers, each of which is larger than the boiler room in the old power station, and the coal bunkers are capable of holding many carloads of fuel. Freight cars will be hauled into the power house and the coal dumped directly into the bunkers from the cars. In the engine room are two compound engines, the flywheels of each being 18 feet in diameter. No belting is used, as the engines are connected directly with the big dynamos, which are capable of generating a current of 33,000 volts, while the capacity of the dynamos in the old power station is 500 volts.

It is stated that the acquisition of the St. Louis and Suburban Railway Company by the North American Company, through its subsidiary company, the United Railways Company of St. Louis, will not involve any fresh capital issues by either concern. According to the terms of purchase the United Railways Company of St. Louis will guarantee the interest of the $7,500,000 St. Louis and Suburban bonds. The entire outstanding $4,000,000 capital stock of the St. Louis and Suburban will be acquired by the exchange of an equal amount of the United Railways Company of St. Louis preferred stock. The latter company has in its treasury $7,000,000 preferred stock, so that the giving of $4,000,000 of this to the St. Louis and Suburban stockholders for their shares will not involve any increase in the authorized amount of United Railways Company stock. The operations of the St. Louis and Suburban Company are not entirely confined to suburban territory, but its lines in some cases run into the heart of the city. Its acquisition will involve an exchange of traffic with the United Railways Company of St. Louis and the issue of transfers between the lines.

PUBLICATIONS.

Bulletin No. 40, issued by the Oswego Boiler and Engine Company of Oswego, N. Y., goes into details concerning sizes, weights, capacities and prices of circular black steel tanks.

About 2,000 firms and individual collaborators are assisting in the compilation of the Technolexicon of the Society of German Engineers, a universal technical dictionary for translation purposes (in the three languages, English, German and French), that was commenced in 1901. Over 3,000,000 word cards have been collected. Alphabetizing has so far advanced that printing will be begun early in 1907. Dr. Hubert Jansen, the editor-in-chief, will be pleased to give any further information wanted. Address Technolexicon, Berlin (NW. 7), Dorotheenstrasse 49.

Several neat little folders, well illustrated, from the Monarch Electric Manufacturing Company, Warren, Ohio, contain interesting information about the various kinds of lamps made by the company. The company supplies any kind of an incandescent lamp. In the folders it tells why it recommends the Monarch lamps.

The second notice of the summer and fall merchants' excursions to the Chicago market, just being sent out by the Chicago Commercial Association, besides giving dates and rates, contains a well-illustrated article showing Chicago as the ideal summer resort. Harry A. Wheeler, 77 Jackson Boulevard, is general secretary of the association.

The Wagner Electric Manufacturing Company of St. Louis issued a novel and clever bit of advertising matter in connection with the electrical contractors' convention in Cleveland, it being a representation of a railroad ticket, issued by the "Wagner Route." The ticket is "good for a continuous era of good business," provided the instructions designated in the coupons attached are followed.

The General Electric Company of Schenectady is distributing a new bunch of publications relating to apparatus furnished by the supply, railway, lighting, power and mining departments. Among other bulletins are those relating to type H transformers, GE-87 railway motors, direct-current steam-turbine generators of the horizontal type and small polyphase motors. All the publications are issued in the attractive style which characterizes the material issued by the publication department of the General Electric Company.

The Central Electric Company of Chicago is sending out a unique "Okonite" blotter, printed in two colors, which is causing favorable comment. The recipient learns that "By using this blotter on an order for Okonite you are entitled to a life membership in the society of satisfied users, composed exclusively of those who use and endorse Okonite as the standard for rubber insulation." It is suggested that anyone desiring to become a member of the "society of satisfied users," write the Central Electric Company for one of these blotters.

"The Commercial Orient in 1905" is the title of a monograph just issued by the Department of Commerce and Labor, through the Bureau of Statistics. It discusses commerce and commercial conditions in all countries occupied by oriental people, the value of their imports and exports in the latest year for which information is available, and the share which the United States and the leading commercial nations have in that trade. The section of the world occupied by people of oriental habits includes all of Northern Africa, Turkey in Europe, as well as Asia, all of Southern and Eastern Asia and the East Indian Islands.

The Emerson Electric Manufacturing Company of St. Louis is sending out four new bulletins illustrating and describing certain of its product. No. 3110 deals with single-phase induction motors applicable especially to slow-speed machinery without intermediate shafts or gearing; No. 3203 describes direct-current motors of a speed range from 50 to 150 revolutions per minute; No. 3204 tells of bipolar enclosed motors for direct current, being the spherical types completely enclosed in cast frames, giving protection from dust and dirt, and No. 3802 goes into the details of motor-driven air pumps for direct or alternating current suitable for compressing a small quantity of air to pressures not exceeding 50 pounds a square inch.

The value central-station men place upon the convention papers of the National Electric Light Association is shown by the large number of orders sent in for sets of these papers and the Question Box. The programmes are now so large and the expense of printing so heavy that it is found impracticable to make free distribution of the papers, before they are issued in the book form, except to members attending the meetings. Although the Transactions are distributed as promptly as the character of the publication will allow, a large proportion of the members are glad to pay the cost of printing and mailing in order to have copies of the papers at once, and the secretary's office has been kept busy filling orders for them.

The Stanley-G. I. Electric Manufacturing Company of Pittsfield, Mass., has just issued bulletin No. 608 and circulars No. 778 and No. 785. The bulletin is devoted to the new G. I. flush-pocket wall receptacle, which is adapted for use with the standard Edison attaching plugs, and has a round door, eliminating the objectionable sharp corners of the old style of receptacle. Circular No. 778 is devoted to "circuit-breakers versus switches and fuses," and gives lists and prices of the Stanley-G. I. C7 circuit-breakers. Circular No. 785 is devoted to the K9 arc lamp for multiple alternating-current circuits which is suitable for operation on all of the standard induction motor voltages, viz., 220, 440, 550. Any of this literature will be gladly furnished those making request of the Stanley-G. I. Company.

"Fundamental Principles of Gas Engines and Gas Producers," by Robert T. Lozier, forms No. X. of the Transactions of the New York Electrical Society, just issued in pamphlet form. The address was delivered at a meeting of the society on February 21, 1906.

The Locke Regulator Company of Salem, Mass., has published a booklet containing a reprint of the comprehensive illustrated article on flywheel explosions written by W. H. Boehm and published in the June number of Insurance Engineering. The article treats the subject in all its scientific aspects from the practical viewpoint of the engineer. The Locke Regulator Company publishes the article in order that owners of engines may realize the value of the protection that the Locke engine stop offers. Every accident shown would have been averted, the company says, had an engine stop been applied. The company will send its complete catalogue containing illustrations of some of the plants where the Locke engine stop is installed.

MISCELLANEOUS.

The grand jury summoned for the purpose of investigating alleged frauds in the vote on corporation franchises and various city and county offices at the May election in Denver, Colo., has been discharged. This, it is said, ends for the present the investigation of the election in the District Court.

A number of Chicago electrical men and their friends listened to the Weil band concert at Riverview Park on July 16th as the guests of the management of the Chicago Electrical Show. The band is the one that was so popular at the show of last January, and one of the selections was "Reminiscences of the Chicago Electrical Show," with electrical effects. Managing Director H. E. Niesz of the Exposition company was active in looking after the welfare of the electrical visitors.

A recent letter from the San Francisco office of the Crocker-Wheeler Company indicates the still unsettled state of affairs in that city. A paragraph in the letter says: "While it is not absolutely sure whether or not the number will be changed in from six months to a year, we think that our office may be considered as located at 206 First Street. We have checked this matter of numbers over as carefully as possible, and we think that the above is as near as we can possibly get until the city authorities get to work and straighten matters out."

TRADE NEWS.

The Fiske Electric Company of Toledo, Ohio, capital $10,000, has been incorporated. The concern will do a general electric business and will be managed by Joseph B. Fiske, Jr., who is now connected with the office of the Ohio Inspection Bureau.

It is reorted that the plan for the consolidation of the National Steel and Wire Company and its subsidiaries with possibly other corporations under the title of the National Wire and Cable Company, incorporated in Maine with $16,000,000 of authorized capital stock, is making good progress, and will probably be announced within three or four weeks.

The Chicago Inter Ocean of July 17th says: "Stockholders of the Allis-Chalmers Company met in Jersey City yesterday and ratified the $15,000,000 bond issue recently decided on by the directors. The bonds will be used to reimburse the treasury for expenditures in connection with the extension of the works at West Allis, the purchase and extension of the Bullock Electrical Works at Cincinnati, and to increase the working capital. When the first $12,000,000 of bonds shall have been sold the net working capital, being the quick assets available after providing for all current liabilities to the public, will exceed $10,000,000."

BUSINESS.

Sealed proposals will be received at the office of the city clerk of Idaho Falls, Idaho, until July 30th for the construction of a power plant on Snake River for the city of Idaho Falls, requiring the building of 2,000 cubic yards of concrete masonry and the placing of 50 tons of steel reinforcement and structural steel, together with other necessary work.

The Allis-Chalmers Company is organizing its new department for the manufacture of Christensen air brakes. Mr. J. H. Denton, who was general superintendent of the National Brake and Electric Company, has been engaged to act as manager of the new air-brake department, and he will be surrounded by a staff of men who have been especially trained in this branch of manufacture. It is expected that shipments may be made from stock within 75 days from date. The entire second floor of the north shop, Reliance Works, Milwaukee, will be devoted to air-brake equipments.

ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued (United States Patent Office) July 10, 1906.

825,286. Ground Detector and Cut-out. Ernst F. W. Alexanderson, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed September 14, 1904.

In a three-phase system with grounded neutral point there are parallel lines, electro responsive devices energizd respectively by currents proportional to the algebraic sum of the currents in the three phases of the several lines and switches controlled respectively by the several devices and each adapted to open the circuit of one of the lines at one end thereof. (See cut.)

825,289. Safety Apparatus. John Barberie, Brooklyn, N. Y., assignor to the Barberie Locomotive Appliance Company, New York, N. Y. Application filed February 26, 1906.

Electrical means are employed, among others, to ap ply the brakes on a railroad car.

825,298. Electric Car Heater. Harold W. Buck, Niagara Falls, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed December 8, 1900.

The combination consists of an electric car, a heater mounted upon the trucks of the car, means for supplying air to the heater, and pipes provided with elastic sections for delivering the air from the heater to the interior of the car.

825,299. Support and Hanger. Joseph T. Bunn, Washington, D. C. Application filed January 19, 1905.

The invention relates to a trolley hanger comprising a standard, a collar and petticoat formed integrally therewith, a base, a stem carried by the base and removably connected to the standard, and also secured to the upper end of the standard for adjusting the hanger laterally. There are also separate adjusting and supporting means secured intermediate to the ends of the hanger for adjusting the hanger in a direction axially of standard.

825,318. Block Signal System. Laurence A. Hawkins, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed January 25, 1905.

Features of this block-signal system are a counterweighted three-position signal, electrially operated mechanism for driving the signal from "danger" to "caution" and "clear," a switch operated by this driving mechanism, two track relays, one polarized and one non-polarized, conjointly with the switch controlling the operating mechanism, and a snap switch arranged to reverse the direction of current-flow in the preceding block while the signal is moving from "danger" to "caution."

825,327. Brake. Carl W. Larson, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed February 19, 1904.

Combined are a rotatable member and a fixed member, radially arranged magnets connected to the fixed member, friction members radially movable with reference to the magnets into and out of engagement with the rotatable member, and a common energizing coil for the magnets.

825,330. Automatic Street or Station Indicator and Advertiser. Gerald R. Livergood, St. Joseph, Mo., assignor of one-half to J. H. Cargill, St. Joseph, Mo. Application filed July 25, 1905.

An automatic street or station indicator has a case provided with a glass front to permit a view of the street or station names or numbers and the advertisements. Electromagnets are used to actuate the operating mechanism.

825,333. Fuse Box. Peter C. Morganthaler, Fort Wayne, Ind., assignor to the General Electric Company, Schenectady, N .Y. Application filed July 20, 1905.

The combination with a three-wire system has automatic means for closing a circuit between either of the outside lines and the neutral when the circuit of the outside line is broken or the fuse is blown.

825,348. Process of Producing Low Carbon Ferro Alloys. Edgar F. Price, Niagara Falls, N. Y. Application filed November 14, 1905.

The process of producing low-carbon ferro alloys consists in providing a charge containing ferro-silicon, an oxidized compound of a metal reducible by silicon and alloyable with iron, and a base flux; establishing an electric arc within the charge, surrounding the zone of reduction and protecting the electrodes from the oxidizing effect of the atmosphere by a considerable body of the charge and tapping the resulting slag and ferro alloy from the furnace.

825,359. Electric Furnace. Frederick T. Snyder, Oak Park, Ill. Application filed July 15, 1904.

This is an electric furnace of the induction type, which has, in combination with a core and a primary winding thereon, a chamber and several molten conducting materials contained in the chamber in series in an electric circuit around the core, these materials being of different resistance, whereby the greater heating effect of the current is localized in the higher-resistance material. (See cut on next page.)

825,367. Controller. Harold E. White, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed November 11, 1905.

A controller, with a revolvable shaft and a disk loosely supported on an axis concentric with the shaft, and means for holding the disk against rotation, including gearing, portions of which are secured to the disk and a fixed part of the controller are described. (See cut on next page.)

825,386. Electric Furnace. John F. Hammond, Brewster, N. Y. Application filed September 18, 1905.

In this furnace there is a muffle having a top and a bottom and side members, each of the portions of the muffle being provided with heating coils, these coils being connected by leads into a plurality of groups, and a commutator arranged to connect with the terminals of the groups of coils. The terminals and commutator are arranged so that the groups will first be connected in series; at an advanced position of the commutator the groups will be connected in parallel. In all positions of the commutator between the positions circuit will be established through one or more of the groups.

825,393. Controlling Switch for Motor Operated Doors. James W. Kellogg, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed June 20, 1904.

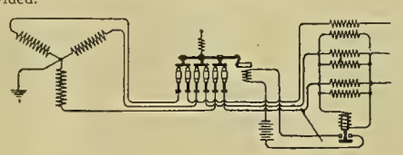
A manually operated reversing switch in combination with an electric motor on a motor-operated door, has both operative positions on the same side of its off position, with means controllable from a distance for moving the switch into an operative position.

825,396. Electrically Controlled Railway-switch. Frederict T. Kitt, Denver, Colo. Application filed July 18, 1904. Renewed June 15, 1905.

This is an automatic track switch for electric street railways, combining means whereby the switch tongue is shifted in one position by the passing of a trolley wheel over a contact placed on the trolley wire, and in the opposite position by means of the controller, of a car being operated a predetermined number of times while the trolley wheel is in contact with an insulated section of conductor.

825,397. Telephone Hook Switch. Herbert L. Knight, Cleveland, Ohio, assignor to the Williams-Abbott Electric Company, Cleveland, Ohio. Application filed March 15, 1905.

The invention relates to a removable telephone hook switch. In combination with a standard and its laterally projecting recessed pivot pin, there is a two-part switch lever, comprising a normally pivoted member and removable telephone hook adapted to be placed in position over the pivot pin, a securing latch or part thereon for engagement with the pivot pin; whereby the telephone hook is secured in position thereon. Switch springs and connecting means for actuating the springs upon the movement of the telephone hook are also provided.



NO. 825,286.—GROUND DETECTOR.

825,405. Condenser and Process of Making Same. Maurice K. McGrath, Chicago, Ill., assignor to the Western Electric Company, Chicago, Ill. Application filed November 28, 1902.

The invention relates to telephone condensers and the process of making them, which consists in assembling strips of foil and paper in a flat roll, reversely folding the flat roll into an S shape, treating the same with melted paraffin wax or the like, placing the folded roll in a narrow rectangular mold and subjecting the same to continued pressure while allowing the wax to cool and set.

825,406. Polarized Magnet. Device. Maurice K. McGrath, Chicago, Ill., assignor to the Western Electric Company, Chicago, Ill. Application filed January 11, 1904.

This invention consists of a perminate horseshoe magnet and a solenoid. Through the center of the latter is pivoted a moving member on the end of which is a soft piece of iron. The ends of this piece of iron are in position to be attracted or repelled by the poles of the magnet according to the polarity imparted by the current in the solenoid.

825,424. Measured Service System of Telephone Exchanges. Charles E. Scribner, Jericho, Vt., assignor to the Western Electric Company, Chicago, Ill. Original application filed February 23, 1904. Divided and this application filed February 6, 1905.

The system employes two branch circuits. A switch is used to connect the magnet with one branch. Another switch mechanism is adapted in a partial attractive movement of the armature to transfer the connection of the magnet to the second branch.

825,433. Speed and Spark Regulating Device for Explosive Engines. Thomas Van Tuyl, Iowa City, Iowa, assignor to The O. S. Kelly Western Manufacturing Company, Iowa City, Iowa. Application filed March 30, 1905.

Relating to an explosive engine, the patent describes the combination with a supply valve adapted to be operated by the piston suction, an exhaust valve and an electric igniter, a pivoted arm having connections to the exhaust valve and igniter, a disk having a cam to engage and move the arm to operate the exhaust valve, and a pin to engage the connection to the electric igniter. A latch is adapted to hold the arm out of the path of the cam.

825,434. Electrical Lamp Fixture. Nelson Weeks, Richmond Hill, N. Y., assignor to the Benjamin Electric Manufacturing Company, Chicago, Ill. Application filed June 21, 1901.

A cluster lamp fixture comprises an insulating base carrying a number of contacts for the central terminals of the lamps, in combination with a metallic cover, a series of sockets for the lamps, and insulating bushings interposed between the cover and the sockets.

825,439. Special Busy Test for Telephone Lines. Charles S. Winston, Chicago, Ill, assignor to the Kellogg Switchboard and Supply Company, Chicago, Ill. Application filed December 22, 1904.

The invention relates to the busy test of a telephone system, the combination with telephone lines having busy-testing terminals and cut-off relays connected with the talking circuits of the lines. A special testing apparatus has a connecting plug adapted to be inserted in a spring-jack of any line.

825,443. Electric Lamp Holder. Reuben B. Benjamin, Chicago, Ill., assignor to the Benjamin Electric Manufacturing Company, Chicago, Ill. Application filed May 7, 1903.

In a socket for incandescent lamps, with a suitable base, is provided a substantially hemispherical metallic casing mounted thereon, lamp contacts arranged within the casing and a lamp receiver carried on the base at one side of the center of the base and extending at an angle to the base and adapted to hold the lamp in an angular or inclined position.

825,444. Electric Lamp Socket. Reuben B. Benjamin, Chicago, Ill. Application filed February 27, 1904.

This invention relates to a lamp receptacle with suitable contacts therein, passage ways extending through the rear of the socket and communicating with the receptacle for the entrance of the leading-in wires and a pair of binding posts in the bottom of the receptacle consisting of screws accessible from the front of the socket, and co-operating fingers projecting into the passageway over which fingers the leading-in wires are adapted to be looped and clamped by screws.

825,445. Electric Lamp Fixture. Reuben B. Benjamin, Chicago, Ill. Application filed May 26, 1904.

This fixture has receptacles for several lamps and a plate with central threaded openings. An inclosing casing has suitable lamp openings, the electrical conducting parts of the cluster being inclosed within the casing of a combined cluster support and shade holder having an externally threaded stud to engage the central threaded aperture.

825,488. Push Button. Frederick A. Schneider, Toronto, Canada. Application filed March 21, 1905.

This push button has two normally separated contact plates, constituting the terminals for the conductors of the opposite poles of an electric circuit. As a means for bringing the contact plates together to close the circuit, an instrument-hook is used which constitutes a terminal for a conductor in shunt to the conductor of one of the contact plates.

825,496. Apparatus for Recording Telephonic Messages or Sounds. Hans Starcke, Elberfeld, Germany. Application filed February 14, 1905.

The invention relates to an apparatus for phonographically recording telephonic messages, comprising a number of phonograph cylinders, a number of radial rods supporting the cylinders and means for simultaneously rotating and effecting the transverse movement of the recording cylinders as they come into operative position.

825,501. Trolley Wheel. Charles F. Wilson, New York, N. Y. Application filed January 17, 1905.

With the hub and web of this trolley wheel two side plates are secured by rivets forming a chamber for lubricating material, the outer portion of the web being enlarged and rounded out and the side plates contacting with the web inside of the rounded-out portion.

825,509. Fire-alarm System. Benjamin F. Beane and Roy P. Bennett, New Paris, Ohio. Application filed December 7, 1905.

This alarm system is the combination of a general-alarm mechanism, an indicating-alarm mechanism, means to cause the action of the latter to be controlled by the former, electrically operated means to set the general-alarm mechanism in operation, and determining means having an electrically operated element to control the action of the indicating alarm mechanism.

825,538. Inductive Bond. Lemuel F. Howard, Edgewood, and Philip B. Rice, Wilkinsburg, Pa., assignors to the Union Switch and Signal Company, Swissvale, Pa. Application filed March 2, 1906.

In railroad signaling, where both track rails are divided by insulation to form block sections, there are provided an inductive band at each end of a block section and adjacent bonds electrically connected together by a single connection, each inductive bond comprising a conductor and a laminated magnetic covering for the conductor, each conductor being connected with the track rails of its block section and having parallel portions through which current of one character passes in opposite directions and a current of a different character passes in the same direction.

825,541. Process for Uniting Metal Pieces. Charles F. Jacobs, Chicago, Ill. Application filed November 6, 1905.

The invention is the process of uniting metal pieces, which consists in securing a form on the adjacent portions of the metallic pieces, placing molten flux in the space between the ends of the pieces, heating the ends of the metallic pieces through the agency of the flux and by means of an electric current, then turning off the current and displacing the flux by means of molten metal.

825,576. Electric Fan. Adolph F. Becker, Elizabeth, N. J., assignor to the Diehl Manufacturing Company, New Jersey. Application filed April 12, 1904.

An electric fan comprises a motor frame provided with a shank terminating in a ball, the shank being provided with an axial channel connected at one end with the frame and extending at its other end diametrically through the ball and flared outwardly beyond the center of the latter into a lateral slot. The base has a threaded boss and a socket member provided with an internally threaded hub fitted to the boss upon the base and having a socket with spherical upper end fitted to the bell.

825,591. Support for Anodes. Frank Engelhard, Frederick H. Engelhard and William A. Engelhard, Springfield, Mass. Application filed September 14, 1905.

This invention relates to a new support for an anode in an electrolytic solution, together with a special fastening.

825,621. Trick Telephone. John W. Trickett, St. Joseph, Mo. Application filed June 30, 1904.

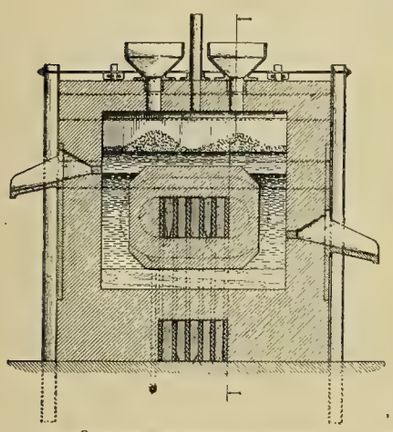
The invention relates to a trick telephone with an ejector tube having its forward end adapted to receive a harmless missile and by means of an electromagnet pull the trigger and eject the missive.

825,623. Combined Telephone and Alarm System. Harry G. Webster, Chicago, Ill., assignor to Milo G. Kellogg, Chicago, Ill. Application filed April 26, 1904.

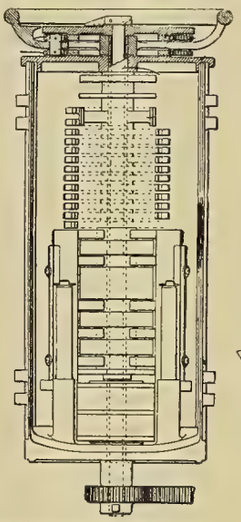
The system is a combination of a telephone exchange, a telephone instrument, a circuit extending from the instrument to the exchange and an alarm-receiving apparatus responsive to any interruption of current in the circuit.

825,624. Combined Telephone and Alarm System. Harry G. Webster, Chicago, Ill., assignor to Milo G. Kellogg, Chicago, Ill. Application filed July 11, 1904.

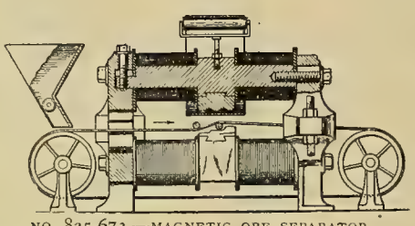
The invention includes a combined telephone and alarm system comprising a circuit extending from a substation to an exchange and means at the substation for producing different electrical variations in the circuit.



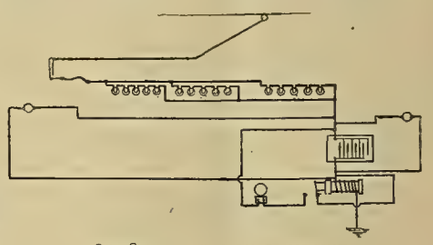
NO. 825,359.—ELECTRIC FURNACE.



NO. 825,367.—CONTROLLER.



NO. 825,672.—MAGNETIC ORE SEPARATOR.



NO. 825,847.—CAR SIGNAL CIRCUIT.

825,625. Combined Telephone and Alarm System. Harry G. Webster, Chicago, Ill., assignor to Milo G. Kellogg, Chicago, Ill. Application filed July 11, 1904.

The system has for its object a combined telephone and alarm system comprising a circuit extending from a substation to a telephone exchange and means for supplying a relatively small current to the circuit; also telephone signaling means for sending an increased current over the circuit, and a telephone signal receiving means operated only in response to such increased current. There is also an alarm signal transmittting means for sending decreased current pulsations of regular frequency over the circuit, alarm-receiving means operated only in response to the decreased current pulsations, and means at the substation and exchange for holding conversation over the circuit.

825,626. Combined Telephone Exchange and Alarm System. Harry G. Webster, Chicago, Ill., assignor to Milo G. Kellogg, Chicago, Ill. Application filed October 10, 1904.

The invention is an improvement in a telephone-exchange system, with the combination of a line circuit extending from a substation to the exchange, and a means for normally maintaining a current in the circuit of unequal value for the two limbs; also a means for interrupting the current in a predetermined manner and signal-controlling mechanism responsive to the interruptions.

825,632. Electric Switch. Charles F. Black, Dayton, Ohio. Application filed July 28, 1905.

An electric switch with a pair of spring contacts forming the terminals of an electric circuit and having curved contact faces is described.

825,635. Telephone Transmitter. Everett C. Brewer, St. Louis, Mo., assignor of one-half to William H. Nolker, St. Louis, Mo. Application filed January 19, 1906.

The transmitter is interesting in that it uses a secondary diaphragm located just back of the first diaphragm.

825,664. Electric Igniter. Henry M. Kolb, Philadelphia, Pa. Application filed October 10, 1905.

The igniter has two contact points which are brought together by pressing on a button with the thumb, and the circuit is then broken quickly by means of a spring on the end of one of the contact points.

825,672. Magnetic Ore Separator. Richard R. Moffatt, Brooklyn, N. Y., assignor to the Imperial Ore Separator Company, New York. Application filed July 19, 1904.

This separator has two poles of opposite polarity, one just above the other. A belt conveys the ore between the poles. (See cut.)

825,685. Combined Telephone Exchange and Alarm System. Harry G. Webster, Chicago, Ill., assignor to Milo G. Kellogg, Chicago, Ill. Application filed October 17, 1904.

The system is for a telephone exchange system in which there is the combination of a normally closed metallic telephone line including a source of current at the exchange, and an electromagnetic mechanism having an energizing winding in circuit with each line limb.

825,734. Switch-operated Signal-light. George W. Jordan, Purvis, Miss. Application filed September 26, 1905.

In combination with the rail and switch point co-acting therewith are an electric lamp, a fixed contact point supported adjacent to the rail and remote from the switch point, a movable point supported to be depressed thereagainst by a moving train, an electrical connection between the lamp and the movable point, an electrical connection between the lamp and the fixed point, a battery interposed in the connection, and means whereby the movement of the switch point may make and break connection.

825,781. Trolley. John H. Walker, Lexington, Ky. Application filed September 9, 1905.

The harp has upper and lower prongs, and the conduit-leads extend alongside the upper prongs and are braced against upward movement by the upper prongs and against downward movement by the lower prongs.

825,785. Device for Painting Overhead Wires. George Welman, New Orleans, La. Application filed April 9, 1906.

The device consists of means to suspend a tank adapted to contain a coating liquid from an overhead wire, means in the tank for applying the liquid, means for operating the applying means from the ground, and independent means for moving the tank along the wire. It is especially intended for electrical construction.

825,795. Insulator. Melvin F. Baker, Lewistown, Mont. Application filed July 25, 1905.

This insulator comprises a hollow box-like stem open on one side and wedge-shaped in longitudinal section. Insulating sections are arranged to clamp the wire between them, and there is a single connection between the stem and insulator sections, the connection serving as a pivot for the sections.

825,823. Burglar and Fire Alarm. Truman D. Goresline and Judson M. Cramer, Gardner, Kan. Application filed June 7, 1904.

A burglar and fire-alarm system includes a generator, motor and comprehensive gearing mechanism.

825,830. Vibrating Mechanism for Interrupting Currents in Spark Coils. John O. Heinz, Jr., Lowell, Mass. Application filed September 19, 1905.

The salient features are a vane or armature and two members of magnetic material, each of which has an arm adjacent to the pole of the electromagnet and to the vane or armature.

825,833. Electric Clock. Robert L. Hight, Decatur, Ill. Application filed August 31, 1905.

An escapement mechanism, an actuating spring therefor, a rotary electric motor for intermittently rewinding the spring, current-controlling means for the motor carried by the escapement mechanism and an automatic brake operatively connected to the motor and in circuit therewith and with the current-controlling means, are the essential features.

825,837. Separator for Secondary-battery Plates. Leonard W. Horton, Providence, R. I., assignor to the Rhode Island Electromobile Company, Providence, R. I. Application filed March 17, 1904.

A separator for secondary-battery plates has internal acid wells embraced within the bounding surfaces, the separator comprising two parts and arranged face to face, and means for locking the parts together. Internal acid wells are embraced within the bounding surfaces, and there is a tongue-and-groove connection between the parts.

825,838. Electric Switch. Edward B. Jacobson, Pittsfield, Mass., assignor to the Pittsfield Spark Coil Company, Pittsfield, Mass. Application filed February 4, 1905.

Fixed contact pieces are insulated from each other, separated by a narrow space, and each having a depression, and the movable contact arm has the projection adapted to enter the depression of either fixed contact piece and the space between the two fixed contact pieces, and which is held therein by spring action.

825,847. Electric Car Signal Circuit. William Lintern, Cleveland, Ohio. Application filed August 22, 1905.

In a system of maintaining display signals for electric railways, the combination, with the line conductor, consists of lamps in series arranged in parallel in circuit with the line conductor, a storage battery, the wire from the lamps being connected to one pole of said battery, the opposite pole of the battery leading to the ground, a signal device exteriorly displayed at each end of the car, and connections for each of the signal devices to the wire of the lamps leading to the battery and the ground connection of the battery. (See cut.)

825,856. Spark Plug. David B. Mills, East Orange, N. J. Application filed October 4, 1904.

A socket has a screw thread and a shoulder, and a shank of insulating material has thereon an enlargement adapted to rest on the shoulder and tapering upward from the enlargement. A threaded bushing surrounds the tapered portion and screws upon the socket to press the bushing against the tapered portion, the bushing where it presses upon the tapered portion being formed of soft metal whereby it is adapted to be upset by the pressing upon the tapered portion, the bushing being of a sufficient length to cause the soft-metal portion to be upset.

825,877. Dynamo-electric Machine. Paul Boucherot, Paris, France. Application filed May 12, 1905.

Combined are a number of magnetic poles and means for imparting to them symmetrical reciprocating movements in the same direction as the lines of force that they emit, the reciprocating means comprising magnetic poles with coils at right angles to the first set, and separate circuits for each set, the reciprocating movements of the first set serving to cause the passage of a constant magnetic flux alternately in one magnetic circuit and then in the other, these circuits being consequently the seat of variable fluxes, through windings suitably arranged and traversed by alternating currents.

825,879. Fuse. George Deisenhofer, Munich, Germany, assignor to R. Stock & Co., G. M. B. H., Berlin, Germany. Original application filed May 31, 1905. Divided and this application filed August 7, 1905.

A safety fuse is described.

825,882. Battery. Charles W. Harper, Malden, Mass. Application filed April 8, 1904. Renewed June 12, 1906.

The device constitutes a box for pocket batteries having a pair of contacts upon the interior to connect with the electrodes of a battery, one of the contacts being connected with a sleeve adapted to receive one terminal plug of a circuit. A number of resistance coils are mounted on the box and connected with the other contacts; a number of fixed contacts also mounted on the box each connect with one of the coils, and a movable contact is co-operatively arranged with relation to the fixed contacts, a sleeve connecting with the movable contact adapted to receive the other terminal plug of the circuit.

PATENTS THAT HAVE EXPIRED.

Following is a list of electrical patents (issued by the United States Patent Office) that expired on July 16, 1906:

406,800. Electric-heating Apparatus for Railway Systems. M. W. Dewey, Syracuse, N. Y.
406,874. Electric Motor. J. Buckley, Boston, Mass.
406,897. Electric Switch. T. F. Gaynor, Louisville, Ky.
406,906. Cut-out for Electric Circuits. W. S. Hill, Boston, Mass.
406,916. Secondary Battery. I. Kitsee, Cincinnati, O.
406,917. Electric Track Sweeper. W. H. Knight, New York, N. Y.
406,922. Electric Motor. G. W. Mansfield, Cleveland, O.
406,949. Non-conductive and Elastic Waterproof Composition for Pipe-joints, etc. B. Overlack, Boston, Mass.
406,961. Regulating Device for Electric-railway Cars. W. M. Schlesinger, Philadelphia, Pa.
406,968. Dynamo-electric Machine. N. Tesla, New York, N. Y.
406,969. Secondary Battery. C. H. Thompson, Detroit, Mich.
406,975. Motive Apparatus and Time Indicator for Use with Secondary Batteries. J. T. Van Gestel, New York, N. Y.
406,978. Underground Conduit. T. Wallace, New York, N. Y.
408,981. Automatic Cut-off for Secondary Batteries. A. Amory and R. Amory, Boston, Mass.
406,994. Electric Wiring. F. R. Chinnock, Brooklyn, N. Y.
406,997. Galvanic Battery. P. B. Delaney, New York, N. Y.
407,004. Telephonic Apparatus. N. S. Fisk, Utica, N. Y.
407,006. Automatic Regulation of Electrical Circuits. Wm. W. Griscom, Haverford College, Pa.
407,014. Regulator for Electric Motors. J. F. Kelly, New York, N. Y.
407,077. Electric Cut-out. J. L. Kimball and H. C. Wirt, Boston, Mass.
407,085. Power-transmitting Device. W. Main, Brooklyn, N. Y.
407,087. Power-transmitting Device. W. Main, Brooklyn, N. Y.
407,088. Power-transmitting Device. W. Main, Brooklyn, N. Y.
407,089. Method of Transmitting Power. Wm. Main, Brooklyn, N. Y.
407,090. Power-transmitting Device. W. Main, Brooklyn, N. Y.
407,091. Power-transmitting Device. W. Main, Brooklyn, N. Y.
407,092. Power-transmitting Device. W. Main, Brooklyn, N. Y.
407,093. Method of Vehicle Propulsion by Electric Motors. W. Main, Brooklyn, N. Y.
407,094. Car-propelling Apparatus. Wm. Main, Brooklyn, N. Y.
407,095. Method of Vehicle Propulsion. Wm. Main, Brooklyn, N. Y.
407,115. Electric Brush. H. P. Pratt, Chicago, Ill.
407,116. Electro-therapeutic Device. H. P. Pratt, Chicago, Ill.
407,154. Electric Machine. E. H. Bennett, Jr., Bayonne, N. J.
407,188. Electric Railway. S. D. Field, New York, N. Y.
407,204. System of Electrical Distribution. D. Higham, Philadelphia, Pa.
407,210. Lighting System. J. H. Hunter, Pittsburg, Pa.
407,293. Regulation of Electric Motors. D. Higham, Philadelphia, Pa.
407,294. Method of Electrical Distribution by Secondary Generators. R. Kennedy, Glasgow, County of Lanark, Scotland.

WESTERN ELECTRICIAN

EVERY SATURDAY

Vol. XXXIX. CHICAGO, JULY 28, 1906 No. 4

Hydro-electric Station at Champ, France.

By A. De Courcy.

The large electric plant which has been erected on the Drac River, in the region of Grenoble, France, uses a considerable amount of hydraulic power, and it has been constructed with a view of supplying current for electric motors throughout a wide extent of country. These motors are mainly placed in the large factories which are situated in the valleys of the Fure and the Morge (see map, next page). The present plant, located at Champ (not shown on the map), is controlled by a large syndicate known as the Fure and Morge Hydro-electric Company, and is one of the leading electrical enterprises of the Grenoble region. At present it has five turbo-alternators of the Brown-Boveri make, having a total output of 7,000 horsepower, on the three-phase system. The generator current of 3,000 volts is transformed to 26,000 volts for the overhead line, which is some 20 miles long and has a number of branch lines. Transformer stations at the factories are used to lower the tension to 2,000 or 1,000 volts.

Water passes from the dam into a large settling chamber and thence into the main canal, which is 2,000 feet long, and ends in a large reservoir. From here leads a penstock of somewhat novel construction, which is one of the features of the plant. It is built of armored concrete and is laid along the ground at a gentle slope. The inside diameter of the penstock is over 11 feet, and it runs for a length of 15,000 feet, including a sheet-iron section, which is placed at the end, and leads to the station (Fig. 1). A net fall of 115 feet is obtained in this case, which gives about 7,500 horsepower with a flow of 20 cubic yards per second.

Fig. 2 shows a view taken in the main hall containing the turbine and dynamo groups. Here are five direct-coupled sets which have been so far installed in the plant. The switchboard is on the left-hand side of the hall in a special gallery. Below the switchboard panels is an annex room of considerable size, in which is the switchboard apparatus for the high-tension and other circuits. The panels which are placed in the gallery are devoted altogether to the low-tension circuits.

The turbines which are used in the station are of French make and were built by the Negret-Brenier works of Grenoble. They are of the centrifugal horizontal-shaft pattern. The water outlet piping of these turbines is disposed so as to give an aspiration of some 16 feet. A uniform speed of 300 revolutions per minute is used for the present groups, and this is kept very nearly constant by an improved system of automatic governors. When running at full speed the amount of water taken by the turbines is 140 cubic feet per second. Speed regulation is secured by the use of a hydraulic motor working from a belt-driven pump, and is designed to open and close the water gates of the turbines. The valves of the hydraulic motor are operated by the ball governor, and the motor thus opens or closes the turbine inlet so as to keep the speed constant. In order to give a constant rate of flow in the penstock, so as to prevent the shocks which would occur were the governor to suddenly shut off the flow, the governing device is designed so that when the orifices of the water supply are closed off more or less, at the same time the hydraulic motor opens a second set of discharge holes to allow the surplus water to pass to the outlet of the turbine.

Turning to the five alternators of the station, it may be remarked that these machines are of uniform construction, and are designed to furnish three-phase current at 50 cycles. When running at the regular speed of 300 revolutions per minute the alternators deliver 3,000 volts. Fixed field and armature windings are employed, with a revolving inductor. For the inductor there is a wheel of large diameter, provided with 20 pole projections, these poles being formed of laminated iron. Some 1,000 kilowatts can be delivered at a maximum, with $\cos.\Phi = 0.8$. Inside the main ring casting is fixed a ring of laminated iron, which forms the armature, and alongside it is a second ring for the field.

The armature uses a copper cable winding, placed in a set of holes around the inside of the ring. Each of the holes contains six turns of cable. There are 10 armature coils per phase, and the windings are connected on the star system. Here the coils are connected in a series of five, and the two series thus formed are joined in parallel. The copper cable of this winding has a section of 34 square millimeters. Each armature coil takes in six of the holes, making 36 conductors, or 18 total turns of cable per coil. All included, these machines weigh some 32 tons each, with the inductor counting for nine tons.

Smaller turbines, two in number, drive the exciters, which are shunt-wound, and run at a constant speed of 500 revolutions per minute. They

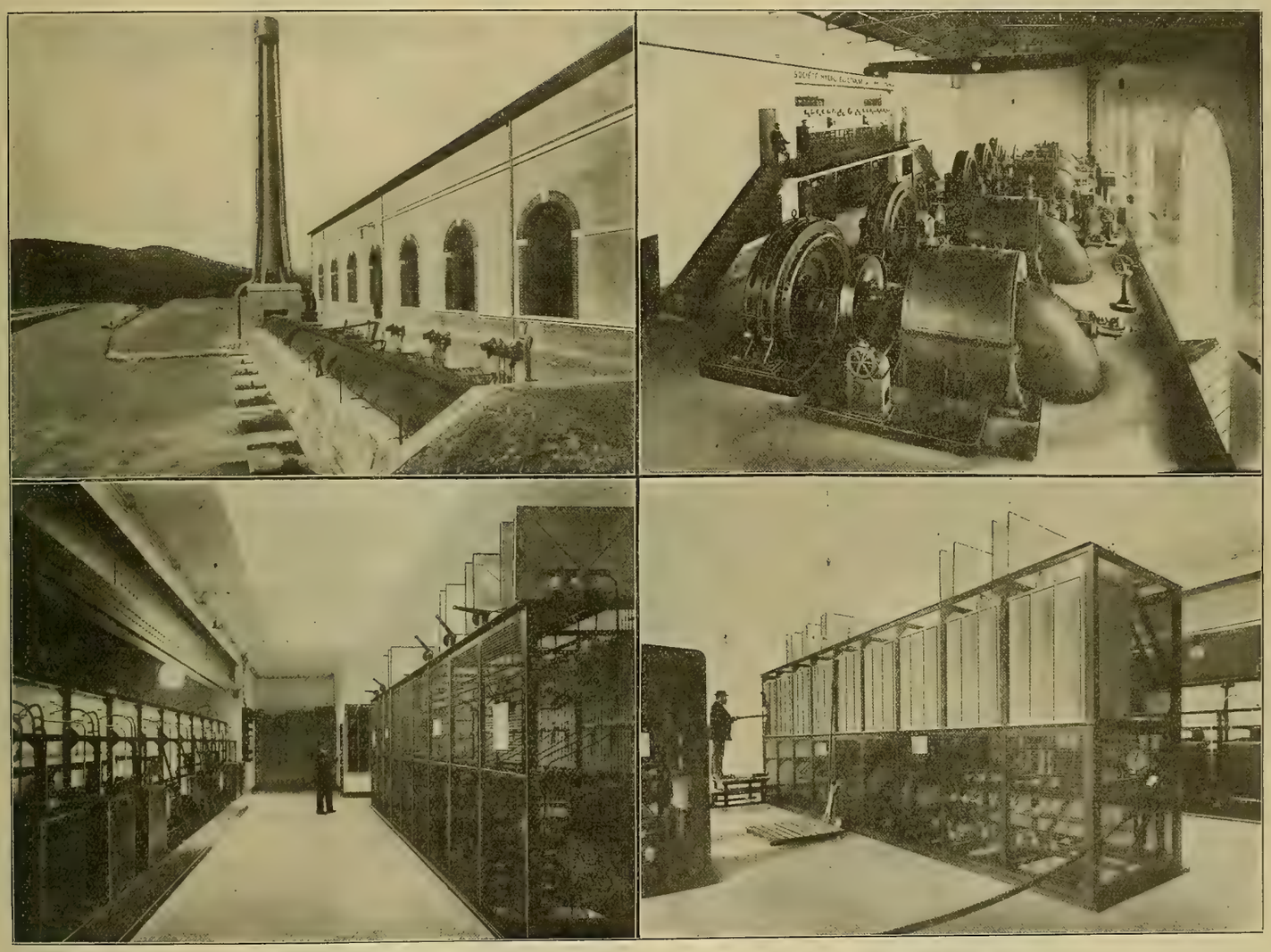


Fig. 1. Exterior View Showing End of Penstock at Station.
Fig. 2. View in Generating Room.
Fig. 3. View in Switchboard Room.
Fig. 4. High-tension Switchboard.

HYDRO-ELECTRIC STATION AT CHAMP, FRANCE.

are rated at 150 horsepower each. From these machines the alternator fields are excited at 115 volts.

A small room which lies off the main machine room contains the transformers of the station, and Fig. 6 shows the five transformer units which the plant now contains. These units are of considerable size, each one being designed to give 1,200 kilowatts. Windings have been given them so as to raise the generator current of 3,000 volts up to high tension at 15,000 or 26,000 volts, which are the two standards used. Of the three-phase system, they have three laminated cores placed in the same line. Well-insulated primaries and secondaries are placed on the cores, and the whole is contained in a large sheet-iron cooling box about 10 feet high. Oil is contained in the boxes, and the latter is cooled by a double worm tube having a high-speed water circulation.

The low-tension coils which take the 3,000 volts are wound in three separate parts on each of the phases, so that a tension of 1,000 volts may be used when desired, by coupling the three coils in parallel for each phase. On the top of the transformer case are the six terminals of the high-tension windings from which the six cables run, on porcelain insulators, fixed in the wall and ceiling, to the switchboard. On the right are the three low-tension cables of large section which lead through the wall to the machines. By the design of the terminals, it is easy to connect the high-tension coils either in star or delta, so as to have 15,000 or 26,000 volts. The weight of these transformers is about 10 tons each.

Switching apparatus of well-planned design is to be found in this station. Behind the marble panel board of the gallery is a large room which contains the apparatus and connections for the high and low-tension circuits. The middle tension apparatus is placed in a second room which lies under this one. Fig. 3 shows the back of the marble panels and one side of the iron framework containing the high-tension board and instruments. Fig. 4 shows the other side of the high-tension board. In the framework are mounted the bars, instruments and switches of the 15,000-volt and the 26,000-volt circuits. In the lower part are the bus-bars, designed so that the high-tension ends of the transformers can be connected in star or in delta.

Between the marble panels at the top of the frame are special switches for connecting the high-tension ends of the transformers to the bus-bars. Blow-out shunts are used on these switches for taking up the arc. On the frames are placed six small transformers for giving low tension to the instruments; also a transformer for the large voltmeter placed on the low-tension board. Two main oil switches are designed to work on 26,000 volts, and are operated from the front part of the low-tension board by a transmission device. Lightning arresters of the double-horn pattern, combined with liquid resistances, are placed behind the high-tension frame. Where the lines leave the station there is another set of arresters.

The high-tension lines consist of bare copper wire mounted upon green glass insulators of American make, which had been tested at 80,000 volts. The main line, which is about 20 miles long, runs from the plant to Grenoble, and thence as far as Moirans. Two branch lines start from this point (see map, Fig. 5), one of them running along the valley of the Morge, and the second reaching the town of Rives. Two other branches start from here, one of which passes along the Fure Valley. At present these lines supply current for 60 large factories which are located in the region.

A type of small square building is used for the sub-stations, topped by a chimney for leading out the wires. A set of transformers lowers the tension from 26,000 to 2,000 or to 1,000 volts, according to circumstances, and where the lines reach the factories we find usually a set of 120-volt transformers for the motors. In some cases the motors use 1,000 volts directly at the terminals, and a few of the motors run on 2,000 volts.

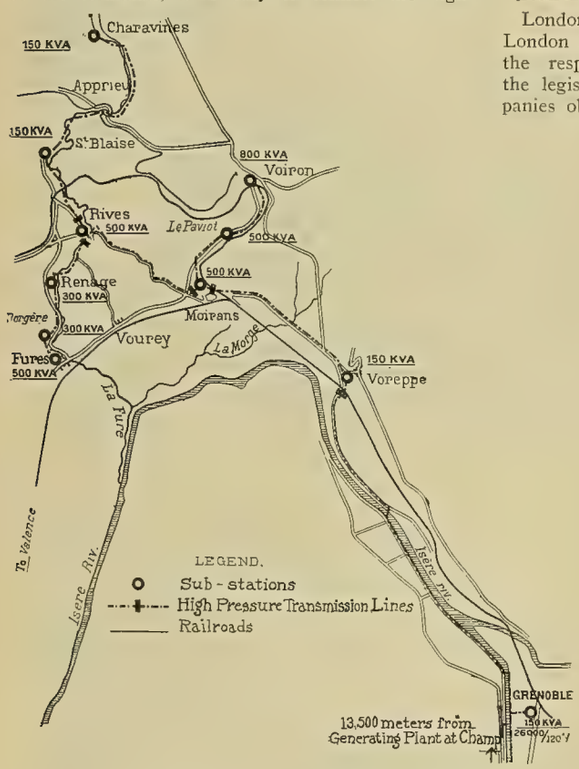


FIG. 5. MAP OF HIGH-TENSION LINES AND SUB-STATIONS SUPPLIED FROM CHAMP HYDRO-ELECTRIC PLANT.

The London County Council's Electric Generating Station and Tramway System.

[From the London correspondent of the Western Electrician.]

London, July 11.—The history of tramways in London has been an eventful one, to say the least. the responsibility for which rests largely upon the legislature. As far back as 1869 private companies obtained powers to construct tramways, and in the following year the Tramways Act of 1870 was passed. That act, with all its provisions applying to the conditions of the tramway industry 36 years ago, remains in force today without any modification whatever to bring it into line with the new circumstances arising out of the advent and development of electric traction.

In 1870 the municipal authority governing London was known as the Metropolitan Board of Works, and it left the field of tramway enterprise so completely to private companies that by the year 1890 no less than 15 tramway companies had powers in various parts of London. As the main purport of this article is to describe briefly the generating station at Greenwich, I will conclude these introductory remarks with the simple statement that after the old Metropolitan Board was superseded in 1899 by the creation of the London County Council the latter quickly took the tramway question in hand, and under the purchase powers of the Act of 1870 commenced to buy up the various interests. That policy has since been persistently pursued, and the result is that at the present time practically all the tramways in London are owned by the Council.

In an article which appeared in the Western Electrician of January 11, 1902, full particulars were given of the opening of the first section converted from horse to electric traction, for which—as well as for all subsequent sections—electrical energy was purchased from one or two of the London electric supply companies. Some 30 street miles of tramway is now being worked electrically, mostly in the south, while the extensive system in the north, which only came into the possession of the council on May 1st of this year, is now actively being reconstructed.

In July, 1901, steps were taken for acquiring certain land at Greenwich, whereon to erect a permanent generating station, and a power house was designed so that, when completed, it should be capable of supplying sufficient energy for the whole of the tramways of the Council. This station is now half completed, and the following are the detailed particulars.

Greenwich Station.

The site of the station (see diagram on next page) is on the Thames at Greenwich, this spot being chosen, among other considerations, for the facilities afforded in the economical transport of coal, and on account of the convenient supply of river water for condensing purposes. There is an area of 3¾ acres with a river frontage of 240 feet. The building is in two parts, the first of which is now completed, the second being in progress and separated from the first by a temporary corrugated-iron screen. The complete structure will measure about 475 feet by 195 feet and about 80 feet high. The station consists of a boiler house, engine room, offices, sub-station, workshop, pump and strainer houses, outside coal bunker and a pier for unloading purposes.

The coal is brought alongside the pier, which has been designed by the Council's engineer to accommodate heavy steam colliers. The coal is carried from the steamers in trucks and tipped into outside coal bunkers, which feed the mechanical conveyors. These latter carry the coal to the main coal bunkers, which are situated over the boilers and have a total capacity of 13,500 tons. The ashes from the furnaces are removed by the conveyors on their return journey and are shot into barges at the wharf. The cranes are electrically controlled, the grabs holding about 2,800 pounds each. The object of having an outside bunker was to aid in the expeditious unloading of the 2,000-ton colliers.

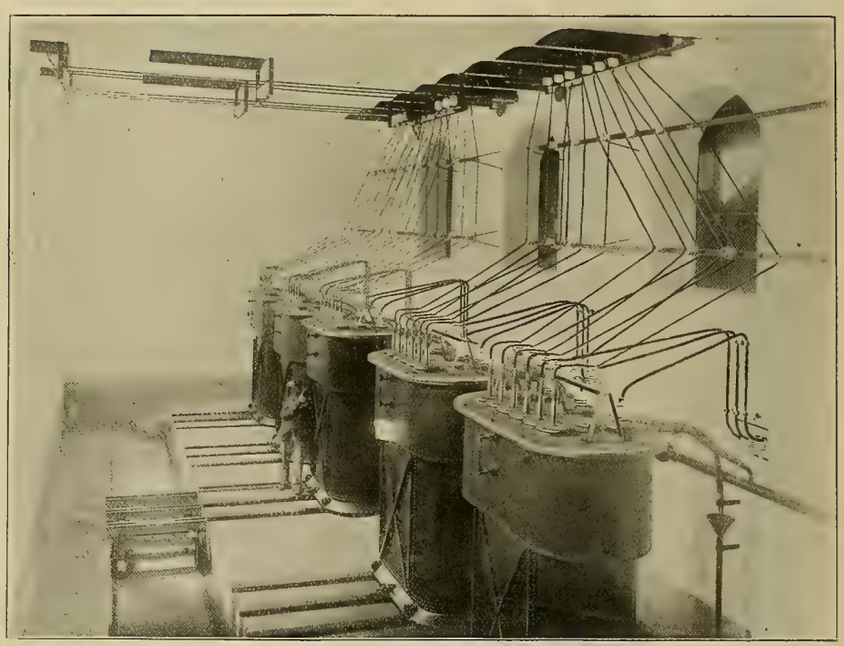


FIG. 6. FIVE 1,200-KILOWATT TRANSFORMERS AT CHAMP HYDRO-ELECTRIC STATION.

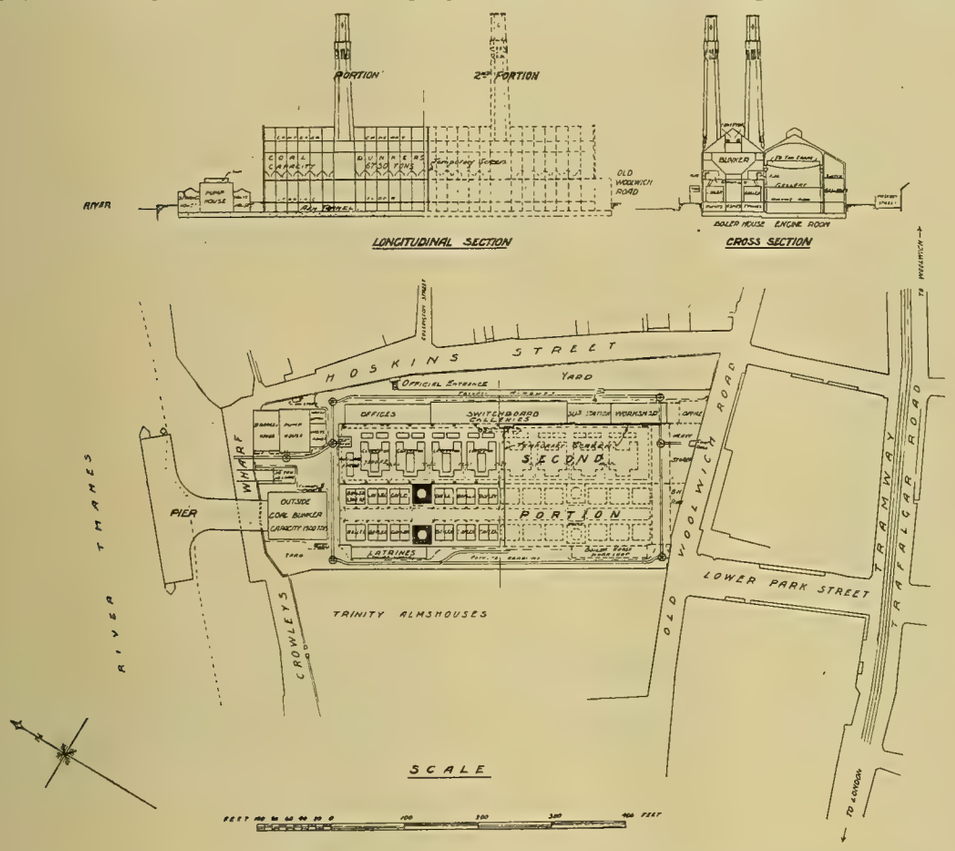
Boiler House.

The boiler house contains 24 Stirling water-tube boilers of the five-drum type, arranged in pairs in two rows, with a firing floor between. Each boiler has an evaporative capacity of about 16,300 pounds of water per hour, working at 200-pound pressure. Chain-grate stokers are fitted. A superheater is placed between the first and second banks of vertical tubes and forms an integral part of the boiler, the amount of superheat being required to raise the temperature of the steam to 500° F.

Eventually there will be four chimneys, but two only are at present erected, these having a height of 250 feet, with an internal diameter of 14 feet. The pairs of boilers are set in groups of three,

with their economizer block and main flue inlet to the chimney above. The boiler groups are equivalent to one of the engine units, and the present half of the station may therefore be said to be divided up into four units of boilers, economizers, flues, engines, etc. Each pair of boilers has its own economizer on the floor above, consisting of 320 tubes, arranged in 32 sections, the scrapers of which are driven through worm gearing by small independent three-phase motors.

On one side of the basement of the boiler house are situated three pump rooms, each containing three horizontal ram pumps. These are each driven by a 35-horsepower series-wound motor, the pumps delivering 8,000 gallons of water per hour against a pressure of 225 pounds. These direct-current motors have two voltages, viz., 125 and 500, with a change-over switch, so that the pumps



PLAN AND SECTIONS OF GREENWICH STATION OF LONDON COUNTY COUNCIL.

can be run at a low speed efficiency. On the other side of the boiler-house basement are situated the hot-well tanks, which are filled from the condensers after the water has passed through chemical purifiers. A water-softening apparatus is installed, and make-up feed water is obtained from an 8½-inch artesian well 350 feet deep.

Engines and Generators.

The feature of the station is in the engine room, where are to be seen the large vertical-horizontal engines, which are generally regarded as the last of that type to be installed in a large power house. There are four generating sets of 3,500-kilowatt normal capacity each. Each engine consists of two complete half engines, one on each side of the generator, consisting of a vertical high-pressure cylinder 33½ inches in diameter and a horizontal low-pressure cylinder 66 inches in diameter. The stroke in each case is four feet, and the two connecting rods on the one side of the engine work on to a common overhung crankpin.

The engines run at 94 revolutions per minute and work at 180 pounds steam pressure. Corliss valves are used on both cylinders, and the exhaust from the high-pressure cylinder passes through a receiver on its way to the low-pressure cylinder, and is there reheated by live steam direct from the boilers. The whole of the engines are entirely enclosed and work with forced oil lubrication, pumps in duplicate being provided. The arrangement of the cylinders creates a perfectly natural drainage. There is an independent steam supply to each cylinder, each of which has its own condenser. These latter are of the surface type, with separate motor-driven air pumps. On its way to the condensers the exhaust steam passes through oil separators.

The generators are mounted directly on the engine shaft between the two half engines of each set. They are of the revolving-field type and generate current at 6,600 volts between phases at 25 periods per second. The normal output is 3,500 kilowatts, or 306 amperes per phase, and 4,735 kilowatts on emergency overload. The stators are star-wound with the center point grounded. The coils are form-wound and are laid in open slots, there being five slots per pole per phase. The excitation is at 125 volts, and each alternator has its own independent exciter driven by ropes from a pulley on the main shaft. There are also two independent direct-current steam sets of 150 kilowatts capacity each, which are used for lighting the station, a standby for excitation, etc.

Piping.

The steam pipes are laid on a simple system. Each pair of boilers is coupled together as one and has a single steam pipe leading directly to a main steam header in the engine room. From this header branches go to the engine separators, and there is a continuous fall in the pipes all the way from the boiler stop valves to the engine separator. Special provision is made for expansion, and the pipes are anchored at certain places. The drainage is perfectly natural, and there are no places whatever where the water can lodge.

Switching Apparatus.

The main switchgear is mounted on two galleries in the center of the long side of the engine room farthest from the boilers. The oil switches are on the top gallery. The switchgear throughout is of the oil-break remote-control electrically operated type, provision being made for eight generators and 32 feeders, each generator being coupled directly to a section of four feeders. The operating table is on the lower gallery and contains the small switches which control the main oil switches. These operations are carried out by direct current at 125 volts. Immediately behind the operating desk is the auxiliary switchboard for controlling the station lighting, station motors, auxiliary machines and certain low-tension tramway feeders which supply the tracks in the neighborhood of the station. This is a 46-panel board, all the circuits being protected by loose-handle automatic carbon-break circuit-breakers and knife switches in series with the same.

Other Features.

A sub-station adjoins the power house and contains three 500-kilowatt motor generators running at 300 revolutions per minute for transforming the 6,600-volt three-phase current to 550-volt direct current for local tramway lines. A battery of 280 accumulator cells is worked in conjunction with these machines. There are nearly a dozen similar sub-stations in various parts of London, and others are in course of construction, many of them for the northern lines now being converted.

A special condenser pumphouse has been constructed, and elaborate straining facilities are employed on account of the difficulty that has been experienced in previous attempts to use the Thames water for condensing purposes.

The pier which has been erected for dealing with about 1,000 tons of coal per day is T-shaped and projects into the river for a distance of about 118 feet 6 inches, the head of the T, which faces the river, being 200 feet long by 40 feet 6 inches wide. The structure consists of 16 cast-iron cylinders sunk in the bed of the river to a depth of about 26 feet below datum, or about 18 feet below the bed of the river, and filled with concrete supporting a framework of steel girders, on which is placed a timber platform. The total cost of the pier, including the condensing water pipes and a wharf wall about 260 feet in length, was about $265,000. The total cost of the station when completed is estimated at about $4,500,000, but as turbine sets will be installed in the second half and the capital cost per kilowatt generally will be less, it will be seen that the first half has cost over $2,500,000.

It may here be stated that the work on the second half of the station has been temporarily suspended pending the appointment of a commission of investigation into the interference which the Greenwich Observatory authorities allege the station is causing to their observations and instruments.

It must be mentioned that the whole of the design of the works has been carried out by the officials of the London County Council, and to Mr. J. H. Rider, the tramways electrical engineer, is due practically the entire credit for the design of the equipment.

G.

Diversion of Water for Power Development at Niagara Falls.

Inasmuch as the Burton bill went into effect when passed by Congress and signed by the President, Secretary of War Taft has seen the advisability of issuing temporary permits to such companies as are developing power at Niagara Falls or transmitting electricity from the Canadian side into the United States. These permits, as stated, are temporary, and are given to cover the existing conditions and in order that the companies may not violate the law.

The Niagara Falls Power Company is granted a permit to withdraw 8,600 cubic feet of water per second, and the Niagara Falls Hydraulic Power and Manufacturing Company is granted a temporary permit to withdraw 4,000 cubic feet per second until further order of the secretary of war. To the Lockport Hydraulic Company a permit has been issued allowing that company to withdraw 500 cubic feet of water from the Erie Canal and for the use of 333 cubic feet from the lower level of the same canal at Lockport, the idea being that these two amounts are duplications, and that a future permit for 500 cubic feet per second will cover them both.

In relation to the transmission of power from Canada to the United States, the secretary admits having received applications for the transmission of 281,500 horsepower, and says:

"It is necessary that the secretary of war should know before final action is taken by him in the matter of permits for transmission the capital already invested in Canadian companies, the degree of completion of the plant, the amount of current likely to be sold on the Canadian side, the time when the plant shall be ready for operation, the amount now actually transmitted to the United States, the amount invested not only in the production of current, but in the plant and machinery for its transmission, including the poles and wires and all the details, and also the capital invested by the American companies who are to receive in the first instance the current thus produced; the form in which that capital is, and the contracts into which they have entered both with the Canadian companies and with the companies or persons to whom they expect to sell the current, the dates of these contracts, and all the circumstances tending to show the extent of the injury that a refusal to grant the permits requested would cause to the investment of capital, together with the question of when the contracts were made upon which the claims for the use of the current are based, with a view of determining the good faith with which these contracts were entered into, and whether the threatened passage of the law induced their making."

Captain W. Kutz of the Corps of Engineers has been appointed to make an investigation upon all the above questions.

However, temporary permits have been granted to two companies in the matter of transmission. The Niagara Falls Power Company is granted a permit to take not to exceed 25,000 horsepower from the Canadian Niagara Power Company, and the Niagara, Lockport and Ontario Power Company is authorized to take not to exceed 25,000 horsepower from the Ontario Power Company.

D.

Fundamental Principles of Gas Engines.[1]

By Robert T. Lozier.

The first question that occurs to one entering the gas-engine subject is perhaps the following:

Do steam engines and gas engines belong to the same general class? They do, in so far as they are both heat engines, which depend for their operation upon that well-known principle which Professor Rankin covers in the definition he gives of the first law of thermo-dynamics, as follows: "It is a matter of ordinary observation that heat, by expanding bodies, is a source of mechanical energy." That is to say, if we take a cylinder containing a charge of fluid against which rests a piston, and apply heat to the cylinder, the expansion will push the piston out, and make it do work. This fluid may be steam, or gas, or air, etc. So that in this respect gas engines and steam engines are the same, in that they are both heat engines.

In what respect, then, does a gas engine vary from a steam engine? The answer is that with the steam engine the fuel is burned in the firebox of a boiler, located apart from the engine, while, with the gas engine, the fuel is burned directly in the engine cylinder. In the case of the steam engine, we find that much of the heat of the fuel is wasted in changing water from its liquid state into a vapor that will expand and give pressure as the temperature is raised. This heat, so used, is called latent heat, and consumes 966 British thermal units, to change one pound of water into steam. Then, again, in order to transmit the steam to the engine it must be kept down in temperature, so that the pressure can be confined by the steam pipe lines and their fittings. But with a gas engine, the gas may be transmitted to the engine at practically atmospheric pressure and temperature. Its heat is not developed until it is safely within the engine's cylinder, which is the exact point where the work is to be performed, and where it is fired, and, therefore, they are called "internal-combustion engines."

Having found the difference between these two types of engines, the next question is, Which is the more desirable? Which engine will turn out the greatest amount of power for a given consumption of coal? It is generally understood that fuel is the greatest single factor in the cost involved in delivering power, and represents from 50 per cent. in small plants to 60 per cent. in large plants of that cost, as has been determined by actual operation. In gas plants the fuel is only from 25 to 33 per cent. of the cost of the power, but in order to bring out this point of efficiency most clearly, let us first develop it from the beginning by taking the theoretical view of the case, and having found out what this is, we can then see how far it is followed out in practice.

The unit representing the calorific values most used when dealing with gas engines, gas producers, gases and fuel is the British thermal unit, abbreviated to "B. T. U." A British thermal unit represents the quantity of heat required to raise the temperature of one pound of water, 1° F., at 39° F. One B. T. U. equals 778 foot-pounds, and there are 2,564 B. T. U. contained in a horsepower. It will be seen that in considering the efficiency of a heat engine the temperatures involved are necessarily the governing factors. The theoretical efficiency of a perfect heat engine of any type is determined by the simple formula,

$$\frac{T-T_1}{T} = \text{efficiency},$$

in which T is the acquired temperature from absolute zero, or the temperature of the power-transmitting element at the time of expansion figured from absolute zero (which is 460 degrees below Fahrenheit's zero), and T_1 the final absolute temperature after expansion. The difference between T and T_1 is known as "the temperature range." The ratio that this temperature range bears to the total temperature taken from absolute zero is the percentage of thermal efficiency that the engine has. It will be seen that we work down to absolute zero.

In Fig. 1 we have worked out practical cases, having assumed for the gas engine that the temperature of the gas mixture at explosion is 2,500 degrees above F. zero, which, when added to 460 degrees below that zero, gives a total absolute temperature for the explosion of 2,960 degrees, which is the heat that the engine received. The exhaust has a temperature of 800° F., which, when added to 460, gives 1,260 degrees. This, when deducted from the original temperature of 2,960 degrees, leaves 1,700 degrees, as a credit to the engine, or an efficiency (thermal) of 57.5 per cent., provided the engine is a perfect translator of energy.

Now for the steam engine. I choose to take the temperatures of the engine cited by Mr. Henry G. Stott in his paper before the American Institute of Electrical Engineers in January, because I desire to use them in the commercial comparison that I will next make. He assumes a temperature for the steam at point of admission of 367° F., which, when added to 460 degrees, gives an absolute temperature of 827 degrees, while the temperature of the exhaust is given as 100° F., plus 460, or an absolute temperature of 560 degrees exhaust. Deducting this from the total temperature of 827 degrees, we have for this steam engine a temperature range of 267 degrees, which is 32.3 per cent. of 827 degrees, the total range, and 32.3 per cent. in this case represents the thermal efficiency of the steam engine. It will be remembered we found the thermal efficiency of the gas engine to be 57.5 per cent.

Some writers elect to put gas and steam engines on the same basis of comparison, by assuming, for theoretical purposes, that they will both exhaust at atmospheric temperature, say 60° F. On this assumption the steam engine will figure out a theoretical thermal efficiency of 37 per cent., and the gas engine with an explosion temperature of 2,500° F., a theoretical thermal efficiency of 82 per cent. But, whether you take it on a theoretical assumption, or whether you use temperatures that may be expected in practice, it is plainly evident that the gas engine has a very much higher thermal efficiency than the steam engine, because the power conveying medium can be eventually used at greatly higher temperatures.

The foregoing assumptions have, as stated, been worked out on the principle that both the gas and steam engines were perfect devices for transforming or translating their useful temperature ranges entirely into useful work. Of course, in practice a proportion of this temperature that is represented by what I have called useful temperature range is used to overcome the friction of the engines, and is also lost in radiation, etc. Then, again, in considering the over-all efficiency of a practical commercial plant, as taken from the coal pile to the engine wheel, you must include the losses of piping, auxiliaries, boilers with stacks, or producers, as the case may be, and we find that in this respect the gas engine is again more efficient, because it has a commercial efficiency from coal pile to driving wheel of 20 per cent., while the very best steam practice in America, as given by Mr. Stott, is but 9.7 per cent., and in Europe eight per cent., and in Great Britain seven per cent., as given by Mr. H. M. Hobart. Furthermore, the commercial efficiency which I have just given for the gas-engine plant is obtained by even the small installations, while those given for the steam plants represent the very highest results that have so far been obtained with the largest and most economical central stations equipped with the very latest apparatus.

Having determined these commercial efficiencies, let us see just what differences in actual pounds of coal consumption they represent. This is easily done. We will divide 2,564 B. T. U., the theoretical quantity required to produce one effective horsepower, by the per cent. efficiencies that we have just determined for each kind of engine, respectively. We then find that the gas engine requires at 20 per cent. 12,820 B. T. U. in order to supply one brake horsepower, and there being 13,500 B. T. U. in an average pound of coal, we easily develop one brake horsepower at the engine from one pound of coal burned in the producer. With the steam engine, dividing 2,564 B. T. U. by 9.7 per cent. efficiency, we must have 26,500 B. T. U. to get one brake horsepower, so that the steam engine will require two pounds of coal burned in the boiler to develop one brake horsepower; at eight per cent. efficiency 2½ pounds, and seven per cent. 2¾ pounds of coal.

These coal consumptions which we have cited represent the very highest engineering practice in their respective countries; other steam-plant coal consumptions will run as high as nine and 10 pounds of coal per brake horsepower, in small central stations and industrial plants in which the installations are inefficiently installed and operated. With the gas plant not only is the apparatus itself inherently more efficient, but its operation is far more simple, and eliminates to a much greater degree the personal equation of the operators, so that one pound of coal per brake horsepower is easily attained in even the smallest gas plants against 10 pounds of coal by steam plants of equal size. The cost of maintenance is less and the cost of operating large gas engines and producer plants is one-half that of steam plants, and where the gas is supplied from an outside source, such as natural gas, blast-furnace gas, etc., the labor is only one-third that of a steam plant if having corresponding capacity.

As concerns repairs, it is possible that for the gas engines they may now be slightly higher, due to the newness of the art, but with a producer plant and its auxiliaries, repairs are far lower than in the corresponding departments of a steam plant, so that the total repairs are less. As concerns overload capacity, a characteristic feature of the gas engine is that its maximum capacity is reached when taking its maximum charge of gas and air combined in the right mixture, and exploded at just the right time. This means that if the commercial rating of the engine is set 15 per cent. below this most economical point, it is not possible to carry more than 15 per cent. overload without slowing down the engine. This condition can be easily met in several ways—by installing additional gas-engine capacity, by running in connection with the gas engines a steam turbine which readily takes up the load changes, or by a storage battery. The additional saving in total cost of power accomplished by the gas engine should be sufficient to more than offset the expenditure necessary to take care of this overload factor. If it is not, then the case is not a good one for gas engines.

As to the first cost, this is very difficult to state exactly, because the conditions vary so largely; but it is, possibly, safe to assume that the complete gas plant, including producers, will cost, say, 20 per cent. more than a corresponding steam plant, and with coal at $2.50 a ton, it is not difficult to earn a handsome return on this additional investment. Important factors are, therefore, (a) the cost of coal; (b) the number of hours a day that the plant is run; (c) the load factor of the plant, i. e., the percentage of its average load to its rated load. The higher these values, the more is it to the advantage of the gas-engine plant.

The gas engine itself is very simple, and its working parts are easily understood and adjusted by the operators in charge, once they have become familiar with the running conditions. The engine may consist of one or more cylinders, in which the gases are burned at initial pressures of about 300

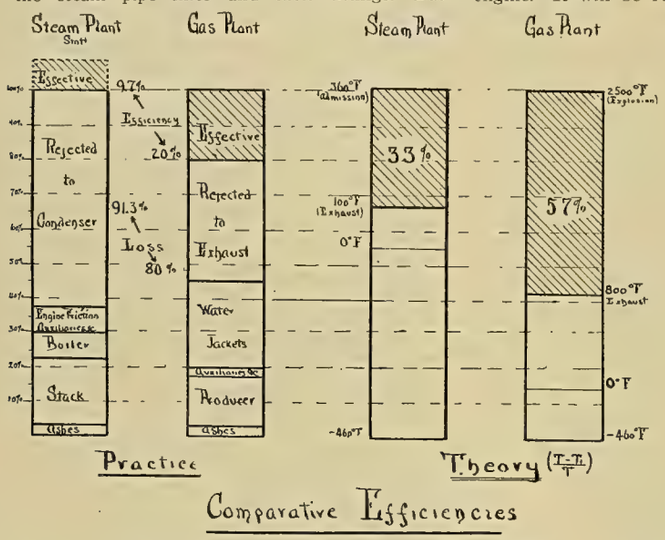


FIG. 1. FUNDAMENTAL PRINCIPLES OF GAS ENGINES.

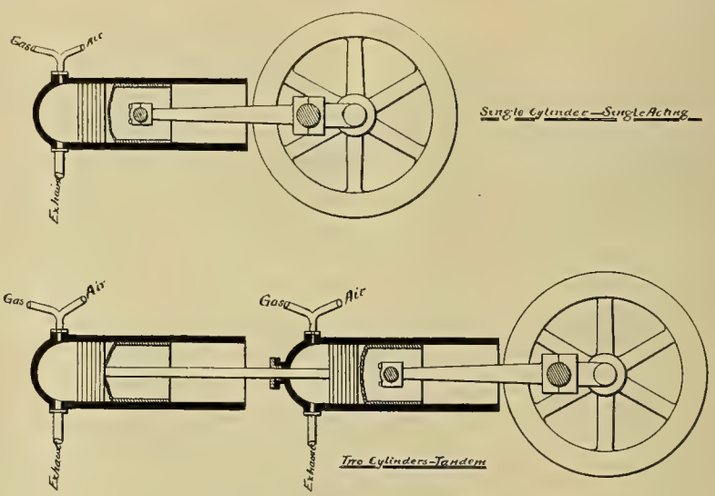


FIG. 2. GAS-ENGINE DESIGN.

1. Part of an address before the New York Electrical Society, February 21, 1906.

pounds per square inch, the gas being admitted at atmospheric pressures and compressed to about 100 or 120 pounds; the resulting mean effective pressures after explosion range from 60 to 75 pounds. Piston speeds run about 600 to 850 feet per minute.

Gas engines are divided into four general classes, as concerns cylinders, single-acting and double-acting; and four-cycle and two-cycle as concerns explosions. Gas engines are built vertically, with one, two or three cylinders, where the weights of the pistons and length of crank shafts permit, and horizontally, with one cylinder, two cylinders vis-a-vis, or tandem, and four cylinder, vis-a-vis or tandem in the larger sizes.

In a single-acting engine the explosion takes place at only one end of the cylinder; with the double-acting engine, the explosions take place at both ends of the cylinder.

When we speak of a four-cycle engine, we mean that four strokes of the piston are taken to complete the cycle from one explosion to the next. The first stroke, called the "suction" or "charging stroke," sucks in the charge. The return of that stroke, called the "compression," compresses it. At the beginning of the third stroke, or "power stroke," the charge of gas is exploded, and on the fourth, or "exhaust" (sometimes called "scavenging stroke"), the cylinder is scavenged of the products of combustion. The four-cycle movement is called the "Otto" cycle or "Beau de Rochas."

With the two-cycle engine the charging stroke and the scavenging stroke are eliminated, the piston's duty being performed by a subsidiary means external to the engine, and either attached to it or operated as an independent auxiliary.

As concerns the working parts of the engine, it is provided with a governor, operated on the same general principles as a steam-engine governor, and with about the same degree of regulation.

The valves of a four-cycle engine consist of the following:

First—Gas and air valves, which determine the proportions of gas and air that are to enter into the mixture. These are simple cocks, placed in the gas and air mains, with dials, showing the extent they are open, and are only changed at the will of the engineer.

Second—The hit-and-miss cut-off valve, which admits the amount of gas determined by the gas valve into the mixing chamber, unless the governor of the engine makes it lose a cycle. The hit-and-miss regulation is only used below one-quarter load with close governing engines.

Third—The cut-off valve with its inlet valve. This cut-off either varies throughout the stroke the opening through which the gas mixture enters the cylinder, or else acts as a straight throttling valve, by maintaining a fixed opening during charging stroke. In either case it is adjusted by the governor to suit the load. Its inlet valve closes the port as soon as the charge has been admitted.

Fourth—The exhaust valve, which, because of the high temperature of the exhaust, is water cooled. I might say that the mixing chamber, which is a simple pocket, is located between the hit-and-miss valve and the cut-off valve.

Now, these four valves are of the simplest type and require but little engineering skill to keep in repair. They are positively opened against springs by cams or eccentrics carried on a side shaft, geared to the engine's crankshaft. These cams and eccentrics are so set as to perform their respective operations at the proper time. This side shaft also operates the igniters.

Ignition is obtained in two ways—one by bringing a small portion of the main gas charge in contact with a red-hot tube operating as a Bunsen burner, or, preferably, by means of a "fat" electrical spark, the latter having survived the former in this country. This spark is either of the make-and-break type or is a jump spark. The terminals in either case protrude directly into the clearance of the engine cylinder, which contains the gas. Modern practice tends to double-ignition plugs, so as always to have one as a standby. The current for supplying the spark can be obtained from vibrating magnetos placed across each spark point, or from revolving magnetos or small generators, or from primary or storage batteries, preferably the latter, but a standby source should always be available. I should like to point out the importance of always having an independent relay or standby source of current entirely independent of the main source.

Gas engines cannot start with full load, and require a clutch where such load is, say, more than one-quarter of their capacity, although I have seen an 865-horsepower engine start and reach full speed with a load of 300 horsepower in less than 40 seconds. Of course, when driving electric generators it is only necessary to open the switch. Starting is obtained by applying compressed air to the engine at about 100 to 120 pounds pressure, or by motoring the generator which it drives. There are two elements that enter into gas-engine operation which are not found in steam engines. One is that when running, a charge of gas may fail to ignite, and will enter the exhaust unburnt; there it is just possible that it will come in contact with particles of incandescent carbon and explode; this explosion is called a "back-fire." Then, again, a charge may enter the cylinder and because it is richer than the adjustment of the compression provides for, the heat resulting from that compression may prematurely fire it, or there may be particles of incandescent carbon in the cylinders that will fire it. This is called a "premature." The result of either one of these two actions is not in any way serious, and only momentarily tends to slow the engine down. Engines properly cared for may run for days without having an occurrence of either kind.

The time of ignition can be adjusted at will, but it is generally set to take place just when the engine piston reaches the highest point of compression.

Gases are compressed before exploding, in order to increase their efficiency. The molecules, when pressed tightly together, operate with greater force on explosion in the same manner that burning gunpowder becomes effective when it is confined in the gun barrel. Compressing the gas generates heat, and the hydrogen in the gas burns at low temperatures, so that the pressure to which any gas can be compressed is limited by the amount of hydrogen that that gas contains, and it is interesting to know that while the gas may be rich in B. T. U., it may not be as efficient as a leaner gas with less hydrogen, which can be worked at a higher compression.

Indicator cards are taken in identically the same manner as with steam engines, and are figured in identically the same way. Eccentricities in the cards, however, have not the same significance as the steam-engine cards, nor is it so easy to trace their origin.

Now, as concerns gas turbines. At first glance these appear to have the same advantages over the reciprocating engine that the steam turbines have. There are, however, two very serious obstacles first to be overcome if the gases in the turbines are to be double acting. The first is that the thin blades of the turbine are not able to stand the high temperatures of combustion, which would run about 2,500° F. The other factor in the problem, and of most serious consideration, is that it is not possible to get compression before igniting the gas.

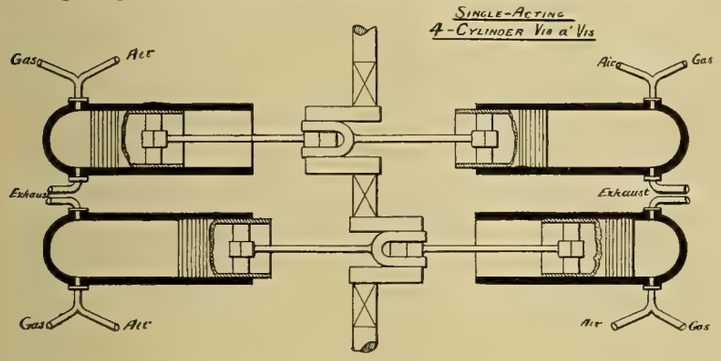


FIG. 3. GAS-ENGINE DESIGN.

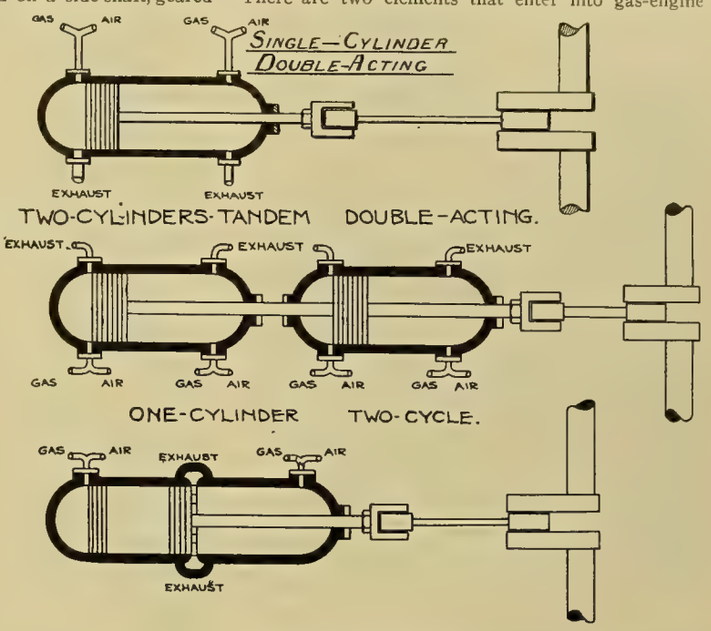


FIG. 4. GAS ENGINE DESIGN.

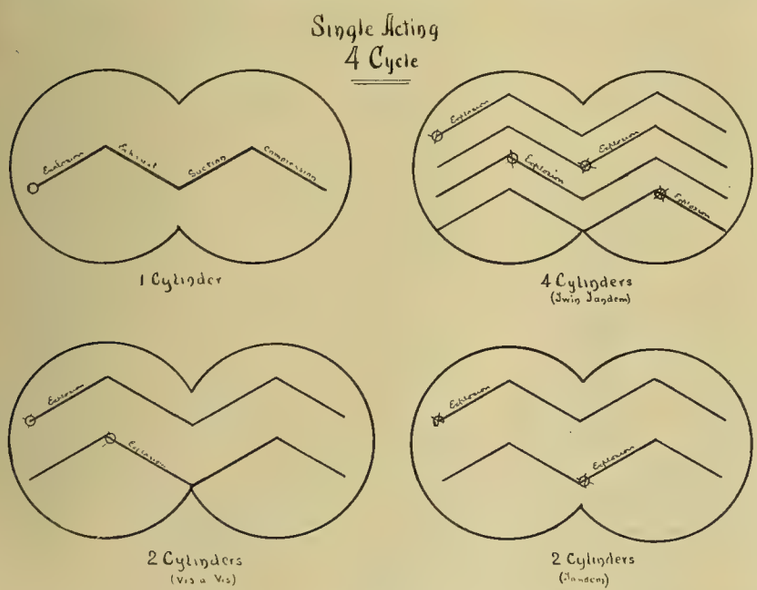


FIG. 5. GAS-ENGINE EXPLOSIONS PER STROKE PER REVOLUTION.

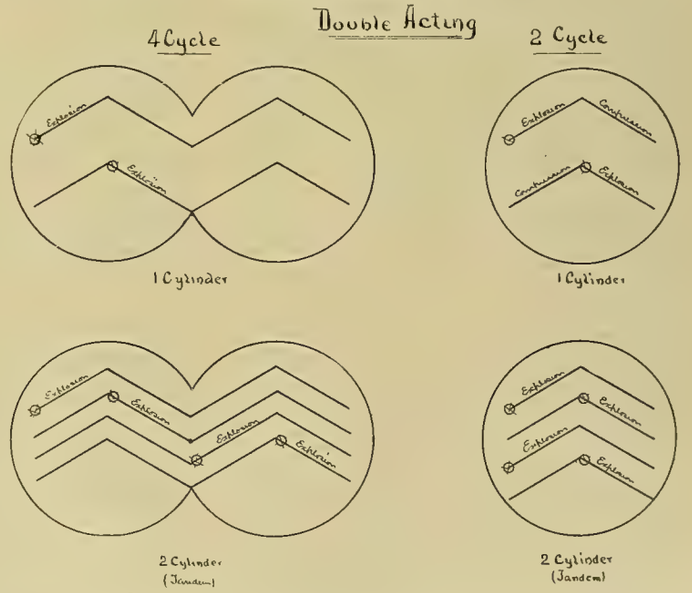


FIG. 6. GAS-ENGINE EXPLOSIONS PER STROKE PER REVOLUTION.

WESTERN ELECTRICIAN

EVERY SATURDAY.

PUBLICATION OFFICES:

507 Marquette Building, - CHICAGO.

TELEPHONE, MAIN 1746.

Eastern Office, 150 Nassau Street, New York.

Telephone, 5220 Beekman.

Trade Supplied by Western News Co.

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SUBSCRIPTION, in advance, postage prepaid, $3.00 for a full year of 52 numbers; in clubs of four or more, $2.50, with free extra copy for eight subscriptions; foreign countries, $5.00 a year; single copies, 10 cents. When change of address is requested, the **old address** as well as the new should be given.

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REMITTANCES.—All checks, drafts and other remittances should be made payable to the order of the publishers, the **Electrician Publishing Company,** and addressed to the offices of publication, Suite 507, Marquette Building (204 Dearborn Street), Chicago, Illinois, U. S. A.

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DATES AHEAD.

International Association of Municipal Electricians (annual convention), New Haven, Conn., August 15th to 17th.

Ohio Electric Light Association (annual convention), Put-in-Bay, Ohio, August 21st and 23d.

Colorado Electric Light, Power and Railway Association (annual convention), Denver, September 18th to 20th.

Illinois State Electric Association (annual convention), Springfield, Ill., September 19th and 20th.

Old Time Telegraphers and Historical Association, and United States Military Telegraphers (annual meeting), Arlington Hotel, Washington, D. C., October 9th, 10th and 11th.

American Street and Interurban Railway Association (annual convention), Columbus, O., October 15th to 20th.

ONE of the rumors that recurs with regular periodicity in electrical circles is that the American Telephone and Telegraph Company is about to invade the field of the Western Union and Postal Telegraph companies, or vice versa. The story is afloat again this summer, and this time it is told with some particularity, in that it is declared that former Vice-president Bradley of the Postal company resigned to take charge of the Bell telephone people's venture in the general telegraphic business. Of course, the long-distance telephone company has thousands of miles of high-class copper circuits which might perfectly well be used for telegraphing (indeed, some of them have been leased to brokers for that purpose), and equally of course, the telegraph companies would find no insuperable difficulties in engaging in telephone transmission. But hitherto powerful financial interests have kept these great corporations attending each to its own knitting. Whether there is any basis of fact in the latest story remains to be seen. The general tendency of the day, however, is toward combination and co-operation rather than toward slashing competition, so that if a great telegraph-telephone conflict is impending it will be an exception to prevailing conditions.

GROWING in importance year by year, the National Electrical Contractors' Association of the United States has demonstrated its right to be considered as occupying an important place among the electrical societies of the country. In the crisp language of the street, the contractors' association has "made good." It has developed in numbers, in prestige and in usefulness in a very encouraging manner; and all three characteristics were exhibited in a satisfactory degree at the sixth annual convention of the association, which was held in Cleveland last week. The proceedings, so far as they are made public, are reported in this issue of the Western Electrician. Primarily, of course, the organization is concerned with the business interests of its members, but nevertheless it considers other questions, such as the fire hazard of electricity, electrical inspection, trade unions and the supply of apprentices, which are of general interest. We are sure that the report of the convention will prove profitable reading to many electrical men who are not members of the association.

The old officers were re-elected, and it was decided to meet in New York next year. With over 600 members, and a total attendance of members and guests at the Cleveland convention of 440, the association enters its sixth year of existence with a record which promises well for still greater things in the future.

IMPORTATION of electric power from Canada into the United States is one of the several interesting features connected with the recent Act of Congress granting authority to the secretary of war to regulate and control the waters of Niagara River for the preservation of Niagara Falls. Electricity is not tangible, and its transmission from one country to another for the purpose of developing power obviously brings up questions of a different nature from the importation of, say, wines or silk. Then again, at Niagara Falls, the question is complicated by the outcry against the further diversion of water for power purposes. Canadians think that they have some advantages, from the topography of the Falls, by which they can use a greater amount of water than the Americans and still preserve the Horseshoe Fall. They have not agreed to waive this advantage by subscribing to an equal diversion of water on each side of the international boundary line. If they do not, the power importation question may take on a different aspect. Further, the Canadians are not agreed among themselves as to the desirability of exporting electric power, while it is not to be forgotten that some of the Canadian power-development companies are largely exploited by American capital. In these circumstances Mr. Taft, the secretary of war, has granted only temporary permits. The Niagara, Lockport and Ontario Power Company has permission to receive into the United States electrical current equivalent to 25,000 horsepower from the Ontario Power Company of Niagara Falls, Ont., and the Niagara Falls Power Company is authorized to receive from the Canadian Niagara Power Company not to exceed 25,000 horsepower of electrical current. These permits are the only ones granted for the taking of electricity generated in Canada into the United States, and the secretary of war says that it will be necessary for him to make a thorough investigation before granting permanent permits for such transmission. Consequently he has designated Captain Charles W. Kutz of the Engineer Corps, who, under the direction of General Mackenzie, chief of engineers, will make a full report on Canadian power and submit it to Secretary Taft, who will lay it before the American members of the International Waterways Commission.

SPACE TELEGRAPHY has recently attracted renewed attention in England, owing to its successful use on a more extended scale than before in the recent naval maneuvers and also to a recent report from the Postoffice Department. In relation to the maneuvers a London Times correspondent on one of the fleets bears this testimony: "Wireless telegraphy, though even yet in its infancy, has played a remarkable part and has enabled the Red admirals to co-ordinate their operations and to concentrate for strategic objects in a manner that would have been impossible a very few years ago. Communication between ship and ship has been carried on at distances of nearly 200 miles."

Passing to the more important Postoffice return, it is to be noted that the report has to do with the applications for license under the Wireless Telegraph Act of 1904 showing how each application has been dealt with. It relates to the period from January, 1905, to March, 1906; and the applications are classified (1) those in respect of installations in existence when the act was passed in 1904; (2) applications in respect of proposed new installations; (3) private installations; (4) experimental installations. There have also been applications for licenses for installations for lecturing purposes, and there are in addition a miscellaneous set of applications.

Among the most important applications may be noted one from the Marconi company, in which the radius of action is stated as 3,000 miles, the object being to communicate with America and with ships at considerable distances. Lloyds and the Eastern Telegraph Company ask to be allowed to communicate with ships generally. In all these cases the terms of the license have not been settled, but the Eastern Telegraph Company is allowed to communicate with its own cable ships. The proposed installations comprise applications by the Allgemeine Elektricitäts Gesellschaft (Telefunken system) and the De Forest company. The former specified the South of England as the area of operations, but the license has been refused on the ground of risk of interference with existing naval and commercial stations. One of the objects of the De Forest company was to send press messages between London, Manchester, Liverpool, Glasgow and Belfast, but the further information asked for by the Postoffice has not yet been tendered. Likewise applications to use the Lodge-Muirhead and Orling-Armstrong systems partly for commercial purposes have been refused, in the first case because the object aimed at would interfere with the postmaster-general's ordinary monopoly, and in the second because of interference with other stations. The private-business applications (seven in number) have all been granted. Four applications are made for experimental licenses to communicate with America, with the object of asking for full commercial licenses if the experiments are successful. The applicants were the Anglo-American Telegraph Company, the Commercial Cable Company, De Forest Wireless Telegraph Syndicate, and the National Signaling Company.

This record is a very intersting one, and shows the systematic way in which the United Kingdom is facing the wireless situation. Something of the same kind should be undertaken in the United States, if warrant for it can be found. And it is to be hoped, also, that the international space-telegraph conference in Berlin in September will result in some concerted action so that the great life and property-saving possibilities of wireless at sea and along the coast may be fully utilized wherever the necessary apparatus is installed.

National Electrical Contractors' Association in Cleveland.

To quote one of the officers of the organization, "The sixth annual convention of the National Electrical Contractors' Association was the best ever held," both because of the attendance and the fact that the committees were better prepared as to the selection of subjects to be discussed and the adaptability of the various members to the consideration of topics that were selected. The convention was held at the Hollenden Hotel, Cleveland, July 18th to 20th. It can be said with truth that the subjects were handled in a thorough and interesting manner, thus affording at the same time pleasant and instructive meetings. In all about 150 members and 290 guests were present. In the list of the latter were many interested in both a direct and indirect manner in the work of the contractors, being manufacturers and others allied with the trade or with the building fraternity.

JAMES R. STRONG,
President National Electrical Contractors' Association.

Opening Exercises.

In the absence of Chairman F. C. Werk of the Ohio state committee, Secretary A. Oppenheimer took charge of the opening meeting on Wednesday morning, July 18th, and welcomed the guests to the Buckeye State in a few fitting words. He introduced Mayor Tom L. Johnson, who was received with quite a storm of applause. His honor spoke of the organization idea and said that much good should come of associations operated upon right lines, as he believed the contractor's association is, but in the organization of trusts or combinations for the restraint of trade or to prevent competition he felt that the results must be the opposite. The mayor then referred to his pet scheme of producing a car that will "shoot people from New York to Chicago in an hour, or from coast to coast in three hours," but he said it was as yet impossible to tell what effect such speech would have upon the car and its occupants, whether they would be deviled or frapped. With an earnest desire to make the visitors welcome, and an invitation to them to visit the City Hall and secure the keys to everything of interest, the mayor, with a few more jocular remarks, closed.

W. B. McAllister, president of the Cleveland Builders' Exchange, invited the visitors to make the Exchange rooms their headquarters while in the city and to make use of every facility that organization has to have an interesting and enjoyable time. He outlined the proposed group plan of public buildings, spoke of the park and boulevard systems and asked the members to inspect them, that they might know what progress Cleveland is making.

E. M. Lawton, Ohio director of the national organization, hails from Cincinnati. He said he could not conceive any reason for the committee inviting a Cincinnati man to make an address in Cleveland; that he knew there is such a place and that it is an eating point on the Lake Shore between New York and Chicago. Otherwise he saw nothing in the village on the lake. But he said he was glad that the meeting was held in the great Buckeye State, and he welcomed the guests to all it contained. Mr. Lawton's humorous remarks on the fight between Cleveland and Cincinnati for supremacy in size and importance caused considerable merriment.

President James R. Strong replied to these various addresses of welcome in a few words befitting the occasion, and then spoke of the great benefit the organization may be in the work in which its members are engaged. From the little band that met at Buffalo in 1901 the organization has grown into a strong body. The policy of the association, he said, is to build up and improve conditions in the trade. One of the things it should do it to stop the ruinous competition between the different branches of the trade. There should be a clearly established basis upon which the manufacturer, jobber and contractor may operate. There is room for all, but there should be an understanding that will prevent them from endeavoring to cut each other's throats. Each should have his share of the business and each should treat the other in a fair manner in every way.

Trade Schools Indorsed.

President S. C. Dickey of the Winona Trade School of Indianapolis was introduced by President Strong. He talked upon the subject of educating boys for the various trades and the advantage it gives them in life. He said that out of 5,300,000 pupils who enter the public schools, but 200,000 reach the high school and 116,000 get into colleges and institutes. Even then, college graduates are often trained away from the business or the work which they decide to enter. Frank A. Vanderlip's investigation of trade schools in Germany was spoken of as showing the great work they are doing. The Winona school has several departments, working under the direction of a board of trustees, and these departments have been started largely through the medium of national trades associations. For this reason, Mr. Dickey wanted to interest this association in the matter. At the business session of Thursday afternoon trade schools, as a general principle, were indorsed and a committee was provided to co-operate with the Winona Trade School in the establishment of a department for training boys in electrical work. The work is now taught to some extent, but better facilities are needed for the department. The school loans scholarships and money to aid students to secure a training.

Liberty and Organization.

Frank A. Pattison a New York electrical man, read an interesting paper on "Liberty and Organization," in which he showed that men in any branch of business properly organized into an association may be of great aid in matters that are of mutual interest and yet not overstep the boundary that takes away the liberty of the individual. In fact, business men must organize to meet the demands of the day, but liberty cannot and must not be trampled upon. In an organization of this kind each member should see that all others do their duty.

Mr. Pattison made a point of the fact that all persons belonging to an association should do the same grade of work or that there should be grades in which the members should be placed, according to the kind of work they do. The weakness of labor organizations, he said, comes through the absence of grading according to the ability of the workmen. Another thing, he said, upon which harmonious organization depends is the determination of every individual to give the other a square deal. Everyone who does not act honestly with his fellow members, is a traitor to the organization and should be expelled—that is, if there are such members.

The speaker said that he was convinced that there are more honest men in the world than ever before and that honorable principles will in the future control business matters, as never before.

Mr. Pattison said that contractors were under the necessity of purchasing labor and materials. He then discussed the manufacturer, and said that an association may demand fair play from them where the individual perhaps could do little, in the event that they did not care to give him a square deal. In making bids the manufacturer should state in plain terms the kind of material he is bidding on, so that there can be no misunderstanding when the bids are being considered. In the labor market Mr. Pattison said that any union or organization that assumes to make a contract for its members should be required to give a bond for the faithful performance of that contract. We are approaching an era of fraternalism, he said, and must conclude that working together in certain directions will be required in order to accomplish the results that this progressive age demands.

Business Sessions.

A business session was held in the afternoon and another in the evening, both being executive. Matters pertaining strictly to business questions and policies to be pursued relative to certain points were discussed.

Co-operative Development.

The session of Thursday morning opened with an address by J. Robert Crouse of Cleveland, of the Co-operative Electrical Development Association. Mr. Crouse explained the methods of the association in creating a demand for certain products of the manufacturer, without advancing the individual interests of one more than another. The additional equipment thus used also proves a good thing for the contractor who rereceives the orders for installing it. Manufacturers some time ago put up $10,000 to stimulate the sale of incandescent lamps. As each lamp requires something like $125 in equipment, tracing back to the beginning, additional business in this direction is valuable to all engaged in the business. In February 100 central stations contracted for $125,000 worth of advertising, and this is proving a good investment. The author's paper on "Profitable Commercial Co-operation," read before the National Electric Light Association at the recent Atlantic City convention, was distributed and attracted much attention.

Work of the Inspectors.

J. H. Montgomery of the National Electrical Inspectors' Association made an interesting and instructive address, giving a picture of the work from the inspector's viewpoint. Among other things, he said that the interest of the manufacturer generally extends only to where his goods are used. While the contractor's primary object is to make a legitimate profit on his contracts, he also desires to do good work. He is, therefore, anxious that the materials he uses should be of the proper quality and kind. He is the practical man in the installation and must see that what he uses will meet the requirements of the underwriters' rules. The inspector's interests extend to the lessening of the fire hazard and danger to life. His work is rendered rather arduous by the fact that public opinion is in a peculiarly unstable position as regards electrical equipment, and the danger of fire from it.

The average man thinks anything will do, and cannot see why overloaded or unprotected wires are dangerous. After their equipment is in, however much they may have kicked against the kind of work done at the time, it takes an immense amount of persuasion to induce them to see the danger of bad work. Newspapers could do much in the way of educating the public regarding the uses and dangers of the electric current. Contractors, however, he said, are fearful of alarming the public, but the public should be alarmed—not over the fact that their buildings are wired, but that they may be badly wired.

Mr. Montgomery discussed accidental hazards and the advantages of lighting with electricity when conditions are all proper and the wiring done right. He also went into the features of the underwriters' rules to some extent, and spoke of the immense amount of money that had been spent by manufacturers in testing material and equipment for their various purposes. Under the underwriters' rules, the inspector's work is now largely confined to identifying materials and conditions. If they are complied with in every particular, then the greater part of his work is done. But at the same time conditions arise where he must use his training and judgment to arrive at a decision. Contractors and inspectors need to study questions more from each other's viewpoint, he said, and there would be a fuller understanding and less friction.

The Fire Hazard.

C. J. H. Woodbury of Boston, now of the engineering department of the American Telephone and Telegraph Company, but formerly connected with the factory mutual insurance companies, introduced his talk with a mention of the great system of telephone lines over the country and the possibility now of transacting business without the loss of time in traveling. This, he believes, is one reason of the unparalleled prosperity that the country is enjoying now. Conversation over the Bell lines amounts to something like 45,000,000 miles a day one way, or double that in counting the replies which must come in the opposite direction.

The introduction of electricity, he said, was followed by an immense number of fires. To prevent this fire waste, or at least to lessen it, the engineers of the insurance companies met with Brush, Edison and some of the other great electricians, with the result that a set of rules was made applying to textile factories. Following these rules almost eliminated the danger from this source. From these rules and the further consideration of the subject, the National Electrical Code finally took shape, and all the amendments to it have been in the nature of additions rather than changes in the original. However, any consideration of the fire hazard must be taken in connection with the great service electricity renders in the way of service and fire prevention, such as the telephone, the fire-alarm system and other things of the kind.

Mr. Woodbury's address was given careful attention and the many interesting points were noted by the members.

History of the Association.

Treasurer John R. Galloway gave a short history of the association, from the time it was organized in Buffalo, July 17, 1901, with 31 members, to the present time, when 610 have been enrolled. In the beginning the little body of contractors had almost no confidence in the final results of their efforts, but a constitution and by-laws were adopted, and the members went to work. Charles L. Eidlitz of New York was the first president, and to his indomitable work the speaker credited much of the success in the beginning. He held the office for two years and was succeeded by E. McCleary of Detroit, who continued the hard work for two years longer, when a "Strong man" (James R. Strong of New York) was chosen to the presidency. His has not been a path strewn with roses, either, said Mr. Galloway, but he has succeeded in clearing away the obstacles in a most satisfactory manner.

Mr. Galloway said that something should be done to increase the profit of the contractors' business and do away with cheap and ruinous competition, and as the first and best means he suggested licensing the contractors by the city authorities, after their ability to do good work and their standing as men had been proven. The curbstone merchant and the cheap contractor who is always trying to "do" every other contractor are the worst elements against which the legitimate contractor has to contend. "We must be

rid of this great burden in some way," said the speaker, "and the best means are through laws requiring the right kind of men and giving them authority, through a license." The underwriters have begun to recognize that legitimate contractors are endeavoring to build up the grade of work done through co-operation and the proper interpretation of the rules.

ELECTION OF OFFICERS AND CONCLUDING BUSINESS.

On Thursday afternoon the old officers were all re-elected, as follows: President, James R. Strong, New York; first vice-president, W. I. Gray, Minneapolis; second vice-president, Walter C. McIntire, Philadelphia; third vice-president, F. E. Newbery, St. Louis; secretary, W. H. Morton, Utica; treasurer, John R. Galloway, Washington; Sargent-at-arms, J. C. Sterns, Buffalo. The directors are as follows: Arkansas, T. B. Martin, Little Rock; Connecticut, W. W. Gale, New Haven; District of Columbia, D. M. Anderson, Washington; Illinois, J. T. Marron, Rock Island; Indiana, T. B. Hatfield, Indianapolis; Iowa, Edward Kunkle, Davenport; Maryland, H. P. Lewis, Baltimore; Massachusetts, Seth B Wetherbee, Boston; Michigan, F. J. Miner, Detroit; Minnesota, L. L. Sanford, Minneapolis; Missouri, C. J. Sutter, St. Louis; New Jersey, Paul H. Jaehnig, Newark; New York, J. R. Strong of New York city, M. L. Barnes of Troy and James Hilton of Syracuse; Ohio, M. W. Hansen, Toledo; Pennsylvania, W. I. Patterson, Pittsburg; Rhode Island, S. A. Potter, Providence; Texas, D. S. Goble, Dallas; Wisconsin, George F. Rohn, Milwaukee.

At this meeting a set of uniform symbols for marking electrical wiring plans was adopted, and a committee was appointed to place these symbols before architects and engineers with a view to their general adoption. Considerable trouble has been encountered in the past because of lack of uniformity in this respect and the widely varied method of marking wiring plans upon building plans and drawings. With a uniform system any contractor can take the plans of any engineer or architect and read them without trouble.

A committee was also appointed to investigate the possibility of preparing uniform specifications and contracts for electrical work the same as is now done in building work. By this method there would be a general form of requirements that every contractor would know in the beginning must attach to each contract, after which the detailed specifications could be written in. The association is anxious that this should be done, as it would make everything easier for both the contractors and the builders or owners, as the case might be.

Next year's meeting will be held in New York city, beginning on July 3d and continuing three days. Several other cities asked for the meeting, and Norfolk, Va., was especially anxious to secure the meeting during the exposition there. H. M. Brown, president of the Virginia state association, headed a delegation of nine, who pulled hard for the meeting for that city.

The annual meeting of the directors of the association was held on Tuesday, there being sessions both morning and afternoon. The business applied to the work of the association and nothing was made public. The annual meeting of the Ohio state association also took place on that day, the following-named officers being elected: President, Emil Grah, Toledo; vice-president, Patrick McNerney, Cleveland; secretary, Richard Stites, Columbus; treasurer, W. G. Reuter, Cincinnati; committeeman to the national convention, M. W. Hansen, Toledo. The next semi-annual meeting of the association will be held at Canton on January 10, 1907.

SOCIAL FEATURES.

The social features of the convention were highly enjoyed. At 1 o'clock on Tuesday the Ohio state association entertained the national officers at luncheon at the Hollenden, while the ladies' entertainment committee held a reception for the visiting ladies and entertained them at luncheon at the same hotel. A trolley ride was tendered them in the afternoon. At noon on Wednesday the ladies were again entertained at luncheon and were guests of the Ohio ladies at the Garden Theater in the afternoon. On Thursday afternoon an automobile ride over the city was enjoyed, and after dinner at the Hollenden the ladies spent the evening at Luna Park.

The annual banquet for the members at the Hollenden on Thursday evening was a very pleasant affair, plates being laid for 250 persons. John P. Coglin of Worcester, Mass., acted as toastmaster and performed the duties in an entertaining manner. President James R. Strong, E. M. Lawton of Cincinnati, John R. Faure of Ossining, N. Y., and D. S. Goble of Dallas, Tex., responded to toasts.

On Friday the members and their guests, about 500 in all, took a boat ride to Put-in-Bay and return. To many this is a most interesting spot, being the scene of Commodore Perry's victory. The boat left Cleveland at 8:30 a. m. and returned about half-past seven in the evening. Lunch was served on the boat. The sixth annual session was formally closed on the boat, and most of the members returned to their homes Friday evening or Saturday morning.

CONVENTION NOTES.

Manufacturers' Agent George S. Searing, accompanied by Mrs. Searing, was on hand.

C. E. Lee did the honors for the Electric Goods Manufacturing Company of Boston, Mass.

W. C. Phelps of the Phelps Company, Detroit, Mich., was most active on behalf of Hylo lamps.

P. H. Hoover, as usual, represented in his inimitable manner the New York Insulated Wire Company.

The Electric Appliance Company of Chicago was well represented by Perry R. Poole and George H. Porter.

Of course Manager L. P. Sawyer of the Buckeye Electric Company was on hand, and, as is his usual custom, was indefatigable as a "prince of good fellows."

Secretary N. L. Norris of the Banner Lamp Company was, of course, present in the interests of "Banner Betterness."

Manufacturers' Agent W. P. Crockett was, of course, at Cleveland. Mr. Crockett has made a great success of his business in Chicago and has recently extended his field of operation.

Of course, "H. B. Kirkland of Boston, Mass.," was registered, all of which meant that the American Circular Loom Company was, as usual, in decided evidence.

S. R. Fralick of the Benjamin Electric Company of Chicago was one of the most popular among the "boys" at Cleveland. Mr. Fralick has done splendid work for the Benjamin company.

The Standard Underground Cable Company appeared in the person of A. A. Anderson of Pittsburg. Mr. Anderson "takes after" all the Standard Underground representatives; everyone likes him.

B. D. Horton of Detroit, well known for his work in the development of fuses, was on hand daily. Mr. Horton has recently developed some new specialties in the fuse line, and is now busy placing them upon the market.

The interests of the Sawyer-Man Company were well looked after by G. B. Dusinberre, Westinghouse manager for Cleveland, Messrs. T. H. Bailey Whipple, C. O. Baker, C. P. Billings and R. W. Beebe. No exhibit was made.

John A. Roebling's Sons Company came nobly to the front. Manager W. P. Bowman and U. G. Tingley, respectively, of Cleveland and Pittsburg, did the honors, in company with Frank Harrington of New York, J. W. Brooks and W. W. Affleck.

Oliver L. Turgeon appeared in person for the Eastern Carbon Works of Jersey City. Mr. Turgeon went over to Put-in-Bay with the delegates, but he had previously made an interesting exhibit of a full line of carbon cylinders, dry batteries and battery connectors.

President Warren Ripple of the J. Lang Electric Company made many friends at the National contractors' convention. Mr. Ripple stated that this was his first convention, but the experienced manner in which he handled "things" indicated that he had the art of entertainment reduced to a fine point.

Nowadays when one says that Habirshaw wire was represented at a convention, that expression is synonymous of the name "Olson." General Sales Manager James B. Olson was there, and was warmly welcomed. But the convention was a sad one for Mr. Olson, owing to the fact of the present serious illness of his father in New York.

H. H. Hornsby, manager of conduit sales of the Sprague Electric Company, New York, was in daily attendance during the convention. Mr. Hornsby, as will be remembered, for many years lived in Chicago, but left the West to look after the conduit business of the Sprague company, with headquarters in New York, and he has made a great success of his work. Mr. Hornsby was accompanied by Mrs. Hornsby.

Manufacturers' Agent Francis Raymond of Chicago at the contractors' convention added a host of new friends to his already long list. Within the year Mr. Raymond started in business for himself, and through his progressive and businesslike methods he has already established on a firm basis a prosperous business. Mr. Raymond's policy has been only to secure the best of agencies, and this policy, no doubt, had much to do with his success.

"Flexduct" put up its usual "front" in the persons of First Vice-president and Sales Manager C. E. Corrigan, New York; I. A. Bennett of Chicago, accompanied by Cleveland Agent W. P. Ambos and Pittsburg Agent F. R. Fortune. Flexduct had already made its mark among the contractors of the United States, but the Osburn Flexible Conduit Company nevertheless felt that a fountain pen would be appreciated as a souvenir. This little gift was highly appreciated. Vice-president Corrigan has made a conspicuous success of Flexduct, and he deserves great credit for his management of such an intricate business. It may be truly said that the present successful condition of the company is largely due to his popularity and diplomatic handling of the many difficult situations that arise in modern electrical business life. Mrs. Corrigan accompanied her husband and helped entertain the ladies.

The National Carbon Company, feeling its share of the pleasant responsibility as a company located in the city entertaining the convention, came nobly to the front with a fine coterie of handsome entertainers, as follows: N. C. Cotabish, sales manager; J. F. Kerlin, assistant sales manager; M. H. Moffett, assistant sales manager; A. G. Summerell, M. E. Rupert, James G. Vernon, E. J. Kenny, A. E. Carrier, F. J. Kysela, F. H. McDowell.

B. T. Bechtel was indefatigable in looking after the interests of the Mark Manufacturing Company. This institution manufactures wrought merchant pipe, boiler tubes, etc. Mr. Bechtel has been with this institution about a year, and his work for the company has been most excellent. At the contractors' convention he made a number of new friends, and, showing himself an adept at entertainment, was voted one of the "good fellows" of the gathering.

The F. Bissell Company of Toledo put in an appearance in the persons of F. S. Bissell, F. N. Knierim and V. I. Gray. The company exhibited voltmeters, switches, security time switches and the Handsome safety switch. As a souvenir, these gentlemen distributed the now well-known Bissell frog pin. Friday morning President F. Bissell himself appeared and was warmly welcomed. Mr. Bissell made the boat trip with the delegates to Put-in-Bay, and there made his adieu, going thence to his home in Toledo.

Among the most prominent contractors at the convention was Arthur Frantzen of Arthur Frantzen & Co. Mr. Frantzen appeared in the dual capacity of contractor and supply man. The Zenco Electrical Supply Company, which has been started during the last six months under the guidance of Mr. Frantzen, has already achieved a marked success, and is becoming a factor in the electrical supply business in the West. The Zenco company now operates not only in Chicago, but in Baltimore and Texas as well.

The American Circular Loom Company was, of course, "there" in all prominence, and this time, as usual, in the person of Thomas G. Grier. Mr. Grier was on hand, accompanied by M. F. King, especially to see to the interests of the American Circular Loom Company, with its hosts of friends among the contractors, and he was accompanied by H. T. Robbins of the Nungesser Electric Battery Company of Cleveland. These gentlemen presented to a number of the friends of their companies a very handsome souvenir watch fob, surnamed "The 1900" fob.

The Brilliant Electric Company, under the guidance of Manager E. J. Kulas, assisted by R. S. Jackson and G. O. D'Urfae, made a most interesting exhibit on the parlor floor of the Hollenden. The opportunity was a splendid one for presenting the Brilliant tantalum lamp; and the Brilliant tipless tantalum lamp was shown, and several other styles in the same make of lamp. A line of interesting circulars was also distributed, which explained in detail the merits of the tantalum lamp. There was given away also a booklet entitled "The Light That Never Failed," with apologies to Kipling.

The Western Electric Company of Chicago was represented at the contractors' convention by prominent officials. Supply Sales Manager A. W. Rockafellow came on from New York, and was assisted at the Hollenden by Chicago Supply Representative L. J. Baldwin of New York. Power Apparatus Manager E. S. Keefer also put in an appearance and was accompanied by Chicago Power Apparatus Representative McEwen. In addition to the above-mentioned gentlemen were F. M. Dusenbury and R. M. Morris. The Western Electric Company, of course, has a host of friends among the contractors of the United States, and although no attempt at an exhibit was made, the company was kept thoroughly in evidence by the conscientious efforts of the Western Electric "army."

Advertising Manager Thomas T. Richards, for the Wagner Electric Manufacturing Company, was untiring in making the large number of delegates at the convention acquainted with his company's product. Mr. Richards was one of the several that deemed the convention most important, and made a most comprehensive exhibit of decided interest to contractors. There was presented in the Wagner parlor a full line of alternating-current and direct-current switchboard and portable instruments. A special exhibit was made of the Wagner portable combination lamp-testing volt-wattmeter. Mr. Richards proved his ability as not only a clever salesman, but a designer of novelty advertising as well. His railroad "ticket" over the "Wagner route" and "Issued by the National Contractors' Railway Company" made quite a hit and created much amusement, to say nothing of help-

ing considerably to "rub in" the merits of the Wagner product to all those present. This little advertisement was so clever that it will undoubtedly be copied and used as a model by other companies, perhaps outside of the electrical business, searching for something unique, to the point, and of easy distrigbution.

Alpha H. Kling, who has recently established himself in his home city, Peru, Ind., as manufacturer's agent, did most excellent work establishing himself in the friendship of the contractors. Mr. Kling already has secured the agency for a number of fine specialties, and it is his purpose to operate from Peru, Ind., as a center. As Mr. Kling's motto is "Travel and keep in touch," he will doubtless succeed. Mr. Kling made a reputation for himself as sales manager and advertising designer for the Peru Electric Manufacturing Company, to say nothing of winning a host of friends for himself in the electrical porcelain trade.

The Crouse-Hinds Electric Company of Syracuse, Chicago and Cincinnati was decidedly "in evidence," and although no attempt at an exhibit was made, it is safe to say that there was no company at the convention more warmly welcomed. Looking after the interests of this institution were Western Manager F. F. Skeel, A. H. Hills of Syracuse and C. M. Crofoot, manager of the company's Cincinnati office. Mr. Crofoot was accompanied by Mrs. Crofoot. The talk of the Crouse-Hinds company at this time is largely "Condulets." Catalogues of new additions to the Condulet line were first shown at this convention in Cleveland. A miniature wall hanger also was distributed, which presents, pictorially, the great variety of Condulets now on the market. Condulets are to the electrician what L's and T's are to the pipefitter. A few interesting samples of the latest forms of Condulets were also presented for inspection.

Pass & Seymour, Incorporated, of Solvay, N. Y., made a strong showing, with headquarters on the parlor floor at the Hollenden. As usual, Sales Manager John W. Brooks was in charge of the P. & S. forces. Mr. Brooks was assisted this time by W. Brewster Hall, New York sales manager, and A. N. Little, who operates for the company throughout the territory west of Solvay. There was exhibited a line of P. & S. porcelain lamps, and several interesting souvenirs were presented to the various friends of the company. The souvenir porcelain ash tray, decorated with the P. & S. monogram, made such a hit that the demand exceeded the supply. "Little's pup" likewise did good work as an advertisement for the company. Incidentally it should be mentioned that the business of the P. & S. factory has increased to such a remarkable extent that a large addition to the plant is now in progress of erection. Much of the company's success is without doubt due to the broad-gauge, straightforward, yet aggressive, policy in the sales department as inaugurated by Sales Manager Brooks.

President R. K. Mickey of the Novelty Incandescent Lamp Company of St. Mary's, Pa., seized the occasion of the meeting of the National Electrical Contractors' Association personally to announce the launching of the Novelty company into the incandescent-lamp field. Mr. Mickey's temporary factory is now in St. Mary's, Pa., but another and much larger and more complete factory is being erected for the company in Emporium, Pa. President Mickey asserts most positively and emphatically that the Novelty Incandescent Lamp Company is not in any association or combination; it is the purpose of this company to do a strictly independent incandescent-lamp business. Mr. Mickey for a number of years was connected with the sales department of the National Carbon Company of Cleveland, and he is already possessed of a host of friends and a large following among electrical buyers in the United States. Through this and his general acquaintance with electrical manufacturing it is safe to say that his company will command its share of the lamp business. He further states that the Novelty company is capitalized at $100,000, and its policy will be "Fair treatment to customers with a fair profit for ourselves."

Interchangeable Mileage on Electric Roads.

A recent meeting of Illinois electric railway traffic officials resulted in an interchangeable mileage book which will be honored by the electric roads in Illinois and Iowa. Ohio and Indiana were not represented at the meeting, but they already have interchangeable mileage to some extent, and it is understood that they are willing to conform to the agreement, making a total of 2,000 miles over which the mileage would be honored. The Central Passenger Association (steam) is also talking of the interchange of business with the electric roads, as stated in the Western Electrician last week.

Scribner, Neb., has voted bonds to the amount of $20,000 for an electric-light plant and waterworks.

Visiting Electrical Engineers in Great Britain.

The concluding feature of the stay in Glasgow on the evening of July 3d was a reception by the corporation in the Art Gallery and Museum, Kelvingrove Park. The guests, who were representative of the civic, commercial and scientific interests of the city, numbered about 2,000 ladies and gentlemen. Among the speakers were Mr. R. K. Gray, the late president of the British Institution of Electrical Engineers, and Dr. Clayton H. Sharp of New York.

On the immortal Fourth the visitors were in Edinburgh. Here there was the usual round of festivities. Mr. J. W. Lieb of New York and Prof. Morgan Brooks of the University of Illinois responded to the toast "Our Guests," proposed by Bailie Dobie at a luncheon tendered by the municipal corporation. Mr. Gavey, Mr. Mordey and Dr. Glazebrook of London also responded to toasts, the proceedings closing with the singing of "Auld Lang Syne."

Newcastle-on-Tyne was reached on the evening of July 4th, and the following day was spent there. Engineering works on the Tyneside were inspected, and there was here, too, the inevitable luncheon, with the usual round of speeches. Leeds was the next point reached in the itinerary (July 6th), where, as in other places, the Lord Mayor told the visitors how glad he was to see them, and the visitors, as represented by their spokesmen, responded in fitting terms. Many of the visitors proceeded to Roundhay Park and had tea in the mansion. Saturday, July 7th, was spent in Leeds and near-by places, the majority of the party returning to London that night. This ended the trip.

Commenting on the results of the tour, an unnamed correspondent of the London Times Engineering Supplement has the following:

"Der elektro-ingénieur ist in England sehr angesehen"—in England the electrical engineer is highly esteemed. This remark, made to me by one of the German visitors taking part in the tour to the electrical engineering centers of Great Britain, is significant. In England the electrical engineer occupies a position of higher standing than in any other country. It is recognized that he contributes largely to our industrial progress on the one hand and to the many comforts of our life on the other hand. The respect shown to him was evidenced by the civic receptions and luncheons given in honor of the Institution of Electrical Engineers and their guests in almost every city they have passed through—Birmingham, Manchester, Liverpool, Glasgow, Edinburgh and Leeds. The fact that the majority of our electric-lighting and tramway systems are owned by the municipalities, and are among the largest departments under their control, has its influence, of course, but this is by no means the only reason for the high regard paid to the electrical engineer. In this country more than in any other, we have esteemed at its proper worth the value of the engineer to society at large and the important part he contributes toward the maintenance of the industrial and commercial supremacy of the nation, and so long as this sentiment prevails we may hope to hold our own in the engineering markets of the world.

As the tour of the foreign electrical engineers continued, intercourse between members of the party increased daily, and the exchange of views between electrical engineers of the various countries represented has been one of the most useful results of the visit. One thing is evident, namely, that we have no need to be ashamed of our recent progress or of the position we hold in the electrical engineering industry. It has been the fashion during the last two or three years to belittle our importance as an engineering nation, and to point to signs which indicated that we had not only been outstripped by America, but also by Germany, Switzerland, and even by France and Belgium. There can be no doubt that we were lagging behind a few years ago; but the quantity of foreign electrical machinery and plant purchased in this country in place of that of home manufacture incited our own manufacturers to greater activity, and so far as our electrical engineering methods are concerned we are now well abreast of other countries. It is even possible to go further than this; the average electrical engineer in this country is better acquainted with the recent progress in electrical engineering matters than is his colleague abroad. Everything comes to England; there is no new development in any part of the world that is not immediately made known in this country. In this respect there can be no doubt that we are more active than our competitors. The organization of our leading technical journals has always been such that British engineers are kept quite au fait with what is being done abroad, and the engineer in this country is constantly meeting his professional friends, so that there is an unrestricted interchange of views and ideas between them. The comparatively small size of the country—a disadvantage in other respects—facilitates this. In the Colonies, on the other hand, we had lost too much ground to be able to win it back rapidly, but we are working hard to regain our position, and the leading manufacturers in some instances are wisely supplementing the endeavors of their local agents by sending over managers from home to ascertain the precise requirements peculiar to each colony, and to introduce the latest practice and ideas from the mother country. Such steps as these, together with the more enlightened commercial methods that now prevail in connection with the electrical engineering industry, should once more place us in the position of the leading engineering nation of the world.

During the tour I have been able to discuss with engineers of the various nationalities represented in what way the progress made in the several countries has been different. The conversation usually turned to electrical generating stations first, as the majority of the visits were paid to these. In the general design of these works British and American practice differs from German practice in the far greater use of such labor-saving devices as coal-conveying plant and automatic stokers. In Germany, where the interest payable on government stock is half as much again as in this country, and where practically all the electricity works are owned by companies and not by municipalities, it does not pay to expend extra capital on plant for the purpose of effecting comparatively small savings in the general expenditure, for it must also be remembered that unskilled labor is far cheaper in Germany than in Great Britain. In America, on the other hand, although a higher rate of interest on capital is also expected there than here, labor is expensive, and so American practice as to coal-handling plant and automatic stokers is very similar to ours.

So far as the generating plant itself is concerned, all countries in their new work employ similar machinery. For engines of 500 horsepower and upward, it is now general to choose steam turbines rather than reciprocating engines on account of their higher efficiency, lower cost, and the smaller floor space occupied, and there is the further great advantage that the efficiency of a steam turbine does not fall off nearly so much as that of a reciprocating engine or gas engine when it is not developing its maximum output. In the use of steam turbines Great Britain has an advantage over America. Here we have four English-made turbines to choose from—the Parsons, Willans and Robinson, Westinghouse, and Curtis—and, in addition to this home competition, our manufacturers are kept up to the mark by the fact that two or three of the steam-turbine makers on the Continent are ready to enter the British market also. In America the chief competition is between two makes of turbine only, the Curtis and Westinghouse, although a third make, the Allis-Chalmers, which is practically the Willans and Robinson turbine, is now also being manufactured in the United States under license to the English company. On the Continent it appears that the Curtis turbine has not yet put in an appearance, or, at all events, is not employed to any great extent. So far the pattern made by the Brown-Boveri Company, under license to the Parsons company, is the favorite; it has proved itself the most efficient of those made abroad, and, in fact, the tests have compared favorably with tests of English-made turbines. Most of the turbo-generator sets made so far have been for alternating current, but continuous-current machines of large capacity are occasionally required, and, other things being equal, it is advantageous to drive them with turbines for the reasons already stated. A difficulty arises in this case, however. Owing to the high speed of the turbine sets, considerable modifications of design have been necessary in the case of continuous-current generators, to avoid sparking or "flashing over" at the commutators; these troubles do not arise with alternating-current generators in which there are no commutators. The cause of the commutator difficulties is well understood; it has been investigated theoretically, especially on the Continent, and experimentally, especially in England. Two 1,800-kilowatt continuous-current Parsons turbo-dynamos have been running in Manchester since 1903, and as a result of the experience gained they have been modified, so that they now run quite sparklessly. Other sets have since been built, and a number were under construction at Messrs. C. A. Parsons & Co.'s works when they were visited last week. Abroad, on the other hand, the design of large continuous-current generators for turbine drive is only now emerging from the theoretical to the constructional stage.

Our visitors from all countries expressed their surprise that, while we were well in advance in other respects, we had shown them no examples of overhead electric power transmission at very high pressures. The reason for this is not an engineering one. As nearly all the districts in England in which electric power distribution on a large scale is required are thickly populated, the Board of Trade has only permitted the use of extra high-pressure overhead lines when these can be run on private property, and has refused to sanction the erection of these wires on public roads. Consequently there are very few cases in which it has been possible to adopt them, and in this branch of electrical engineering we are bound to acknowledge that the experience abroad has been far greater than ours.

THE SMALL CENTRAL STATION.

Practical Hints on Its Construction and Operation.

CHAPTER IV. (*Continued*).

BOILERS AND SETTINGS.

Selection of Boilers.—Having determined how much water it will be necessary to evaporate per hour to do the duty of his station, the purchaser must decide upon the size of the units he will employ to handle the work. In so doing he must always bear in mind that it will be necessary to place a boiler out of commission occasionally for cleaning and repairs. By judicious handling of his plant it need never be necessary in the ordinary running to have more than one boiler cut out at a time. While that one is out the remaining ones must have overload capacity enough to make up the deficiency. As the properly proportioned boiler may be run at one-third above its normal capacity, it is good practice to select four, or a multiple of four, as the number of units to be employed, unless of course the plant is so small that a single boiler or two of moderate size will furnish all the steam needed. Then the expense of providing a boiler to lie idle all the time for the emergency service is encountered. The normal duty of the plant should never be divided among three boilers, however, as two together could not be forced sufficiently to furnish the steam of three, and the fourth would have to be installed anyway to lie idle most of the time.

The size of units settled, further specification should include the size of heating service and grate area as best adapted to the fuel to be burned and the details of the construction. These last, comprising the quality of the materials used and their properties under test and the proportions of parts for the pressure, are satisfactorily stated in the rules of the Hartford Steam Boiler Inspection and Insurance Company, which are gradually coming to be adopted as standard practice. An abbreviated specification is given herewith:

STANDARD TUBULAR BOILERS.—HARTFORD SPECIFICATIONS.—FOR PRESSURE UP TO 125 POUNDS.

Horsepower	50	60	75	80	90	100	125	150
Dimensions	48″x14′	54″x14′	60″x14′	60″x16′	60″x16′	66″x16′	72″x16′	72″x18′
Cost of boiler complete	$430	$ 500	$ 620	$ 660	$ 660	790	$ 980	$1,050
Iron stack erected	97	114	131	131	131	201	231	291
Masonry setting	175	195	210	225	225	250	280	300
Cost of boiler set	702	809	961	1,016	1,016	1,241	1,491	1,641
Feed-water heater	135	135	140	150	150	150	160	160
Boiler feed pump	60	60	60	70	70	85	90	90
Injector	20	20	20	24	24	28	30	30
Pump and heater foundations	12	12	15	18	18	21	25	30
Total	$929	$1,036	$1,196	$1,278	$1,278	$1,525	$1,796	$1,951

Note.—These boilers have 4-inch tubes.

CHAPTER V.

OPERATION OF BOILERS.

Draft.—Draft is the difference in pressure of the air just before it enters the bed of fuel and the pressure of the gases as they leave the boiler to take their course up the chimney. In the case of draft from chimney alone it is equal to the difference between the weight of the column of hot gases within the chimney and the weight of a like column of the external air. It is measured in inches of water, and the statement of a draft of so many inches means that this difference in pressure is equal to the weight of a column of water that high. With forced and induced draft the same measure is used, although it may be less easily determined.

To attain the best furnace efficiency it is necessary that there be exactly enough draft, and not too much. For if an insufficient quantity of air be forced into the furnace, only partial combustion will take place, and gases strong in heat units will pass off without giving over their heat to the production of steam. Again, too much air cools the gases, and by increasing their volume raises the speed at which they pass over the heating surfaces, giving a correspondingly shorter time for the transmission of heat to the water. The weight of authority among leading engineers is that steam boilers develop their greatest efficiency when the fuel is burned at a comparatively high rate. So it is always well to burn a fuel at the highest rate at which it will show economy, and to do so ample draft must be provided with a sufficient additional amount to permit of running the boilers above their normal rating upon demand.

Natural Draft.—The draft may be natural (as that produced by a chimney is termed), induced, or forced, the last two coming under the classification of mechanical draft. In the case of a chimney the draft may be increased either by increasing the height of the chimney or the temperature of the gases which it contains, either means resulting in a greater difference in weight between the column of chimney gas and the similar column of outside air. The latter method is very wasteful and should never be resorted to except possibly over short periods of forced firing, which are not of long enough duration to warrant the expenditure which a higher chimney would entail. The greater the resistance offered by the bed of fuel to the passage of air through it, the greater the draft required, and in consequence the kind of fuel to be used again enters into our calculations in determining the height of chimney to be needed. The more modern practice has seen the successful erection and operation of chimneys of great height, they of course being for plants of much greater capacity than those we are considering. For moderate-sized plants 200 feet is probably the highest chimney that would be demanded, or the size of the plant warrant one in building.

For plants of over 750 horsepower no chimney of less than 150 feet in height should be built, irrespective of the kind of coal to be burned, but for the smaller plants corespondingly lower chimneys may be employed, their height varying with the nature of the fuel to be burned.

Gas and oil require very little initial draft, cordwood a little more, and so on through the list of free and slow-burning bituminous coals into the anthracites, which require greater draft as the size of the pieces become smaller. For these smaller plants a chimney of 150 feet height has been recommended for anthracite buckwheat coal, 125 feet for anthracite pea coal and slow-burning bituminous, 115 feet for bituminous slack, and 100 feet for a free-burning bituminous coal.

For wood 60 to 75 feet would furnish ample draft, and for oil and gas the chimney would become more of a conveyor to take the escaping gases to a proper height before unloading them upon the atmosphere. The figures are given as mere approximations, as something depends upon climatic and weather conditions, and much upon the character and number of boilers. The smaller and more circuitous the boiler passages for gases are, the higher the stack required. A single boiler will require less height than two which total the same horsepower and which discharge into a horizontal flue. So it is quite impossible to give any absolute figures or even a general rule.

In purchasing a chimney thought must be given to the possibility of future extensions of the plant and to the use of a lower grade of fuel which at some time it may be advisable to use. The only unvarying rule that can be laid down in the matter is to be sure to have the chimney large enough. It will then be a never-ending source of satisfaction and economy.

The table of chimney sizes (given below) is based upon the assumption of one horsepower generated to five pounds of coal burned per hour, or upon the use of the ordinary grade Illinois bituminous slack coal.

For stations of modest power iron stacks are universally used, and they are being erected in many cases for those of greater size. The larger stacks, however, are special and are usually built upon specifications furnished by the purchaser with a consequently varying price. For the smaller sizes which are to be had in the market the table on the next page gives sizes and average prices erected, including stack plate.

Mechanical Draft.—As stated, this classification of draft includes the two methods, known as induced draft and forced draft. The former is obtained by placing a fan of sufficient capacity in the smoke flue of a boiler or battery of boilers so as to draw the gases through the furnace and gas passages to the fan and discharge them through a chimney, which is usually, but not always, a short one. It is more frequently employed in new plants where mechanical draft is desired, as its installation in an old plant is accompanied with considerable expense of tearing out and remodeling, while forced draft may be put in with little or no alteration to the plant.

Forced draft is obtained by forcing air into the furnace either with a fan or by means of a steam jet blower. The latter method has been used most extensively in furnaces where a certain kind of anthracite coal which was productive of much clinker was the fuel employed. Its use has gradually become less and less, however, as it can produce but a moderate draft and is wasteful of steam. A board of steam engineers of the Navy Department has made extensive tests, which show that from 8.3 to 21.2 per cent. of the steam generated in the boilers to which they were applied was used with five different types of jets tested. But the steam required to drive a fan for forced draft amounts to but from 2.5 to 8 per cent. of the whole amount evaporated by the boilers it is applied to.

The chief advantage possessed by mechanical draft over that from chimneys is its flexibility, it being possible of control at will simply by changing the speed of the fan. But this introduces a dangerous element as well, for it has been shown that much injury may be done to the boiler by forcing the draft too hard. With the use of mechanical draft economizers may be placed in the flue and the heat of the escaping gases utilized to raise the temperature of the feed water. The result of doing this is to lower the temperature of the gases to a point far below that which would be necessary to the creation of a draft in a chimney alone. With a powerful draft at command a much cheaper grade of fuel may sometimes be burned with economy over that which could be obtained from the coal for which the ordinary chimney would furnish sufficient draft. Another point argued in favor of the fan draft is its portability compared to a chimney should it at any time become desirable to change the location of the boiler plant.

Of the two systems, induced and forced draft, the former produces a slight vacuum in the furnace, while the latter places it under pressure. And experience has shown that combustion is not as perfect under pressure as under a slight vacuum. Also a leakage of air inward through the walls helps to supply hot air for combustion, while with the leakage outward, as it is under forced draft, considerable loss in radiation and escape of partially burned gases is entailed, to say nothing of the discomfort

SIZES OF CHIMNEYS FOR STEAM BOILERS.

Square Chimney, Sides of Square.	HEIGHT OF CHIMNEY. Round Chimney, Diameter in Inches.	Area. Square Feet.	Effective Area. Square Feet.	50 ft.	60 ft.	70 ft.	80 ft.	90 ft.	100 ft.	110 ft.	125 ft.	150 ft.	175 ft.	200 ft.
				COMMERCIAL HORSE-POWER OF BOILERS.										
16 x 16	18	1 77	97	23	25	27	.....	.....	.....	.....	.....	.....	.....	.....
19 x 19	21	2 41	1 47	35	38	41	.....	.....	.....	.....	.....	.....	.....	.....
22 x 22	24	3 14	2 08	49	54	58	62	.....	.....	.....	.....	.....	.....	.....
24 x 24	27	3 98	2 78	65	72	78	83	.....	.....	.....	.....	.....	.....	.....
27 x 27	30	4 91	3 58	84	92	100	107	113	.....	.....	.....	.....	.....	.....
30 x 30	33	5 94	4 48	.....	115	125	133	141	.....	.....	.....	.....	.....	.....
32 x 32	36	7 07	5 47	.....	141	152	163	173	183	.....	.....	.....	.....	.....
35 x 35	39	8 30	6 57	.....	183	196	208	219	.....	.....	.....	.....	.....	.....
38 x 38	42	9 62	7 76	.....	.....	216	231	245	258	271	.....	.....	.....	.....
43 x 43	48	12 57	10 44	.....	.....	.....	311	330	348	365	389	.....	.....	.....
48 x 48	54	15 90	13 51	.....	.....	.....	.....	427	448	472	503	551	.....	.....
54 x 54	60	19 64	16 98	.....	.....	.....	.....	536	565	593	632	692	748	.....
59 x 59	66	23 76	20 83	.....	.....	.....	.....	.....	694	728	776	849	918	981
64 x 64	72	28 27	25 08	.....	.....	.....	.....	.....	835	876	934	1,023	1,105	1,181
70 x 70	78	33 18	29 73	.....	.....	.....	.....	.....	.....	1,038	1,107	1,212	1,310	1,400
75 x 75	84	38 48	34 76	.....	.....	.....	.....	.....	.....	1,214	1,294	1,418	1,531	1,637
80 x 80	90	44 18	40 19	.....	.....	.....	.....	.....	.....	1,496	1,639	1,770	1,893	
86 x 86	96	50 27	46 01	.....	.....	.....	.....	.....	.....	.....	1,876	2,027	2,167	

IRON STACKS.

Horsepower.	Height in Feet.	Diameter in Inches.	Number of Iron.	Price Erected.	Price per Foot.
25	50	18	14 and 16	$ 51.00	$1.02
25	60	18	14 and 16	61.00	1.02
50	50	24	12 and 14	97.00	1.94
55	60	24	12 and 14	114.00	1.90
75	60	28	12 and 14	131.00	2.18
100	70	30	10 and 12	201.00	2.87
100	60	34	10 and 12	201.00	3.35
125	70	34	10 and 12	231.00	3.30
150	90	34	10 and 12	291.00	3.23
160	70	36	10 and 12	255.00	3.64
200	80	40	10 and 12	312.00	3.90
200	70	42	10 and 12	293.00	4.19
250	90	42	10 and 12	370.00	4.11
300	80	48	10 and 12	370.00	4.63
400	90	54	10 and 12	485.00	5.39

Y BREECHING, DAMPERS INCLUDED, FOR TWO BOILERS.

Diameter Boilers.	Center to Center.	Diameter Stack.	Height from Boilers.	Price Erected.			
				No. 16 Iron.	No. 14 Iron.	No. 12 Iron.	No. 10 Iron.
Inches.	Inches.	Inches.	Inches.				
30	56	18	54	$11.00	$14.00	.....	.....
36	62	22	54	12.00	16.00	.....	.....
40	66	26	60	15.00	19.00	.....	.....
42	68	28	60	.....	21.00	$26.00	.....
48	78	34	66	.....	27.00	36.00	$42 00
54	84	36	66	.....	32.00	41.00	50.00
60	90	40	68	.....	36.00	45.00	56.00
66	96	46	72	.....	42.00	54.00	66.00
72	106	52	78	.....	48.00	63.00	78.00

TANDEM BREECHING FOR TWO OR THREE BOILERS, DAMPERS INCLUDED.

Diameter Boiler.	Center to Center.	Diameter Breeching.		Price Erected.							
				Two Boilers.				Three Boilers.			
		Two Boilers.	Three Boilers.	No. 16.	No. 14.	No. 12.	No. 10.	No. 16.	No. 14.	No. 12.	No. 10.
Inches.	Inches.	Inches.	Inches.								
30	56	20	24	$11.00	$13.00	.....	.....	$17.00	$21.00	.....	.....
36	62	24	30	12.00	16.00	.....	.....	19.00	23.00	.....	.....
40	66	28	32	16.00	20.00	.....	.....	24.00	31.00	.....	.....
42	68	30	36	17.00	22.00	$28.00	.....	27.00	35.00	$45.00	.....
48	78	36	44	18.00	30.00	38.00	$46.00	37.00	48.00	60.00	$ 75.00
54	84	38	48	27.00	35.00	45.00	54.00	45.00	57.00	72.00	89.00
60	90	42	52	32.00	40.00	52.00	63.00	51.00	66.00	84.00	102.00
66	96	48	58	37.00	48.00	60.00	75.00	60.00	78.00	99.00	120.00
72	106	54	66	47.00	60.00	77.00	93.00	75.00	96.00	123.00	150.00

BRICK CHIMNEYS.

Approximate Horsepower.	Height in Feet.	Diameter of Flue.	Outside Diameter, Base, Square.	Outside Wall.		Cost of Fire Brick Lining.	Cost of Concrete Foundation.	Total Cost.
				No. of Brick.	Cost at $15 Per M.			
85	80	25"	7′ 5"	32,000	$ 480.00	$ 60.00	$100.00	$ 640.00
135	90	30"	8′ 3"	40,000	600.00	85.00	150.00	835.00
200	100	35"	9′ 10"	65,000	975.00	120.00	200.00	1,295.00
300	110	43"	10′ 2"	75,000	1,125.00	190.00	260.00	1,575.00
450	120	51"	11′ 2"	87,000	1,305.00	265.00	310,00	1,880.00
700	130	61"	12′ 6"	131,000	1,965.00	340.00	365.00	2,670.00
1000	140	74"	13′ 11"	151,000	2,265.00	445.00	425.00	3,135.00
1650	150	88"	15′ 1"	200,000	3,000.00	495.00	475.00	3,970.00
2500	160	110"	17′ 10"	275,000	4,125.00	740.00	535.00	5,400.00

of the fireman and the annoyance to him in tending his fires.

[To be continued.]

More About the Gary (Ind.) Mechanical Equipment.

Further details are at hand concerning the extensive use to which electricity will be put for power purposes in the large steel plant at Gary, Ind., plans for the building of which were outlined in the Western Electrician last week. When completed it is estimated that the plant will handle substantially 5,000,000 tons of ore a year and produce annually approximately 2,500,000 tons of steel. There will be 16 blast furnaces of 450 tons daily capacity each and 84 60-ton basic open-hearth furnaces.

The necessary electrical generating equipment capable of handling such an output is to have an initial capacity of 18,000 kilowatts, and will be so designed that extensions may be added indefinitely at one or both ends. Of the initial equipment of 18,000 kilowatts, 14,000 kilowatts is in 2,000-kilowatt 25-cycle 2,300-volt units and 4,000 kilowatts in 2,000-kilowatt 250-volt direct-current units. These generators are now on order from the Allis-Chalmers Company, Milwaukee, and they will be direct-coupled to nine Allis-Chalmers horizontal twin tandem gas engines.

The power-house building for the present is to be approximately 700 feet long, with a span in the main building of 88 feet. An 18-foot extension under the same roof through the entire length of the structure has been planned in order to provide the necessary room for high-tension switches. The power house will be located immediately adjacent to the blast-furnace blowing-engine houses and between the blast furnaces and the open-hearth furnaces, most advantageously placed for fuel supply and for securing a minimum length of transmission lines to the various departments using electric power.

Another indication of the great extent that gas will be used in producing power in the Gary plant is the fact that the Westinghouse Machine Company of East Pittsburg has closed a contract for eight large gas-driven blowing engines to be installed in the steel plant. The machines comprised in this initial order will be uniform in size and capacity. Each gas engine will have a rated capacity on blast-furnace gas of nearly 3,000 horsepower, corresponding to a rating of 4,000 horsepower on natural gas. The unit will be arranged in twin-tandem fashion, each side consisting of two double-acting gas cylinders and one blowing cylinder in the opposed or vis-a-vis arrangement. Power cylinders are 42 inches, and the air cylinders 68 inches in diameter, with a common stroke of 54 inches, the unit running at a maximum speed of 75 revolutions per minute for blowing and 84 revolutions per minute for electric work. The capacity of air delivery at this speed will be 33,000 cubic feet of free air per minute at 18 pounds pressure, with a maximum pressure delivery of 30 pounds per square inch.

In this type of engine, in all sizes, a resemblance to the horizontal tandem heavy-duty steam-engine design is strong. The general design conforms quite closely to that of similar machinery ordered by the United States Steel Corporation for the Carnegie Steel Company's plant at Bessemer, near Pittsburg. It also follows closely, but upon a larger scale, the design of a number of smaller units already in operation in various parts of the country for power work. Some of these smaller plants are operating on natural gas, but with the exception of slightly different proportioning of air and gas passages and cylinder diameter, the general construction of the natural-gas engine is practically identical with that intended for leaner gases, such as producer and blast-furnace gases. For several months a 350-horsepower engine of this type has been in regular operation on blast-furnace gas at the Edgar Thompson Works, Pittsburg, generating electricity for motor-driven foundry machinery.

The finance committee of the Council of Niagara Falls, N. Y., has recommended an appropriation of $14,500 for installing an electric pump at the city pumping station.

Has the Sight Telephone Arrived?

BY FRANK C. PERKINS.

Many scientists and electrical engineers in America as well as in Europe have tried with little or no success to solve the problem of sight telephoning—that is, transmitting visual impressions as well as speech, and it is now asserted by a genius in the western states that he has obtained an apparatus which will simultaneously transmit a visual image and also spoken words by means of wires, the sight telephony being accomplished in conformity with the general principle embodied in the ordinary telephone.

The accompanying illustration shows the appearance of this wonderful invention, as it is claimed, known as the "televue," as designed by J. B. Fowler of Portland, Ore., and which, it is maintained, is being placed on the market by the American Televue Company of San Diego, Cal.

THE TELEVUE OR ALLEGED "SIGHT TELEPHONE."

The picture certainly shows a unique and interesting type of instrument which might have the appearance of a sight telephone, but the details of construction provided by the inventor and the mode of operation given as to the principles involved are so meager as to cause one to distrust the claims of this inventor.

Mr. Fowler maintains that demonstrations have been repeated many times in public in the city of Portland and that the apparatus is capable of transmitting images in all their natural colors, as well as spoken words, for distances of a mile or more. It is declared that in all tests thus far conducted four copper wires are employed for transmission purposes between the two terminal points, but that eventually the inventor hopes to be able to reduce the number of wires one-half. It is held that extra induction coils and batteries are required for use in this instrument in addition to the ordinary telephone apparatus, but what their function is, is not stated. The transmitting lens employed in the televue resembles somewhat the lens of a photographic camera and is called by the inventor the transmitting disk, before which the person or object stands, or is placed, the image of which is to be transmitted. This transmitting disk or lens is six inches in diameter, but the receiving plate, where the transmitted image is noted, is only 1¾ inches in diameter. It is asserted by the inventor that by means of the televue these images may not only be transmitted from a distance, but they may be also thrown in enlarged form upon a screen with equal facility.

While such an instrument as this would undoubtedly be of great value to the public, and many inventors have turned their attention to this problem, it is a question whether a sight telephone has been really invented, as the details given are so scanty, and the company seems to be engaged at the present time in selling stock to the confiding public. If such an invention has really been made, the drawings of the electrical connections would be certainly most interesting, and the electrical engineering societies would only be too glad to hear a paper upon this subject, which would

give the public confidence in the claims as to the success of the instrument and the solution of the problem of sight telephony.

By a coincidence, since Mr. Perkins' contribution, as above, was put in type, the Western Electrician has received the following on the same subject from a southern correspondent:

Mr. William H. Thompson, who has won the title of the "Little Wizard" as city electrician of Richmond, Va., is working on a device which is expected to be used in connection with the telephone so that the speaker can see a person miles away with whom he may be conversing over the telephone. The instrument, known as the televue, as perfected by Mr. Thompson, can be used on a wire of any length, and, more to the point, it is said to be practical. While not exhibiting his model, the inventor says that the idea embodied is the transmission of a visual image in the form of a photograph, and the apparatus depends for its efficiency on the variations in the electrical resistance of a ribbon made of selenium, the variations being produced by varying intensity of a beam of light impinging upon the ribbon. A similar device has been patented by J. B. Fowler of Portland, Ore., but Mr. Thompson expects to improve upon this and render the instrument practical and adapted to every-day use so that the householder or the purchaser of goods may see them by means of the televue at any distance as he discusses their merits with the merchant or business man at the other end of the line.

First Wireless Message from the Arctic Region.

Walter Wellman of the Wellman-Chicago Record-Herald polar expedition, has reached Dane's Island, from whence he will soon begin an attempt to reach the North Pole by airship. As readers of the Western Electrician are aware, Mr. Wellman has with him several space-telegraph experts and abundant equipment. Several wireless stations have been established en route by which it is proposed to relay messages from the airship to Hammerfest, Norway, the most northerly point in the world with cable communication.

On July 21st Mr. Wellman and his party were at Dane's Island, 650 miles north of the northeast coast of Norway and 600 miles from the North Pole. From this point Mr. Wellman sent the following message on July 21st by space telegraphy to Hammerfest, and from there by cable it was sent to the Record-Herald in Chicago:

Dane's Island, July 21, by Wireless Telegraph to Hammerfest, July 21.—This is the first wireless message ever sent to the outside world from the arctic regions within 600 miles of the north pole. The message goes by wireless from Dane's Island, Spitzbergen, to Hammerfest, Norway, the most northerly settlement in the world with cable communication. The Wellman-Chicago Record-Herald polar expedition's wireless station here has just been completed. I am sending this message in the hope that it will be received by the Record-Herald in due course, though thus far I have not received from our other wireless station at Hammerfest a single signal or word of assurance that connection has been effected. Work at the headquarters is proceeding with great energy and without setbacks. The immense balloon house is now under construction. The machine shops are working and the motor sledges are being tested. The twenty-four members of the expedition are well and in good spirits. I hope to start for the pole the latter part of August at the latest, unless the weather conditions are unusually unfavorable.

This message is of importance, as it marks the introduction of original methods in communicating with the world from the Arctic region. The airship in which Mr. Wellman proposes to reach the pole is equipped with space-telegraph apparatus, the details of which have been given in the Western Electrician, and by this means it is hoped to keep in constant communication with Chicago.

On July 22d and 23d other messages were received at Hammerfest from Dane's Island reporting good progress in the work of preparing for the northward airship flight. Further developments will be looked for with interest.

Standard Operation for Ohio and Indiana Interurban Roads.

Prominent electric traction officials connected in managing capacities with the interurban syndicate represented in Indiana by Hugh McGowan and in Ohio by W. Kesley Schoepf held a conference in Cincinnati on July 21st for the purpose of devising a standard for unified operation of all the roads of the system. The conferences will be continued until the schedules, methods of operation, switches, connections, the handling of employes and equipment are brought to a common standard of highest efficiency.

J. Benson Foraker, president of the Indiana, Columbus and Eastern, presided. This company is the one recently organized in Ohio as a holding company for all the Schoepf properties of the state. Charles A. Baldwin, superintendent of transportation of the Indiana Union Traction Company, took a prominent part in the conference. He explained how his company had organized the various lines of its system and how the 400 miles of road had been brought under one management. His presence at the conference was largely for the benefit of the managers of the Ohio lines. D. G. Edwards, vice-president, in charge of traffic of the Schoepf-McGowan lines, also gave the conferees the benefit of his experience.

J. L. Adams of Dayton, general manager of the western division of the Indiana, Columbus and Eastern; W. A. Gibbs of Newark, general manager of the eastern division; F. T. Hepburn of Lima, manager of the Lima and Toledo; F. J. J. Sloat, general manager of the Cincinnati Northern, and C. T. Baldwin of Indianapolis, superintendent of traffic of the Indiana Union Traction Company, were among those present.

Specifications for Rubber Wire Insulation.

The Okonite Company of New York has issued for the benefit of engineers "Specifications for 30 Per Cent. Rubber Insulating Compound." These specifications read as follows:

Insulating Compound.—The compound shall contain not less than 30 per cent. by weight of dry, fine Para rubber, without any reclaimed or soft rubber. The composition of the remaining 70 per cent. shall be left to the discretion of the manufacturer.

Chemical.—The vulcanized rubber compound shall contain not more than five per cent. by weight of extractive matter.

Mechanical.—The rubber insulation shall be homogeneous in character, shall be placed concentrically about the conductor, and shall have a tensile strength of not less than 800 pounds per square inch. A sample of vulcanized rubber compound, not less than four inches in length, shall be cut from the wire with a sharp knife held tangent to the copper. Marks shall be placed on the sample two inches apart. The sample shall be stretched until the marks are six inches apart and then immediately released; one minute after such release the marks shall not be over 2⅜ inches apart. The sample shall then be stretched four times its original length without rupture, and on release the marks shall not be over 2½ inches apart.

Electrical.—Each and every length of conductor shall comply with the requirements given in the following tables. The tests shall be made at the works of the manufacturer when the conductor is covered with vulcanized rubber and before the application of tape, braid or other coverings. Tests shall be made after at least 36 hours' submersion in water and while still immersed. The insulation test shall follow the voltage test, shall be made with a battery of not less than 100 nor more than 500 volts, and the reading shall be taken after one minute's electrification.

Inspection.—The purchaser may send to the works of the manufacturer a representative, who shall be afforded all necessary facilities to make the above specified electrical and mechanical tests, and also to assure himself that the 30 per cent. of rubber above specified is actually put into the compound, but he shall not be privileged to inquire what ingredients are used to make up the remaining 70 per cent. of the compound.

30% RUBBER COMPOUND
VOLTAGE TEST

SIZE	THICKNESS OF INSULATION IN INCHES										
	2/64	3/32	3/64	5/32	7/64	4/32	5/32	6/32	7/32	8/32	9/32	10/32
1000000 to 550000	....	....	....	..	3000	4500	7500	10500	13500	16500	19500	22500
500000 to 250000	....	....	...	2000	4500	6000	9000	12000	15000	18000	21000	24000
4/0 to 1	....	....	3000	4500	6000	7500	10500	13500	16500	19500	22500	25500
2 to 7	....	3000	4500	6000	7500	9000	12000	15000	18000	21000	24000	27000
8 to 14	2250	3750	5250	6750	8250	9750	12750	15750	18750			

NOTE:—It is our experience that the above are sufficiently high voltages to employ. Higher voltages, although not necessarily causing a breakdown of the insulation, are apt to *strain* it.

MEGOHMS PER MILE
60 DEG. F.
One Minute Electrification

		2/64	3/32	3/64	5/32	7/64	4/32	5/32	6/32	7/32
1000000	C. M.	....	..	....	.	530	600	730	855	975
900000	"	....	..	....	.	555	625	760	900	1025
800000	"	....	..	....	..	585	650	800	950	1075
700000	"	....	..	....	.	620	700	850	1000	1150
600000	"	....	..	....	..	675	760	900	1075	1200
500000	"	....	..	....	625	720	800	975	1150	1300
400000	"	....	..	....	700	800	900	1100	1250	1400
300000	"	....	..	..	800	900	1000	1200	1400	1600
250000	"	....	..	..	850	980	1100	1300	1600	1700
4/0	Strd	....	..	800	950	1050	1175	1400	1600	1800
3/0	"	....	..	850	1050	1150	1300	1500	1800	2000
2/0	"	....	..	950	1150	1275	1400	1700	1900	2150
1/0	"	....	..	1050	1250	1400	1550	1800	2100	2350
1	Solid	....	..	1300	1500	1700	1900	2200	2500	2800
2	"	....	1200	1400	1600	1850	2050	2400	2700	3000
3	"	....	1300	1500	1800	2000	2200	2500	2950	3250
4	"	...	1400	1700	2000	2200	2400	2800	3150	3450
5	"	....	1650	2150	2400	2600	3000	3400	3700	
6	"	....	1700	2000	2300	2600	2800	3250	3600	3975
8	"	1800	2000	2400	2700	3000	3300	3750	4150	4600
9	"	1800	2200	2600	2900	3250	3500	4000	4400	4790
10	"	2000	2400	2800	3150	3500	3750	4250	4700	5050
12	"	2300	2800	3200	3600	3950	4250	4800	5250	5600
14	"	2700	3250	3700	4100	4500	4800	5350	5850	6250

NOTE:—The above are conservative figures, and are composed containing 30% of dry fine Para Rubber should give lower results.

An Improved Indicator for Enclosed Fuses.

The new line of National Electrical Code standard 250-volt enclosed fuses, herewith illustrated, is equipped in all capacities with a positive mechanical indicating device just patented. The manufacturer of these fuses is so sure of their indicating device that it guarantees every fuse equipped with the patent indicator to indicate clearly and unmistakably when it is blown, and not before.

Fig. 1 shows the size from 1 to 30 amperes not blown. The indicator for this capacity consists of a projectile shell at the end of the fuse tube and

Fig. 1. 1-30 Ampere Type Not Blown. (Holes in End of Shell Not Closed.)

Fig. 2. 1-30 Ampere Type Blown. (Holes in End of Shell Closed.)

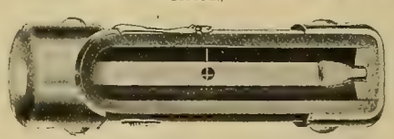


Fig. 3. 31-60 Ampere Type Not Blown.

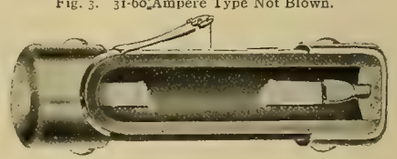


Fig. 4. 31-60 Ampere Type Blown. (Case Cut Away.)

AN IMPROVED INDICATOR FOR ENCLOSED FUSES.

inside one of the end caps. This projectile cap is held down over a spiral spring, which is released on the disruption of the fuse, and the shell inside is thrown out longitudinally and closes both side and end holes of the outside shell, as shown in Fig. 2.

This construction provides an indicating fuse for either the spring clip form of contact or the 250-volt Edison screw-plug casing, because it is easily seen either from the side or the end of the fuse whether the fuse has blown. Being able to determine whether the fuse has blown in a plug casing without being compelled to unscrew the casing from the cut-out is a decided advantage, and these fuses are rapidly coming into use for this purpose.

Fig. 3 shows the size from 31 to 60 amperes, not blown. The indicator for fuses above 30 amperes and up to 600 amperes consists of a phosphor-bronze spring on the side of the enclosing case. This spring is held down by a fine phosphor-bronze wire passing through the case from the end of the compressed spring, and is fastened to a cut-away portion of the fuse strip. This part of the strip is the weakest portion, and, being the first to melt on disruption, releases the indicator, which springs upward into clear view, and can be readily detected, even along a whole row of fuses, as shown in Fig. 4.

These fuses have been thoroughly tested, approved and listed. They are made by the Horton-Morehouse Company of Detroit, Mich.

Ohio Electric Light Convention.

The twelfth annual convention of the Ohio Electric Light Association will be held at Hotel Victory, Put-in-Bay Island, on Tuesday, Wednesday and Thursday, August 21st, 22d and 23d. An excellent program and enjoyable entertainment features will be provided. The papers already prepared and the arrangements made seem to insure the best convention the association has ever held. The programme is particularly attractive to the central-station man. A few of the subjects upon which papers will be presented are as follows: Natural gas engines in competition with electric motors; what inducements should be given to increase business in villages or small cities in which the population is not increasing? Description of wiring of a moderate-priced residence scientifically lighted; progress of high-efficiency lighting in Ohio by central-station men; new business—how to get it and how to keep it; one successful way to get business; legislation—its uses and abuses; report of committee on cost determination; report of committee on publicity; luminous arc lamps with mercury arc rectifiers; electric heating and cooking devices (illustrated lecture); notes on high-efficiency lighting units by the manufacturers, and wiring for electrical appliances other than light. On some of these subjects as many as four papers will be presented.

An urgent invitation is extended to the ladies

to attend this convention, particular attention having been given to their entertainment. A list of prizes has been very generously donated for distribution among the ladies attending. A series of games and contests has been arranged so that every lady attending can take part. It consists of a card party, bowling contest, guessing contest, tennis or croquet, and one aquatic contest in the natatorium. In addition will be balls, bathing, boating, automobile rides and other special features for both the ladies and the gentlemen. The Sons of Jove will hold a rejuvenation on Wednesday evening, August 22d.

Hotel Victory, where the convention will be held, has a national reputation for its excellence as a resort. Rates for the convention will be $2.50 to $4.50 a day, depending upon location, bath, etc. W. E. Russell of Massillon is acting president, and D. L. Gaskill of Greenville is secretary and treasurer.

Additions to Brunot's Island Power Plant, Pittsburg.

New equipment in boilers, engines and electrical machinery to the extent of 27,500 horsepower will be added to the great Brunot's Island power house of the Pittsburg Railways Company this year. Contracts were closed last week and involve considerably over $300,000 in investment.

There lately have been tremendous demands for power upon this plant because of the extension of lines in all directions, not only in Pittsburg and Allegheny, but throughout the suburban districts. The company, when it built the big plant on Brunot's Island, arranged for increasing the plant to 50,000 horsepower. With this additional power, the plant will contain practically this limit, and there is a likelihood that it will be further increased in the future.

New equipment contracted for consists of three turbine engines of 7,500 horsepower each and one of 5,000 horsepower, making a total of 27,500 horsepower. Besides this, there will be the additional boiler capacity, electric generators, switchboards and wiring. The Westinghouse Electric and Manufacturing Company and the Westinghouse Machine Company have the orders for the entire contract.

The additional power will not only be used for the new traction lines to be ready for operation soon, but for lighting purposes as well. The company has started a regular schedule on its new line from Avalon to Emsworth, that line having recently been completed. Work is now to be started on the next division of the road down the Ohio River toward Beaver, which will run from Emsworth to Dixmont, passing around the rear of Sewickley, and when that line is completed the distance between Pittsburg and Beaver, Pa., will be nearly closed up with electric roads. These will be supplied with power from the central power station in Pittsburg.

The new suburban line from Pittsburg to Canonsburg and then to Washington, Pa., will be completed this year and will demand more power, while the expansion of the city lines in many directions all call for additional power. In these additions, the plan is to transmit the power over high-tension wires from the power house to distributing points, where it will be reduced in voltage to the requirements of the service. The power will go out of the power station in the form of an alternating current and be transformed to a low-voltage direct current for car service.

Fuel for this plant will come almost exclusively from a coal mine owned by the Pittsburg Railways Company, adjacent to Brunot's Island, and which will give the company plenty of coal at practically the cost of mining. The fuel arrangements give the company quick handling of coal, and the ashes from the boiler are being used to fill up the low parts of the island, thus reclaiming them for commercial purposes. The total cost of this great plant will be close to $2,000,000.

Circuit-breakers with Massive Rollers and Stationary Brushes.

The "S. E." circuit-breakers, heretofore described in the Western Electrician, are characterized by extreme rigidity and simplicity of construction. The customary moving brush and latch has been omitted and in its place a stationary brush and massive roller substituted.

Fig. 1 shows a double-pole 1,800-ampere circuit-breaker which is unique in the fact that it has but one contact, that being the one between the main arm and the laminated brush, and that each pole is equipped with an independent tripping coil and an independently adjustable armature.

A four-pole rigid connection is shown in Fig. 2. Here, while each pole is equipped with an independently adjustable armature, an overload on any one pole will trip all four, and it is not possible to close the breaker without closing all poles. This breaker is used particularly for the protection of quarter-phase alternating-current circuits and on muti-voltage direct-current work for machine tool drive.

A protective panel can be supplied for the protection of motors, and it is particularly applicable to such machine tools as lathes, where it is desired to protect against a constant overload for a considerable space of time. The circuit-breaker on this panel gives instantaneous protection in case of short-circuit or heavy starting current, while a switch and fuse mounted on the same panel give the necessary time-limit protection.

Fig. 3 shows a single-pole overload and auxiliary trip-breaker. This type is used either with a push-button release, a no-voltage release, or with an underload release. When used as an underload breaker for the protection of storage batteries it is so arranged that the breaker can be closed and will stay closed on no load, while the load will automatically set the breaker so that when the no-load condition comes the breaker will open the circuit. This is all done with but one movement of the handle.

There is also a single-pole breaker of the same general type as that shown in Fig. 1, but of 3,000 amperes capacity. All of these breakers open and close with one handle like a switch and will carry their full rated current continuously with a temperature rise not exceeding 20° C. above the surrounding atmosphere.

These interesting specialties are made by the Switchboard Equipment Company of Bethlehem, Pa., which is also constantly engaged in manufacturing special devices such as electrically operated circuit-breakers, time-limit circuit-breakers for starting induction motors, underground switches and special high-tension work.

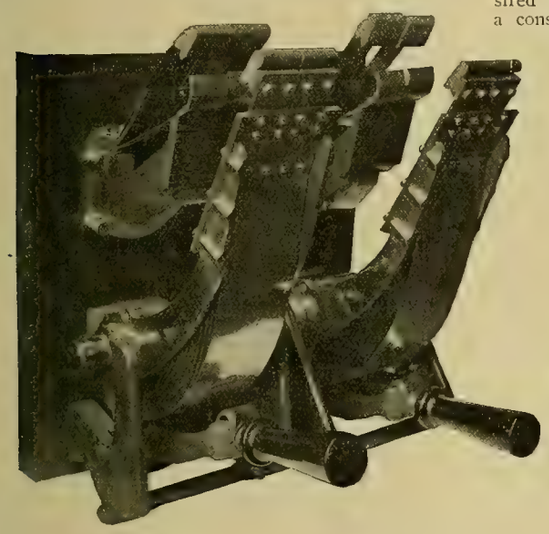


Fig. 1. Double-pole 1,800-Ampere Type

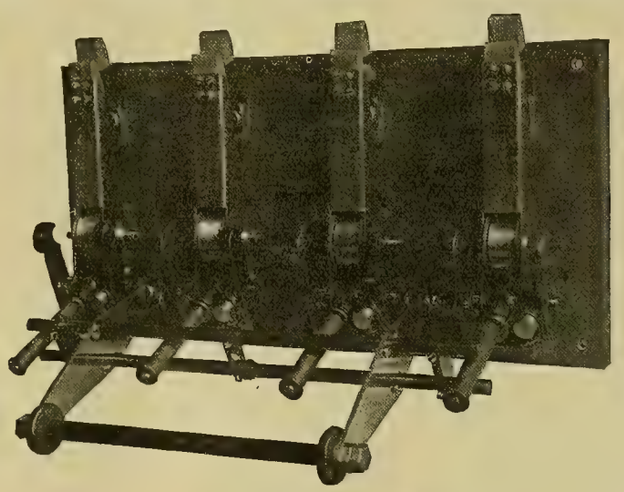


Fig. 2. Four-pole Rigid Connection.

Fig. 3. Single-pole Overload and Auxiliary Trip Breaker.

CIRCUIT-BREAKERS WITH MASSIVE ROLLERS AND STATIONARY BRUSHES.

Telephone Rebate in Chicago.

The Chicago Telephone Company has begun the payment of a $50 rebate for every year since January, 1902, to subscribers who were paying $175 a year for improved service. The Supreme Court recently decided that the company could not under its franchise charge more than $125 a year. The company also announces that the charges for private switchboards after August 1st will be reduced 50 per cent. This will affect about 1,500 subscribers, having at least 3,500 telephones. Another reduction to be made is in the measured service, the charge for 600 calls being reduced from $75 to $60.

Telephone Situation on the Pacific Slope.

The Pacific States Telephone Company is keeping up a spirited fight with the Interstate Co-operative Telephone Company for the control of the business of 11 rural telephone lines centering at Palouse, Wash. The former company has secured the switching business of two more of these lines, leaving seven lines to the Co-operative company. The Pacific States is cutting switching rates to $1 a year, and it looks as if all of the rural lines in Eastern Washington will come into the control of the Bell interests in time.

The Pacific States Telephone and Telegraph Company is sparing no expense to rehabilitate its San Francisco system, which received a very severe blow from the great fire. About 15,000 of the original 52,000 subscribers are receiving service now, and additional telephones are being installed at the rate of almost 200 a day. Permanent switchboards will be installed in the four class A office buildings that were burned out, but not destroyed. Much of the switchboard material is on the road, 127 carloads of telephone supplies having been shipped already. The offices that were destroyed will be rebuilt, including three new offices in the unburned district. The demand for renewed telephone service is phenomenal. A new telephone directory is just ready for distribution, and will be greatly appreciated by subscribers, who have had to call up "Information" and wait for a long time to ascertain the number of the person they desired to communicate with. The lack of an adequate book was partly due to the difficulties of having printing done, owing to the limited number of large printing offices that have resumed operations.

Three additional offices will be erected in the unburned district. The new building of the executive offices will be erected on a different site. Large multiple switchboards will be installed in the Main office and the South office as soon as enough new material arrives from the East.

It is said that the poor service between San Francisco and Oakland, caused partly by the rapid increase of business, overtaxing the facilities, will be improved by the laying of an additional cable across the bay.

H. V. Gates of Hillsboro, Ore., who is president of the Midway Telephone and Telegraph Company, says that his company intends building a telephone line from Klamath Falls, Ore., to Lakeview this summer.

The application of the Home Telephone Company of Alameda County for a franchise to construct and operate an automatic system in Alameda, Cal., was laid aside by the city trustees, who feel that they wish to secure an opinion of the residents before passing on any application. A.

Bell Telephone Output.

The American Telephone and Telegraph Company makes the following statement for June:

	1906.	1905.	Increase.
Gross output	217,243	120,555	96,688
Returned	54,973	52,427	2,546
Net output	162,270	68,128	94,142
From January 1st to June 30th:			
Gross output	1,161,857	807,620	264,237
Returned	358,335	283,542	74,793
Net	803,522	614,078	189,444
Total outstanding	6,501,780	5,094,642	1,407,138

The Home Telephone Company of Detroit, Mich., has filed with the city clerk a $6,000,000 first-mortgage deed of trust, running to the Commercial Trust Company of St. Louis. The deed is issued to secure a bond issue to extend and increase the Independent telephone system which the company is constructing in Detroit. A bond issue of $3,250,000 will be made immediately.

CORRESPONDENCE.

Great Britain.

London, July 11.—The first of the municipal telephone systems to be sold to the government as the outcome of the determination of the state to own the telephone systems of the country under the terms of the agreement with the National Telephone Company is that of the Glasgow Corporation. Curiously enough Glasgow was the leading spirit in the agitation for municipal telephone systems four or five years ago. As I have previously noted, the postmaster-general has been in negotiation with the various corporations owning telephone systems with a view to purchase, but the stumbling block hitherto has been that he insists on deducting about 40 per cent. for depreciation, which has been strongly resented. Consequently hitherto the negotiations have come to a standstill, but whether the action of the Glasgow Corporation will act as an incentive to its more stubborn brethren remains to be seen.

The last of the reports of the Royal Commission on London Traffic has now been issued, and it contains some most instructive information upon the transit facilities in other countries. Particular detail is given to New York, Boston and other leading cities in the United States, the secretary to the commission having prepared a most complete history in each case. Great praise is bestowed upon American tramway systems generally, but apart from this the commissioners do not appear to have been particularly struck with the street traffic facilities as a whole. Overhead railways are quite condemned as absolutely unsuitable for British towns. Emphasis is laid upon the fact, however, that in the United States there is a very marked tendency toward a comprehensive and general scheme of locomotion in direct opposition to what has obtained in London. In fact, even now that the specific recommendations of the commission are in the hands of the government, there is little disposition to act upon them, at any rate this session, and the result has been that all tube-railway schemes have once again been suspended for a further twelvemonths.

After many years of hard trying the London County Council has this week scored two distinct triumphs. The scheme for carrying tramways over the Thames bridges and along the Victoria Embankment has passed through Parliament after bitter opposition extending over 10 years, while at the fourth attempt the proposal that all London borough councils supplying electricity should be allowed to embark in the business of supplying electric fittings, either for cash or on hire, or on hire purchase, has also received final parliamentary sanction.

The International Commission which it was agreed to appoint during the run of the St. Louis Exhibition, and which was specifically to consider the question of electrical units and nomenclature, held its first meeting in London last week, advantage being taken of the fact that all the members were in Great Britain at the invitation of the Institution of Electrical Engineers. Lord Kelvin has been appointed the first president and Colonel Crompton the honorary secretary. A draft set of rules has been circulated and adopted, the end aimed at being the standardization of nomenclature, and later of physical formula.

Widespread regret is being expressed here at the untimely death of Mr. Louis Cassier in the disastrous accident to the South Western American boat train last week.

The London County Council and the authorities of Greenwich Observatory have appointed a committee of experts to investigate the interference threatened by the Greenwich generating station to the work of the observatory. G.

Dominion of Canada.

Winnipeg, Man., July 21.—The by-law for the development of a power site at a cost of $3,500,000 for the supply of hydro-electric energy to the city was carried by a big majority. The city will build this plant and maintain it, and the electricity furnished will be sold to consumers as near the absolute cost as possible; the amount that will be required annually to meet interest and sinking-fund charge will be $108,438, and the by-law comes into effect August 15, 1906. The money is to be used to acquire sites, rights-of-way and other necessary property, building and maintaining a tramway and for constructing a power plant for producing and distributing electricity for heat and power purposes, for commercial use in the city of Winnipeg and for electric street lighting and the lighting of civic buildings and public places. Colonel Rultom is the city engineer, and Thomas Sharpe is mayor.

The Winnipeg electors carried the Sunday-car by-law by over 2 to 1 majority, the people being determined to have them, despite all opposition. By the terms of the by-law the double fare after 11 p. m. is abolished and cost of transportation to school children and to patrons of the cars on Sunday is reduced.

The recent trouble between the city of West Selkirk, Man., and the Winnipeg, Selkirk and Lake Winnipeg electric railway has been settled for the time being by extending the time for operating the road by steam power for six months provided the company enters into an agreement, with suitable guarantee, to have the road operated by electricity throughout the whole distance between Selkirk and Winnipeg by the expiration of six months.

Three different companies have applied to the City Council of Prince Albert, Sask., for a franchise to build and operate an electric street railway in Prince Albert. One offer is from W. S. Weeks of Edmonton and Prince Albert, one from the Prince Albert Land and Investment Company, and one from James McKay for Mackenzie & Mann of the Canadian Northern Railway, who have just secured the Prince Albert branch of the Canadian Pacific Railway.

The St. Mary's River Power Company of Nelson, B. C., has been formed by Charles Mackay of Nelson, Robert Campbell, James A. McDonald of Moyie, W. Hanwell of Hammond and L. Shaw of Vancouver. They propose to develop sufficient waterpower to light all the cities and operate the mines in the vicinity. This will include Kimberley and its neighboring mines, the city of Cranbrook, Fort Steele and Moyie. They have $1,500,000 capital.

The West Kootenay Light and Power Company of Rossland, B. C., is adding to its already splendid equipment six Westinghouse transformers of 1,875 kilowatts, 2,200 to 60,000 volts, and 15 transformers of 1,250 killowatts, 60,000 volts to 2,200 and 440 volts. These are to be used in connection with the Rossland mines. Ross & Holgate are the consulting engineers.

The largest generator ever made in this country has been shipped to British Columbia from the works of the Canadian Westinghouse Company of Hamilton, Ont. The purchaser is the British Columbia Electric Company of Vancouver. The generator is 2,000 horsepower, three-phase, 7,200 alternations, 200 revolutions per minute, with engine pipe for direct connection with the waterwheel. The order also includes one rotary converter of 1,350 horsepower, 550 volts, three-phase, 7,200 alternations, 400 revolutions per minute, and eight air-blast transformers, each of 733 horsepower, 2,200 volts to 24,000 volts, 7,200 alternations; also the necessary switchboards for controlling. This new machinery is required by the company for its ever increasing business, and is the fourth purchased by the company of this size, but the other three were supplied by the Westinghouse company from its Pittsburg works previous to the building of the Hamilton works. H.

Hamilton, Ont., July 21.—Two electric power companies propose to enter Hamilton in opposition to the Cataract Power Company. They are the Ontario Power Company and the Toronto and Niagara Power Company, so that the city will have three strong competitors in the field for the supply of electrical energy to its numerous manufacturing industries.

The Berlin (Ont.) and Waterloo electric street railways' charter expires in September, and Berlin wishes to acquire and operate the system. Accordingly, J. E. Jones, acting for the municipality, has asked Chief Justice Meredith to appoint an arbitrator.

Now that the Southwestern Traction Company of London, Ont., is advertising trips to London by electric cars, there develops a new situation in railway circles, a rate war being threatened by the Pere Marquette Railroad against the traction company, they threatening to make a time schedule of 15 minutes between London and St. Thomas. But the electric service will be equally as good and with a plentiful supply of cars they will run cars every half hour between the two cities.

The by-law to enlarge the electric-light plant at Barrie, Ont., to the extent of $27,000 has been carried. The new plant is to consist of water-tube boilers, a 450-horsepower Corliss engine (valve), direct connected to a two-phase, 2,200-volt, revolving-field generator, switchboards, condensers, heaters, pumps, economizers, etc., and a series alternating street-lighting system. K. L. Aitkin of Toronto is the consulting engineer.

The Senate committee at Toronto has passed the bill to incorporate the Buffalo, Niagara and Toronto Electric Railway Company, to run from Niagara to Welland.

Kenora, Ont., will spend $85,000 in contracts for the construction and equipment of the power house and will generate 2,500 horsepower. The contracts have been let to Peterboro and Montreal firms.

The $1,000,000 contract given by the Montreal Light, Heat and Power Company to the Westinghouse company of Canada calls for 55,000 horsepower of various apparatus. There will be three 3,750-kilowatt, revolving-field, alternating-current waterwheel-driven generators of 4,000 volts, three-phase, 7,200 alternators, and 12 44,000-volt transformers of 2,500 kilowatts capacity each. The machinery is to be installed in a new power station to be built about 40 miles from Montreal. The energy will be transmitted by the Montreal Light, Heat and Power Company. There was strong competition for the large order.

Leamington, Ont., has finally granted a franchise to the Windsor, Essex and Lake Shore Radial Railway.

The City Council of Niagara Falls, Ont., has asked the Ontario government for permission to develop 10,000 horsepower to run the waterworks, pumping plant and electric-light plant, and have a surplus for an emergency. H.

New England.

Boston, July 21.—The Massachusetts highway commissioners are endeavoring to ascertain just what companies are under their jurisdiction under the law giving them supervision over "all companies engaged in the transmission of intelligence by electricity within this commonwealth." The law went into effect on July 1st. The commissioners have located the two commercial telegraph companies—the Postal and the Western Union—and they are now on a hunt for telephone companies. They find that there are quite a few small telephone companies in the state which are not connected with the Bell company. The publication of the statistics obtained by the commissioners will not be begun until the end of the year beginning October 1, 1906, and the commission will not be able to report to the State Legislature until the session of 1908.

The D. K. Carpenter Corporation of Brookline, Mass., has been incorporated. It has a capital of $3,000 and will deal in gas and electric goods. Dauphin K. Carpenter, Albert J. Blair and Harry H. Williams are the incorporators.

A Hartford County (Conn.) Superior Court judge has authorized the transference of the Stafford Springs Railway Company's franchise to build an electric railway between Somerville and Stafford, Conn., to the Hartford and Springfield Street Railway Company. This line will be four miles long and it will connect with the Consolidated Railway Company's road at Stafford. The latter company controls the Stafford Springs Company, but it did not care to build the Somerville and Stafford road.

The Danbury and Bethel Street Railway Company has executed a blanket mortgage to the American Loan and Trust Company of Boston to secure the bonds it will issue for the purpose of obtaining funds with which to build a double track, extend its road and purchase more equipment. These improvements are to cost $100,000. The mortgage also covers a previous issue of bonds amounting to $200,000.

At a meeting Tuesday the Hartford and Springfield Street Railway Company's stockholders authorized an issue of 850 additional shares of capital stock to be redeemable at $110 per share at the company's option. The company's capital now amounts to $535,000. The last Connecticut Legislature authorized its increase to $1,000,000.

The Salem (Mass.) Electric Lighting Company has broken ground for its new office building on Lafayette Street in that city.

John Jay Crain, electrical engineer for the Fore River Shipbuilding Company of Quincy, Mass., and Miss Louise Truax were married in St. Bartholomew's Church, New York city, on July 9th. Mrs. Crain has achieved considerable fame as a whistler.

The Somerville (Mass.) aldermen have been petitioned to order the removal of the Boston Elevated Railway Company's power house on Clarendon Hill in that city. The petitioners claim that the power house is a nuisance and that it has caused a depreciation of the value of property in its vicinity.

Engineers have begun boring in Cambridge, Mass., to determine the quality of the soils through which the subway will go under that city.

The Portland Electric Company has been organized in Portland, Me. It has a capital of $1,500,000 and it will obtain control of the Consolidated Electric Light Company and the Portland Lighting and Power Company of that city. The new company will control the electric-lighting and power business of Portland. It will build a dam and power house on the Saco River at a cost of $300,000. It will issue five per cent. first mortgage bonds amounting to $1,500,000, which have been underwritten. Charles O. Bancroft of Portland is president of the company.

The Executive Council of Massachusetts has confirmed the nomination of Hon. Alonzo R. Weed of Newton as gas and electric-light commissioner. B.

New York.

New York city, July 21.—Some of the daily papers say that an idea of the value of a telephone monopoly may be gained from the fact that the New York Telephone Company is willing to pay $200,000 a year for such monopoly, while John M. Shaw, president of the Atlantic Telephone Company, the concern which is seeking a franchise in New York city, declares he will give $1,000,000 a year for a monopoly franchise. He adds: "If the city has the right to sell the monopoly of the business to any bidder, the city should in justice to itself get a good price. The Atlantic Telephone Company will pay the city of New York $1,000,000 a year and supply all the departments with free service if the city of New York will guarantee to the Atlantic Telephone Company a monopoly of the telephone business under the same terms

the New York Telephone demands for $200,000 per year."

Announcement was made yesterday that the substitution of electricity for steam on the New York Central's lines within 35 miles of the Grand Central Station will be accomplished, it is expected, by October 15th. Successful tests have been made with two electric locomotives sent back and forth over a section of track constructed near Kingsbridge. Officials of the road explained that all trains entering or leaving the Grand Central Station would be moved by electric power, but added that the electric equipment would take some time, and for the present would only extend for 35 miles out of the city. At the 35-mile limit steam locomotives will pick up the trains, and steam will be the power used over the rest of the Central's system. There are persistent rumors that the Central plans to do away entirely with steam very soon and equip the road with electricity over its entire length.

City Engineer Frederick T. Crane of Orange, N. J., has completed work on the maps of the city showing the location of electric lights to be run in connection with the city electric-light and power works. The new plant is designed to supply current to private consumers and power to run the pumping machinery of the sewer and waterworks and light the streets, all at a figure considerably under the amount charged for years by the Public Service Corporation. There now seems no doubt that the plant will be in full operation in a few months. A contract which the Public Service has tried to get through the West Orange Town Council is now held up, and it is likely that West Orange and probably South Orange will operate the plant jointly with Orange. If this plan is carried out it will probably put the electric-light department of the Public Service Corporation out of business as far as the Oranges are concerned.

The project of supplying Central New York with hydro-electric power developed in the vicinity of Niagara Falls has been made a reality by the arrival in Syracuse, N. Y., of 60,000-volt current generated at Niagara Falls. The transmission distance is 165 miles and the power is to be used for the operation of street railways exclusively. The Syracuse Rapid Transit Company will use the current to operate its system, comprising 80 miles of track and about 100 cars. Current is generated at the Niagara Falls hydro-electric plant of the Ontario Power Company, and is delivered to the transmission lines of the Niagara Falls, Lockport and Ontario Power Company, which is the transmitting company, at 60,000-volt, three-phase, 25-cycle current. This current is delivered at the city line of the city of Syracuse to the transmission line of the Syracuse Rapid Transit Company at approximately 55,000 volts. From the city limits the Syracuse Rapid Transit Company carries the current at this voltage over its own high-tension line, located along the Erie Canal, to its own substation, which has been built on the banks of the canal near the present power house of the company about two miles from the receiving point at the city limits. In the sub-station the current is stepped down at one operation in lowering transformers from 55,000 volts to 430 volts alternating current, thence passed through rotary converters and deliered to the railway feeders at 600 volts direct current. C. I. C.

Southeastern States.

Charlotte, N. C., July 21.—The prospects of the building of an electric railway from Newport News to Yorktown, Va., is now said to have become a certainty. The Gould interests are behind the move and contractors are now placing their orders so that work can begin soon.

Ground has just been broken at High Point, N. C., for the interurban electric line from that place to Winston-Salem. The company is known as the North Carolina Electric Company, E. D. Steele of High Point being one of the principal promoters.

The city of Alexandria, Va., has recently offered for sale the electric franchise of the city. Before taking action the committee on lights heard an explanation of the bids offered by an electrical expert, Hugh Hazelton of Massachusetts, who carefully went over the various bids submitted.

The Alabama City, Gadsden and Attalla Railway Company (electric) has awarded the contract for the new machinery and equipment for the power house in Gadsden, Ala., to the Westinghouse Company, the same firm also getting the contract for the steam turbines. The Henry R. Worthington Company secured the contract for the pumps and condensers. The total improvement will represent about $150,000.

The Coosa River Electric Power Company of Anniston, Ala., has secured additional lands which will give it all needed water rights for the electric plant to be erected. The power house will cost $100,000, not including the machinery. The general plans for the water improvements have been approved by the United States engineer in charge. The Ambursen Hydraulic Construction Company of Boston has the detail plans in hand.

A franchise for an entirely new proposition in Winston, N. C., has been obtained by a number of representative citizens, who propose to build an electric-light plant and to construct an electric-railway system through parts of the town not covered by the existing system and to run to several suburban points of interest, including Piedmont Park.

William M. Camp, superintendent of the Pullman Company in Atlanta, has just perfected a plan for electrically cooling the Pullman cars that are backed into the terminal station and occupied sometimes for hours by passengers before the trains pull out. It is proposed to have a number of electric fans so placed that by connecting with the current at the station a cooling breeze can be maintained through the cars as long as they stand at the terminal, proving a great convenience to the traveling public in general.

Following the disastrous fire at the Portman Shoals plant of the Anderson (S. C.) Water, Light and Power Company, two new machines are already in operation and three more will be installed during the next few weeks, thus making the plant even more up-to-date than before the fire. The success of the company has been the means of introducing the uses of electricity to many industries and into homes where its convenience and economic value were unknown quantities before the establishment of the plant.

The directors of the Annapolis Short Line have called a meeting for August 6th for the purpose of taking some action on the consolidation plan of that company with the Maryland Electric Railway Company under the name of the Maryland Electric Railways Company. L.

Mexico.

City of Mexico, July 18.—An electric-light plant is to be installed in Miahuatlan, which is one of the largest towns in the state of Oaxaca.

A large hydro-electric plant is to be installed at the Chorro del Embocadero waterfall, situated 12 kilometers from Mascota. Carlos Izquierdo and Miguel Izquierdo have applied to the state government for the necessary concession for the enterprise.

A number of wealthy landowners of the state of Tlaxcala have organized a company called the Ferrocarril Agricola for the purpose of building a tramway through the richest agricultural part of the state.

The Mexican Light and Power Company has decided to extend its system of transmission lines into the city of Pachuca, and a distributing station for handling the 60,000-volt current from Necaxa will be put on the main transmission line at Irolo. From this point the power will go on transmission lines to be built as soon as the structural towers can be erected, north 30 miles to Pachuca and south 67 miles to Puebla. It is stated that there is a fine market for electric power in the mines of the Pachuca district.

W. W. Wheatley and W. J. Sherwood, president and secretary, respectively, of the Perico Exploration Company of Mexico City, have applied to the Mexican government for a concession to use the water of the San Geronimo de Voblanes River in the state of Jalisco for generating electric power in a hydro-electric plant which they propose to install.

G. and O. Braniff & Co. of Mexico City will install a large hydro-electric plant at a waterfall at the point of confluence of the Blanco and Purificacion rivers, near Aramberri, in the state of Nuevo Leon.

An electric-light plant is being installed at Tepic and will be ready for operation in about four months.

Dr. Frank Lake has been granted a concession by the government of the state of Jalisco to establish an automobile factory at Guadalajara. The proposed factory is exempt from all state taxes for a period of 10 years.

Paul Ginther of Santa Rosalia and Joaquin Cortazar of Chihuahua, who recently obtained a concession to install a large hydro-electric plant on the Conchos River, are preparing to erect a dam about 18 miles from Santa Rosalia. Engineers report that nearly 35,000 horsepower can be generated. Transmission lines will be built to Santa Rosalia, Chihuhua, Parral, Torreon and other towns and industrial centers. American and French capitalists are said to be interested.

The Mexican Congress has granted an additional concession to the Mexican Light and Power Company to use the waters of several more streams in the neighborhood of Necaxa for generating electric power. By the use of those waters the total available horsepower of the company will be increased to 180,000.

A syndicate of Mexican capitalists with a capital stock of $500,000 has taken steps to construct an extensive street-railway system in the flourishing town of Iguala. The syndicate has obtained a concession from the government of the state of Guerrero for the purpose.

The large hydro-electric plant which has been under construction at Tequisquiapan for some time will soon be completed. It will furnish electric power and lights for the city of Queretaro and other towns of the state.

A new electric-light plant is being installed at San Miguel Allende.

The contract will soon be let for installing the electric-light and power plant at Torreon. The plant will cost about $250,000. W. D. H.

Ohio.

Cleveland, July 21.—There is some talk of municipal light and gas plants for Dayton, the City Council having passed resolutions on the subject, which will be referred to the council as a committee of the whole for consideration.

The statement has been issued that the Lake Shore Electric will shortly issue bonds for improvements.

On August 15th a meeting of the directors of the Western Ohio Railway Company will be held to consider the question of increasing the capital stock from $3,000,000 to $3,400,000 and the securing of an independent entrance to Lima.

Most of the preferred and common stock of the Tucker-Anthony properties is said to have been deposited, thus insuring the success of the deal by which the Canton-Akron, Canton-New Philadelphia and the Tuscarawas Traction properties will be merged with the Northern Ohio Traction and Light Company. It is thought that this will take place by September 1st.

The receivership of the Appleyard properties will soon be closed. But few minor details remain now to be disposed of.

H. P. Clegg, general manager of the Dayton and Troy, entertained the operating heads of the roads centering in Dayton at the Dayton Club a few days ago. The affair was of a social nature.

Director of Public Service Springborn stated to representatives of the Yaryan Heating and Lighting Company a few days ago that he is opposed to granting a lighting franchise to the company for Cleveland, but wanted it to go on with its hot-water heating system. The company claims that it could do nothing with a heating system without a franchise to furnish electric current as well.

J. G. White & Co. have secured the contract for electrifying the Youngstown and Southern, a road between Youngstown and Columbiana, which is now being extended on to Leetonia to provide through service to East Liverpool.

The work of surveying the proposed electric railway between Lima and Marion is well under way. W. H. Ogan of Indianapolis is at the head of the enterprise.

Several new cars have been ordered for the Cleveland and Ashtabula run. They will be large, roomy cars, provided with 75-horsepower motors.

A new line for the Cincinnati Northern is being surveyed between Hamilton and Middletown. This is necessary because of opposition to improvements through several villages.

The negotiation for the sale of the plant of the People's Light, Heat and Power Company of Springfield to the Consolidated Public Utilities Company is now off.

The Cleveland interurban ticket office and waiting station will be moved to the Forest City Block, where rooms are being prepared for them.

The Ohio Manufacturing Company, which is preparing to move from Upper Sandusky to Columbus, will manufacture gasoline passenger and freight cars.

In return for a 25-year franchise for its line, the Cleveland Electric Railway Company has prepared to offer the people of Cleveland, Ohio, seven tickets for 25 cents, with universal transfers, as at present, and to build such extensions and additional lines as may be desirable, including rapid-transit lines, either overhead or underground, as may be thought best. Taking into consideration the transfers and such other things as come in to reduce the fare, it is estimated that the company is offering practically a 3½-cent fare. O. M. C.

Michigan.

Grand Rapids, July 21.—The work of wiring city buildings for lighting from the municipal electric-light plant, instead of by gas, is being done.

The lighting commission of Detroit reports that in the fiscal year ended June 30th it reduced the cost of arc lights from $34.99 a lamp for 12 months' maintenance to $33.18, a decrease of $1.81. In the year 237 arc lights were installed. The total number now is 3,080. The cost of operating the plant is given as $102,179.60, and for operating the incandescent plant, $24,792.03. The total cost of operating the plant was an increase over the preceding year of $5,591.22; there was, however, an increase in output of 488,711 kilowatt-hours. The city's investment in the lighting plant to June 30th last, less a three per cent. depreciation, is $902,641.25.

The Detroit Edison Company has made arrangements with a prominent engineering firm to draw a set of preliminary plans for a plant the duplicate of the establishment at Delray. The business of the company at Detroit has grown so rapidly that before the end of next winter the present plant, with all of its turbines, will be worked to its fullest capacity.

The Flint council has granted a franchise to H. R. Loranger and Robert O. Hart, who contemplate installing a dam on the Flint River for the purpose of furnishing electric light and power. The franchise differs in no great degree from that already held by the Flint Light and Power Company.

Grand Rapids has adopted the street railway

company's sprinkling proposition of 12 cents a mile. General Manager Hanchett declared that the sprinkling offer was made in the same spirit as that which led the company to carry mail boxes upon the cars. He said that this service was given at a loss to the company of about $7,000 per year.

Work surveying the proposed electric road from Grand Rapids to Ludington has been completed as far as Hesperia.

The Berrien Springs Power and Electric Company, of which Charles A. Chapin is president, will make application to the Board of Supervisors of Berrien County for permission to construct a dam across the St. Joseph River at the head of Pardee Island at the village of Berrien Springs.

L. W. B.

Indiana.

Indianapolis, July 21.—The Capital Circuit Traction Company, which proposes to build a railway around Indianapolis connecting the county seats of the seven adjacent counties, has secured franchises to enter and pass through Lebanon, Danville, Franklin and Martinsville. These grants are for 50 years and provide for modern equipment and that the rate of fare in the cities shall not exceed five cents. J. N. Crabbs of Indianapolis is president.

The Louisville, New Albany, French Lick and West Baden Springs Traction Company has applied for a right-of-way for an interurban railway system in New Albany. The company contemplates, in addition to the construction of a line to French Lick, by way of Paoli, to operate a line between New Albany and Louisville.

The Clover Leaf Railroad has felt the effects of the interurban competition. Passenger traffic has dropped off 95 per cent., according to report, between points of interurban competition. The officials of the road have stated that they are building motor cars at the shops at Frankfort which they hope to use successfully in competition with the electric cars on the traction lines.

J. R. Dunlap has begun surveying the final route for an electric railway between Crawfordsville and Danville, Ill. Recent events indicate that the Indianapolis and Northwestern is back of the enterprise. That this new line will be an extension of the Northwestern and a line connecting the Indiana trolley system on the east and the McKinley system on the west is now generally believed.

The new interurban line between Logansport and Indianapolis, to be built by the Indiana Rapid Transit Company, is assured, according to P. M. Dunn of Indianapolis, who is one of the chief promoters. The bonds for the new enterprise are all sold and it is a matter of short interval until the preliminaries are completed and work begun.

The Wabash Valley Traction Company is preparing to build modern freight stations in Fort Wayne. This company is now hauling large quantities of wheat for the farmers along its line. It is now demonstrated that numerous switches along the line are advantageous for loading grain on the cars.

The Muncie and Union City Traction Company, organized recently to take over that part of the Dayton and Muncie line between Muncie and Union City, has issued $925,000 five per cent. 30-year gold bonds. The authorized capital of the old company is $500,000. The sale of the Dayton and Muncie to the Indiana Union Traction Company is subject to the bonds, and the entire capital stock has been turned over to the purchasing company as a consideration for its guaranty of the principal and interest on the bonds.

The City Council of Evansville has passed an ordinance making it imperative that all wire-using companies put their wires in conduits underground. The Evansville Gas, Electric Light and Power Company has agreed to the provisions of the ordinance.

Indianapolis authorities have decided upon an immediate inspection of all exposed wires that carry a high voltage of electric current. This action grows out of the death of a patrolman who came in contact with a charged fire-alarm box. Trolley poles have also been charged, and the light and power companies' wires are found dangerously near telephone wires. The city electrician says that in the overhead system in Indianapolis skilful work alone can prevent the loss of life. The Board of Public Safety is demanding that all wires go underground as soon as possible.

The Columbus Street Railway and Light Company of Columbus announces that it will erect a large addition to its plant and install it with modern machinery this fall.

S. S.

Illinois.

Peoria, July 21.—The railroad and warehouse commissioners have prepared a new map of the state. It shows 66 different steam roads, indicated in different colors. Also the 67 electric railways are now shown instead of being on a small separate map as heretofore.

Connection between Peoria and St. Louis by the McKinley lines will be made in the spring by building from the Peoria-Bloomington line to Lincoln, where the line to St. Louis is now in operation.

The Illinois Traction Company has filed 65 deeds conveying right-of-way in Tazewell County for the Peoria-Bloomington line, and from these it is shown that the total cost of the right-of-way through Tazewell County will aggregate nearly $150,000. In McLean County the deeds on record show an expenditure of over $20,000, exclusive of $5,000 for right-of-way within the city limits of Bloomington.

Cars will be run through from Decatur to Bloomington, beginning August 1st.

On Wednesday the Illinois Traction Company turned over the street-railway lines in Bloomington to the ladies, who operated them for charity. The company donated the entire receipts of the day, and with the numerous entertainments that were held the travel was very heavy.

The Central Union Telephone Company has furnished the Fire Department headquarters with a new switchboard to which is connected every engine house in the city. It also has five trunks running to Central over which alarms of fire may be sent direct, and then transmitted direct to the engine houses.

Articles of incorporation were filed by the Carthage and Western Illinois Electric Railway Company, principal office to be in Chicago, capital $2,500, to construct a line from Carthage, Hancock County, to points in the counties of Fulton, Cass and Adams. The incorporators and first board of directors are W. M. R. Vose and F. P. Vose of Evanston, C. C. Breuer, Ralph A. Griffen and George A. Griffen of Chicago.

The Iroquois Utilities Company has been incorporated, with offices at Watseka, capital $100,000, to furnish public utilities. Incorporators are Harry J. Frith, H. T. Riddell and John Frith.

The Majestic Service Company of Chicago has been incorporated with a capital stock of $2,500, to produce and sell heat, steam and electricity. Incorporators are E. A. Larson, Edmund D. Adcock and Colin H. Fyffe.

The East Side Light, Heat and Fuel Company of Bloomington has been incorporated with a capital of $100,000, to furnish public utilities. Incorporators are Samuel R. White, Ora E. White and John H. Pitts.

V.

Northwestern States.

Minneapolis, July 21.—By deflecting the water of the Cedar River into a canal 10 miles long, connecting with the Mississippi River at Muscatine, Iowa, it is said about 25,000 horsepower can be generated, and investigations as to the feasibility of the plan to construct a new power plant are being made.

Work has been started by the Northern Traction Company on its new trolley line connecting Chisholm and Hibbing, Minn. The road will be completed by October 15th and next year will be extended to Eveleth. The total cost will be $3,000,000.

The contract has been let to the Cooke Construction Company of Minneapolis for the construction of the new interurban line between Oskaloosa and Buxton, Iowa.

The Northern Heating and Electric Company of St. Paul has been granted a franchise by the Board of Aldermen.

The rights granted by the United States government to the St. Cloud (Minn.) Electric Power Company for damming the Mississippi River at St. Augusta will interfere with the plans for the construction of a dam and power house at Clearwater, Minn., and it seems probable that it will be impossible for the work on the latter project to be started this season.

R.

Pacific Slope.

San Francisco, July 19.—The United Railroads of San Francisco, which has been trying for several weeks to forestall a strike of its linemen, failed to induce the men to wait until Patrick Calhoun should arrive on August 15th. The strike began on July 18th, when the company's force of over 60 linemen employed on the overhead wires failed to report for duty as the result of an all-night meeting with the labor-union leaders. It is announced that the company has made the usual preparations for housing non-union men at the car barns and will attempt to keep up its repairs as well as possible under the circumstances. The men assert that Mr. Farley, the professional strike breaker, is on his way to the Coast with a force of men in the interest of the United Railroads. The company has been doing an immense amount of reconstruction work since the fire and has been anxious to secure 3,000 additional laborers in order to hasten the time of reopening a number of its lines that were put out of business by the disaster. Most of the old cable lines are being rebuilt as electric lines.

The situation is viewed with much apprehension by the business community, as sympathetic strikes are feared, that may interfere seriously with the reconstruction of the city, which is now in full swing. A general strike of street-car employes might easily result in a tie-up of all the street cars on the system.

Floods are delaying the completion of the Kern River plant of the Edison Electric Company in Southern California. Work that might have been finished August 1st will not be in readiness before the middle of September.

The Klamath Falls Light and Water Company of Klamath Falls, Ore., of which corporation H. V. Gates is president, will expend about $20,000 this season in extensions of its light and water systems. The company now has three miles of pipe at Pokegama, and two more miles will arrive there shortly. The electric-lighting system will be extended and electric railways will be in operation in the near future.

The Park Board of Los Angeles, Cal., has recommended that J. W. Eddy be given the privilege of building an electric railway through Griffith Park and operating it for 21 years.

E. S. Babcock, president of the Los Angeles and San Diego Beach Railway Company, which is supposed to be backed by the Huntington interests, has petitioned the City Council of San Diego, Cal., for a franchise for a double-track electric railway north from La Jolla to the north line of the city limits of Del Mar. The company has also petitioned the council for permission to lay additional track on its road between this city and La Jolla, with a single line of trolley poles, and for a franchise on Fourth Street.

The Board of City Trustees of Covina has granted the Los Angeles Interurban an extension of 90 days in which to complete the construction of its road, the franchise expiring on July 28th.

The National City and Otay Railroad has been formally transferred to J. D. Spreckels & Co. of San Francisco. Work will commence immediately on the construction of three new cars for the railroad. The work of electrifying the road, which extends from San Diego to Tia Juana, with a branch to the Sweetwater reservoir, will be pushed to completion as rapidly as possible. For the present the road will be electrically equipped to Third Street, San Diego, Cal., Chula Vista, and later to Tia Juana.

The supervisors of San Luis Obispo, Cal., have adopted an ordinance granting to Russell Robinson a franchise to erect and maintain poles for electric wires along certain highways in the county of San Luis Obispo.

The Mad River Bluffton Mining Company and the Clentaga and Copper Mountain Mining Company are about to erect an electric-light and power plant at Bolster, Wash., for the purpose of supplying the properties with light and power. Chesaw and Bolster, Wash., will be supplied with power by the company.

The state of Washington will buy the $600,000 issue of Seattle lighting bonds on the behalf of a permanent school fund.

A.

PERSONAL.

Among the honors announced on the occasion of the birthday of King Edward VII. is the conferring of a baronetcy on Mr. Edgar Speyer of Speyer Bros., London, prominent in "tube" railway affairs.

C. M. Paxton, secretary and traffic manager of the Dayton and Troy Traction Company, has been advanced to be general manager. L. D. Johnson, traveling freight agent, has assumed the duties of traveling passenger agent.

Frank R. Phillips of Cincinnati has been appointed chief engineer of the Michigan United Railway Company and will have his headquarters in Lansing, Mich. Mr. Phillips held a similar position with the South Covington and Cincinnati Railway.

Edgar Jay Rauch of Newark, Ohio, has been appointed general superintendent of the Saginaw (Mich.) and Bay City railways, to succeed J. C. Young, resigned. Frank Gavignan of Saginaw becomes superintendent of the electrical properties for the Saginaw and Bay City Light and Railway Company. Mr. Rauch was formerly superintendent of the interurban system connecting Columbus, Newark and Zanesville.

J. L. Adams, general manager of the western division of Ohio for the Indiana, Columbus and Eastern Traction Company, has moved his family to Dayton temporarily. A great deal of his time will be spent in Dayton, Ohio, for some months in superintending the practical reconstruction of the Dayton and Northern and Dayton and Western, over which his jurisdiction was recently extended. Mr. Adams will retain his office and headquarters at Columbus.

The sudden death of John Saltar, Jr., on July 12th removes from the engineering world one of its most active members. Mr. Saltar was a graduate of the Rensselaer Polytechnic Institute of Troy, N. Y., class of '67. He was variously connected in an engineering capacity in this country and abroad, and in 1881 he accepted the management of the western department of the Otto Gas Engine Works of Philadelphia. About seven years ago he was elected president of the company, which position he held at the time of his death. Under his efficient management all larger sizes of the Otto engines have been perfected and placed on the market. The name of John Saltar, Jr., is

probably best known to the engineering world, however, as the inventor of the submarine engines now being used in submarine boats throughout the world. Mr. Saltar was an active member of the masonic order and of the Western Society of Engineers of Chicago. Interment took place at Rockford, Ill., the place of his birth.

John P. Boylan, for the last two years connected with the Cuyahoga Telephone Company at Cleveland, Ohio, has resigned his position to become general traffic manager of the Home Telephone Company of Louisville, Ky. He spent 10 years as exchange manager of the Bell telephone company.

George W. Bryson, president of the Chicago, Desplaines and Fox River Railway Company and president of the Illinois and Wisconsin Construction Company, died of lockjaw in Mercy Hospital on July 18th. He received a slight injury on July 4th while discharging fireworks with his family at his home, 1448 Montrose Boulevard, Chicago. The wound was not considered severe, but in a few days a soreness developed. It grew worse and resulted in his death. Mr. Bryson was 43 years old. He came to Chicago 20 years ago, during which time he was connected with two electric roads. He became interested in suburban trolley roads and organized the companies mentioned. Construction work on the former was in progress at the time of his death.

Mr. E. W. T. Gray, who for years has been manager of the New York sales office of the Westinghouse Electric and Manufacturing Company, resigned recently to take up commercial work in another field. Mr. Gray's decision to sever his connection with the Westinghouse company was received with great regret by the management, as he was one of the pioneer employes of the company. Mr. Gray began his work with the Westinghouse company about the year 1890, starting in the laboratory of the original works in the heart of the city of Pittsburg. Later he took up installation work for the company, installing the first railway motors the company made, on cars in Lansing, Mich., about the year 1891. Following a short period spent in installation work, Mr. Gray was called by the company to its sales organization, with headquarters at Pittsburg. In 1898 Mr. Gray received the appointment of manager of the New York office. Mr. W. C. Webster, who succeeds Mr. Gray as manager of the New York sales office, has a broad general knowledge of the company's commercial policy, and on account of his close association with the sales department in the past enjoys a personal acquaintance with the entire sales force, which should be of great advantage to him in his new work. Mr. Webster entered the employment of the company in 1898, and has always been identified with the sales department.

ELECTRIC LIGHTING.

Muskogee, I. T., contemplates installing an electric-light plant.

J. A. Jewett of Black Duck, Minn., will put in an electric-light plant at Kelliher, Minn.

The council of Natchez, Miss., has petitioned for authority to issue $75,000 electric-light bonds.

The Independence (Kan.) Electric Company has been incorporated with a capital stock of $50,000.

T. A. Heinze of Butte, Mont., has petitioned for a franchise to establish a lighting plant in Butte.

Sapulpa, I. T., is investigating the cost of an electric-light plant. Mayor Weeks may be addressed.

The Northwood Electric Light and Power Company of Northwood, Iowa, has been incorporated with a capital of $25,000.

The citizens of Paw Paw, Mich., have voted to issue $50,000 in bonds for the purpose of improving the water and light plants.

An election is to be held at McComb, Miss., on August 4th, to vote on the question of issuing $30,000 of electric-light and $15,000 of water bonds.

The railway and municipal board of Ontario, Canada, has approved the application of the city of Niagara Falls for confirmation of by-laws for the extension of the city's waterworks and electric-lighting systems.

The Spokane County Electric Company, Spokane, Wash., with a capital stock of $10,000, has filed articles of incorporation. The company is organized for the purpose of furnishing electric light to a number of towns in the Palouse country, including Rockford, Fairfield and Latah.

A public meeting in Elgin, Ill., called by the Merchants' Association, was attended by citizens and officials of the Elgin, Aurora and Southern Traction Company. The railway company does the city lighting in Elgin. The lighting situation was discussed, and in the course of the discussion Manager Faber of the traction company recommended the use of meters for all lights, including arc lamps. He also promised lower rates and better service and said that the company planned to spend $100,000 in bettering its lighting department.

It is announced by the Board of Public Works of Louisville, Ky., that the franchise for lighting the city of Louisville with electricity, created by the passage of the ordinance known as the Atherton-Jones measure, will be sold at public auction in the council chamber at the City Hall, August 17th, at noon.

The Edison Company of Grand Rapids, Mich., has begun work on big improvements in its power system. Power will be secured from the old power dam in the Flat River at Lowell, which was erected by the now defunct Lowell Water and Light Company. The property is in a fair state of preservation and can be utilized by the Edison Company.

It is stated on apparently reliable authority that the La Belle light and power plant of Victor, Colo., has been transferred to the Colorado Light and Power Company of Denver, Colo., for $100,000. As one of the results, the power furnished the electric-railway system of the district will in future be transmitted from the Canon City plant at Canon City, Colo.

Negotiations have been concluded for the merging of the two electric-lighting systems of Portland, Maine. The Portland Electric Light Company has been incorporated with $1,500,000 capital for that purpose. The company has purchased the water privileges and the Hargraves Woolen Mills at West Buxton, on Saco River, and will establish an extensive electric plant there to furnish power to the woolen mills and supply electricity to Portland for manufacturing purposes.

Bids will be received by the Board of Local Improvements of the city of Bloomington, Ill., until August 3, 1906, for the furnishing and erecting of engines and generators of sufficient size and capacity to furnish current for 500 arc lamps for street lighting; also for 400 arc lamps, together with switchboards, exciters, transformers, and everything necessary to make a complete and up-to-date lighting plant ready to run. Also one direct connected automatic engine and generator, together with switchboard and all necessary instruments, to run 1,400 16-candlepower incandescent lamps. Bids will include the taking out of seven old arc machines, 320 old lamps and the line shafting now in use. The salvage on old machines, lamps and line shafting shall become the property of the contractor. Bidders will furnish their own plans and specifications for the work complete. J. S. Neville is chairman of the Board of Local Improvements.

ELECTRIC RAILWAYS.

The City Council of Beloit, Wis., has granted franchise to the Rockford and Interurban Railway for the use of six miles of city streets.

It is asserted that the Indiana Union Traction Company has now the largest electric traction system in the world, controlling 343 miles of track.

The Twin City Electric Company of Roanoke, Va., which proposes to build a line in Roanoke and from Roanoke to Salem, has applied for a franchise in Roanoke.

The stockholders of the Maysville, Carlisle, Millersburg and Paris Traction Company of Maysville, Ky., have decided to commence work at once. James Kehoe is president.

The Kalamazoo, Gulf Lake and Northern Railway Company of Kalamazoo, Mich., has been incorporated with a capital stock of $20,000 for the purpose of constructing an electric line in Barry County.

The Lake Shore Electric Railway Company, Cleveland, Ohio, proposes to sell $500,000 of an issue of first-mortgage five per cent. 80-year bonds of the Sandusky, Fremont and Southern Electric Railway.

It has been announced that the new Lima and Toledo Traction Company, Lima, Ohio, will open its line north as far as Leipsic on August 15th. To supply power for this additional Schoepf line a new unit has been added at the local power house by the installation of an additional boiler.

The Mohawk Valley Company of Utica, N. Y., has increased its capital stock from $10,000,000 to $20,000,000. Of the original stock, the New York Central and Hudson River Railroad owned $6,000,000, and Horace E. Andrews $4,000,000. This company is the holding company for a number of roads that the New York Central has purchased during the last few years.

Some progress is being made, it is said, in the plan to consolidate the Chicago elevated railroads. An offer has been made both to the Metropolitan and the South Side companies by the Blair-Mitchell interests, which already control the Northwestern and Oak Park lines, and the Metropolitan directors have had several meetings recently for the consideration of the figures. After considering the first offer the South Side Elevated management submitted a counter proposition, and the terms of the two were so close together that active negotiations were taken up at once with the Metropolitan.

At a meeting of the stockholders of the Nashville Railroad and Light Company, Nashville, Tenn., the issuance of $15,000,000 five per cent. bonds was authorized. Of this amount, $7,500,000 will be marketed at once, $6,500,000 of the proceeds to be used in retiring old securities, and $1,500,000 for improvements and extensions of the plant.

Work on the Northern Pacific's electric line between Centralia and Chehalis, Wash., is being pushed. The Northern Pacific has ordered 10,000 ties, to be used between Centralia and Chehalis. A crew of 20 surveyors of the Union Pacific is working south from a point about three miles north of Centralia, surveying what is thought will be the permanent right-of-way of the Union Pacific.

The West Coast Traction Company of Spokane, Wash., with a capitalization of $150,000, has filed articles of incorporation. C. H. Weeks of Spokane, B. J. Weeks of Tacoma and D. D. Leverson of London are the incorporators. The company is organized for the purpose of operating electric roads in Centralia and Chehalis, and has taken over the rights of the old Centralia and Chehalis Electric Company.

The Racine branch of the Chicago and Milwaukee Electric Railroad Company will be opened for the public service about August 10th, and the company has applied for water to be used for cooling purposes on the installation of three new transformers at the North Chicago power station, the North Chicago village board receiving the application. With the laying of about 1,000 feet of track at North Chicago the west side line will be connected with the main line, and through service will be inaugurated.

POWER TRANSMISSION.

The Brainerd (Minn.) Hydro-electric Power Company has been incorporated with a capital stock of $200,000. Incorporators are Judd Wright, William D. McKay and Horace M. Woolman.

The Columbus Power Company of Atlanta, Ga., is erecting a power station which will give 3,000 horsepower. The demand for electrical power from the manufacturers in Atlanta is very keen. A power house developing 15,000 horsepower will be built later.

The New York and Ontario Power Company of Brockville, Ont., proposes to develop the water-power at Waddington, N. Y., and transmit the current to Prescott and Brockville, via Ogdensburg. The company has a capital of $2,000,000, and claims that upward of 30,000 horsepower can be developed.

The Northern Power Company of Denver, Colo., is planning to build an electric power plant near Lafayette. The management of the company has decided to embrace Fort Lupton, Platteville and Brighton in the sections to be supplied with power. It will also furnish some power to Gilpin County. Hundreds of pumps will be sunk and the water will be pumped by electric power.

The Chickasha Water Power Company, Chickasha, Okla., has been incorporated with $75,000 capital stock by C. E. Cross, Dennis O'Brien and L. E. Wetling. It is proposed to develop the waterpower of the Washita River two miles from the city, obtaining about 1,000 horsepower, which will be transmitted by electricity for light and power purposes.

The largest hydraulic power installation in the South American continent is now being erected on the Rio Das Lages River for the purpose of furnishing electric energy to operate street cars, electric-lighting and manufacturing plants in the city of Rio de Janeiro. The plant will have an initial capacity of 40,000 horsepower, and all the machinery to equip the plant is being manufactured in the United States.

Articles of incorporation of the Columbia River Power Company, Spokane, Wash., have been filed in Stevens County and in Olympia. This company is headed by J. P. Graves and purposes to develop the power at Kettle Falls, Wash., recently acquired by Mr. Graves and associates. The incorporators are Jay P. Graves, Charles H. Wolf and Will G. Graves. A meeting of the officers of the company will be held later, at which time permanent officers and a board of directors will be chosen. The company is capitalized for $150,000.

The Telluride Power Company of Telluride, Colo., recently contracted for some additions to its power transmission plant, consisting of two 7,500-horsepower generators and a number of transformers, aggregating 15,000 horsepower. The Telluride power transmission plant was one of the pioneer enterprises in this country inaugurating long-distance transmission of electric power by the alternating system of electrical distribution. The original plant was installed in 1894 for the purpose of transmit-

ting power into the mountains, a distance of three miles from the source of supply, there to operate a gold mine.

The Northern Colorado Power Company has purchased the business of the Loveland (Colo.) Light, Heat and Power Company.

The Charles City (Iowa) Water Power Company will put in a large electric power plant. A solid concrete dam will replace the old one.

The citizens of Joliet, Ill., are alarmed over the rumor of faulty construction of the new retaining wall of the Drainage Canal waterpower north of the city. It seems that part of the wall was built during the winter, and a few cracks have appeared. The engineers in charge say that it is perfectly safe and there is no danger. The citizens fear that should the walls give way the great amount of water backed up would flood the city.

PUBLICATIONS.

The Electric Railway Review, formerly the Street Railway Review, has made its first appearance as published by the Wilson Company, Chicago. The July number shows decided improvement over former issues.

A profusely illustrated catalogue from the Abbé Engineering Company, 220 Broadway, New York city, presents a complete line of pebble mills and various other machines for the reduction of all hard and soft materials, made by the company.

In bulletin No. 33 from the H. T. Paiste Company of Philadelphia the company gives some more interesting "Aleck" talks. This particular bulletin deals especially with panel cut-outs for rotary switches and for knife switches, illustrating and describing the good points of the Paiste product.

The Central Electric Company of Chicago is sending out to the trade a bulletin and circular descriptive of the Stanley-G. I. type K arc lamp. The good qualities and merits of this lamp are set forth in an interesting and convincing manner, and the Central Electric Company says that it is carrying a large stock and is in a position to quote attractive prices.

An interesting article on "Home Uses of Electricity" appears in a recent issue of The Home Magazine. The article is written by Errett L. Callahan, E. E., who describes the different uses for electricity in the home. The publication of this class of articles in the popular periodicals indicates the rapid advance that is being made in the introduction of electricity for everyday uses in the household.

MISCELLANEOUS.

The Canadian Nickel Company will start a plant for the refining of nickel by electricity on the Canadian side at Sault Ste. Marie. This will be the first plant in the world, it is said, where nickel will be commercially refined by electricity. Negotiations have been completed by which an existing copper plant at that place has been leased by the Canadian Nickel Company, and the necessary installation is being put in place.

Reports from San Francisco say that it has been ascertained that in all except the building trades the demand for labor is fully supplied with one exception—ordinary laborers—several thousand such men being in immediate demand for railway construction and debris removal. Plumbers, electrical workers, gas and electric fixture hangers, hod carriers, bricklayers, cement workers, bridge and structural-iron workers, architectural-iron workers, plasterers, lathers, carpenters, sheet-metal workers and elevator constructors are said to be in demand.

A mineralogical study of the native copper deposits of the Keweenaw Peninsula, Michigan, will be made this summer by Charles Palache, assistant geologist of the United States Geological Survey. Up to the present time the ores and unusual gangue minerals of these unique deposits have been but imperfectly described. An investigation of the magnesite deposits and other non-metalliferous deposits in California will be made by F. L. Hess, assistant geologist of the United States Geological Survey.

Lightning struck the grand stand at a ball game in Manitowoc, Wis., on July 22d, with fatal results. A heavy rain, accompanied by thunder and lightning, drove the players and spectators to the stand. Suddenly a bolt of lightning made its way through the roof of the stand. The flames seemed to hit the stand and follow a wire over the roof to the gate, where the bolt entered another building. When the panic that followed had partially subsided it was found that four were dead, another dying, and about 20 injured.

Count A. E. Arlhausen of the Austrian Army, who has been in Chicago incognito investigating conditions at the stockyards, is a firm believer in municipal ownership as it has been established in his own country, but declares it is not feasible in Chicago on account of politics. He thinks the street-railway service is good and the transfer system excellent, but the streets are the worst he ever saw. "If your city authorities cannot maintain better streets, how can it help the people with municipal ownership?" he is quoted as saying.

TRADE NEWS.

R. E. Overton has succeeded to the business of the B. and O. Electric Company in Guthrie, Okla., and will continue as the B. & O. Electric Company.

The Denver office of the Allis-Chalmers Company has been removed to the McPhee Building, Seventeenth and Glenarm streets. The El Paso office of the same company is now in the Guarantee Trust Building, rooms 301-306.

The Indianapolis correspondent of the Western Electrician says that the plant of the Commercial Electric Company, Indianapolis, has been sold to the Fairbanks-Morse Electric Manufacturing Company, recently incorporated with a capital stock of $150,000. The new officers are C. H. Morse, president; Walter E. Miller, vice-president, and S. L. Hadley, secretary and treasurer. They say that they intend enlarging the Indianapolis plant to double its present capacity and compete with the large manufacturers of electric appliances.

The total foreign commerce of the United States in the fiscal year just ended aggregated $2,970,000,000. If the trade with Porto Rico and Hawaii, which was included in our foreign commerce prior to their annexation, were added, the total would materially exceed $3,000,000,000. Both imports and exports exceed those of any earlier year. The total imports of the year were $1,226,000,000, exceeding the highest record of any earlier year (1905) by $109,000,000, and the exports were $1,744,000,000, exceeding those of the highest record year (1905) by $225,000,000.

The Boston correspondent of the Western Electrician writes: "Lewis E. Sanders of Schenectady, N. Y., Mr. Park of New York and E. T. McHugh of Holyoke, Mass., have formed a partnership for the purpose of enlarging the Holyoke Motor Works, of which Mr. McHugh is the head. An addition 65 by 40 feet is being built. The new company has taken contracts to supply 10,000 electric flatirons to a Boston firm and for making conduits. The firm will retain the name of the Holyoke Motor Works and it will conduct a general foundry and machine business, employing 50 persons."

BUSINESS.

The National Carbon Company of Cleveland, Ohio, has issued several attractive blotters illustrating its new styles of carbon brushes.

A good midsummer business is reported by the American Electrical Supply Company, which some time ago found it necessary to move to larger quarters at 211-213 East Lake Street, Chicago. Since the removal Mr. E. J. Johnson, who enjoys a large acquaintance in the electrical trade, has been appointed general manager of the company.

During the month of June the Allis-Chalmers Company reports having taken more orders for machinery than at any previous period of equal length in its history. Sales aggregating over $3,000,000 were made to steel mills, factories and industrial establishments of all kinds located throughout the country. The company's foreign trade was also brisk.

To prove its quality, the Ajax Line Material Company, 12-14 South Jefferson Street, Chicago, is sending a sample of its Ajax rainproof rope, now ready for the trade. This rope, made in three-eighths and one-half-inch sizes, is first twisted into strands and then braided, every strand being weatherproofed before being braided into the solid rope. It is only one of the many Ajax arc-light specialties.

The Western Electric Company reports a greatly increasing demand for the Sunbeam lamp, due largely to the fact that users are becoming acquainted with its quality. This is the eighteenth consecutive year of the sale of this lamp, and it was one of the first successful lamps produced. The Western Electric Company will answer promptly all inquiries which it receives, and it is in a position to furnish without delay lamps suitable for all circuits.

The Stromberg-Carlson Telephone Manufacturing Company, Rochester, N. Y., reports having closed contracts for switchboards in the following-named places: St. James, Minn.; Stites, Idaho; Palouse, Wash.; Weatherford, Texas; Seattle, Wash.; Rochester, N. Y.; Syracuse, N. Y.; Minneapolis, Minn.; Carbury, N. D.; Webster, N. Y.; Sodus, N. Y.; Mt. Vernon, Wash.; Eminence, Ky.; Plain City, Ohio; Columbus, Ohio; Caldwell, Idaho; Esmont, Va.; Rome City, Ind.; Delaware, Ohio; Lyndonville, N. Y.

ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued (United States Patent Office) July 17, 1906.

825,894. Telephone System. William W. Dean, Chicago, Ill., assignor to the Kellogg Switchboard and Supply Company, Chicago, Ill. Application filed February 8, 1904.

A telephone line, a number of substations on the line and a source of current permanently connected therewith by a continuous conductor free from series contacts or possible variable resistances are the salient features. A differential relay has its coils interposed between the source and the limbs of the telephone line. There are a single source of ringing current for the line, a normally open contact of the relay adapted by its actuation to connect the source of ringing current with one limb of the line, and a normally open ground connection at each substation of the line adapted to be closed to send current through one side only of the relay.

825,927. Electrical Signal System. Carl P. Nachod, Wilkinsburg, Pa. Application filed August 2, 1905.

There are means for automatically indicating at single-track railway turnouts the passage of cars therefrom to the single track. Means are provided for terminating such indications only after vacation of the single track by the corresponding number of cars. Other means prevent changes in the indications while the block of single track is occupied by a car, and a single auxiliary conductor connects the means located at the respective turnouts.

825,938. Electric Cooker. George J. Schneider, Detroit, Mich., assignor to the American Electrical Heater Company, Detroit, Mich. Application filed June 28, 1905.

In an electric cooker the heating conductor is provided with a protecting grating, the conductor being arranged to expose the greater portion thereof for radiation through the spaces of the grating.

825,954. Cleat for Electric Wires. Charles C. Blake, Brookline, Mass. Application filed October 27, 1905.

A cleat for electric wires is made from suitable insulating material compressed on all sides and provided with a channel on its under side, whose edges extend to and join the periphery of the cleat.

825,964. Fire-extinguishing System. Charles H. Godfrey, Omaha, Neb. Application filed January 9, 1905.

The mechanism of a fire-extinguishing system for buildings has electrical connections. A switchboard has separate switches and indicators for each floor of the structure, and there are electrical connections between each floor and the indicators and electrical connections between the pumping mechanisms on each floor and the switches.

825,974. Brush Holder for Electrical Machines. Chester B. Mills, Wilmerding, Pa., assignor to the Westinghouse Electric and Manufacturing Company, Pittsburg, Pa. Application filed October 3, 1904.

A brush holder bracket and a brush holder have co-operative means for right or left location of the holder and for adjustment of the holder on the bracket toward and away from the commutator cylinder. There are means for clamping the holder in any position to which it may be adjusted on the bracket.

825,981. Method of Converting Spongy Lead into Lead Sulphate. Charles J. Reed, Philadelphia, Pa., assignor to the Security Investment Company. Application filed May 7, 1903.

The process of converting spongy or finely divided lead into lead sulphate consists in connecting the same in circuit with an electrode having a coating or deposit of platinum black in a bath of dilute suphuric acid. To reverse a spongy lead electrode the process consists in subjecting the same to the action of dilute sulphuric acid in conjunction with an electrode having a coating of platinum black, and connected therewith in a closed circuit, and subsequently charging the same as a peroxide plate.

825,986. Voltage Regulator. Harve R. Stuart, Wilkinsburg, Pa., assignor to the Westinghouse Electric and Manufacturing Company, Pittsburg, Pa. Application filed April 14, 1904.

There are means for first closing one switch of a series and then opening the last preceding switch of that series, the operation of the switches continuing to the end of the series. Means are provided for next closing one of a pair of switches and then opening the other, the two switches being alternately opened and closed. (See cut on next page.)

825,988. Railway Signaling System. Louis H. Thullen, Edgewood Park, Pa., assignor to the Union Switch and Signal Company, Swissvale, Pa. Application filed June 20, 1905.

This system, which has a number of block sections combined with a track circuit for each block section, comprises a relay and means comprising a source of alternating current for reducing the magnetic field of the relay when a train enters a block section. Each track circuit comprises a source of current supply and a relay device adapted to respond in the movement of its armature to the presence or absence in its coils of current derived from the source of supply. There are means for causing alternating current to traverse the magnetic field of the relay.

825,991. Semaphore. Jean F. Webb, Denver, Colo. Application filed July 21, 1905.

A revolving semaphore has electrically controlled devices for revolving it always in the same direction to alternately display safety and danger signals. A return signaling circuit includes a circuit-closer co-operatively

connected with the semaphore-operating mechanism for operating a return signal at each movement of the semaphore signals.

825,995. Conduit Receptacle. Frank T. Wheeler, Plainville, Conn., assignor to the Trumbull Electric Manufacturing Company, Plainville, Conn. Application filed October 25, 1905.

With a base of insulating material is combined a tubular contact member having secured in one end an insulating button of convex form, with a concave recess in its lower side, and a central contact member fitting within the button and having a part projecting therethrough and into the concave recess.

826,003. System of Signaling. Paul Winsor, Weston, Mass., assignor to the Union Switch and Signal Company, Swissvale, Pa. Application filed January 27, 1902.

A track circuit has a relay which controls the signal system. There is a source of current supply for the relay and means which permit the relay responding to the current intended for it, and which prevents the relay being affected to control the operations of the railway signal by currents traversing the track circuit of a different character.

826,015. Electrically Propelled Vehicle and Permanent Way Therefor. Arthur St. Vincent Burnaby, Brighton, England. Application filed October 16, 1905.

In a single-rail high-speed railway is combined an upper guide rail with a lower spring-supported carrying rail, the carrying rail being flexible and under tension.

826,048. Temperature Alarm. William T. Munroe, East Blairlinn, Cumbernauld, Scotland. Application filed September 22, 1904.

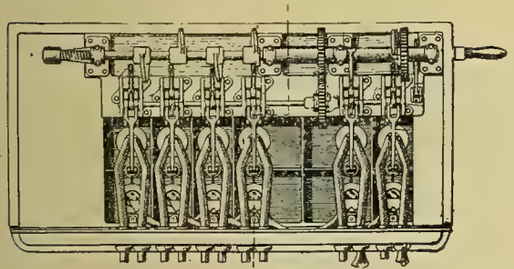
An automatic temperature alarm comprises two bulbs, the wall of the one bulb being thicker than that of the other. A capillary tube having mercury therein connects the two bulbs. Two smaller bulbs are contained in the capillary tube and there are electric terminals in the tube.

826,050. Trolley Pole. Augustus Neubert, Elizabeth, N. J., assignor of one-half to Edward H. Radel, New Brunswick, N. J. Application filed November 5, 1903.

The arrangement consists of crossed trolley wires at different elevations, the upper wire being continuous and the lower wire having an opening directly below the upper wire. A trolley pole has a fork and a trolley wheel, the wheel engaging the lower trolley wire and being of a diameter exceeding the width of the space or opening in the lower wire to prevent the fork from moving upwardly so far as to come in contact with the upper wire when the wheel is passing under the upper wire.

826,072. Outlet Box. Robert M. Thomas, Elizabeth, N. J., assignor to Thomas & Betts Company, New York, N. Y. Application filed July 8, 1905.

An outlet box is provided with knock-out portions held in place by a layer of extraneous fastening material applied after the knock-out portions have been removed and returned.



NO. 825,986.—VOLTAGE REGULATOR.

826,090. Electric Signaling and Testing System. John Doran, Schenectady, N. Y. Application filed March 23, 1906.

Combined in the system are a source of electrical energy, an electrolytic cell resistant to the passage of an electric current in one direction and non-resistant to the passage of an electric current in the opposite direction, and conductors normally connecting the cell and source of electrical energy in circuit with the cell resistant to the passage of the electric current therethrough. A normally open signal switch is adapted to connect together the conductors on opposite sides of the cell, and there are means whereby a testing electric current may be passed in the opposite direction through the circuit. (See cut.)

826,097. Conduit Outlet Box. Arthur Frantzen and William H. Rattenbury, Chicago, Ill. Application filed March 24, 1903.

A conduit outlet box comprises a body portion and a cover fixedly screwed in place therein. An outlet tube is threaded in the top of the box and adjustable in position therein. A floor plate has means to fasten and seal the tube at various positions in the floor plate.

826,123. Electric Sparking Igniter for Explosive Engines. Lem A. Smith, Englewood, N. J. Application filed April 16, 1904.

The explosion inclosure has a piston arranged therein. In a recess set apart from the space therein in which the piston plays is an electric igniting means. There are means for admitting fuel into the cylinder, and a baffle plate is arranged between the igniting means and the fuel-admitting means and close to the former.

826,124. Means for Splicing Telegraph, Telphone and Other Poles. John D. Soseman, Monroe, Wis. Application filed September 2, 1905.

This device, for the purpose specified, comprises a pole clamp adapted to be fitted to or removed from operative position by movement in a direction transverse to the length of a pole, and a number of extensible legs extending downwardly and outwardly from the clamp, each having an enlarged base or shoe at its lower end.

826,136. Bond. Francis B. Badt and George M. Willis, Chicago, Ill. Application filed March 10, 1902.

The patent describes a method of fastening a terminal within a hole, consisting in subjecting the plastic material of the terminal to pressures initially applied below the planes of the surfaces at the ends of the hole, thereby producing a flow of the plastic material first in a longitudinal direction, then outwardly from the axis of the terminal and substantially at right angles to the axis and finally in a direction parallel with the axis of the terminal but from the interior toward the outer ends of the terminal.

826,138. Collector. Benjamin H. Bedell, London, England. Application filed November 22, 1904.

A collector of electricity from successive studs for use in stud-contact systems of electric traction of vehicles comprises an elongated pole of a magnet longitudinally situated in the vehicle so as to be adapted to travel in close proximity with electricity-conveying road studs. The pole consists of two plates equidistantly situated from one another throughout their length, a chain of links composed of magnetic material extended between the two plates of the aforesaid pole of the magnet, the ends being secured to the vehicle, and means for sustaining the intermediate links of the chain in a yielding manner normally out of contact with the road.

826,152. Cluster Socket. John H. Dale, New York, N. Y. Application filed May 25, 1905.

A cluster incandescent-lamp socket is described, comprising a number of lamp contacts and a number of converging arms pivoted to each of the lamp contacts.

826,173. Storage-battery Plate or Electrode. Alfred E. Knight, Somerville, Mass., assignor to James H. Churchill, trustee, Quincy, Mass. Application filed November 8, 1905.

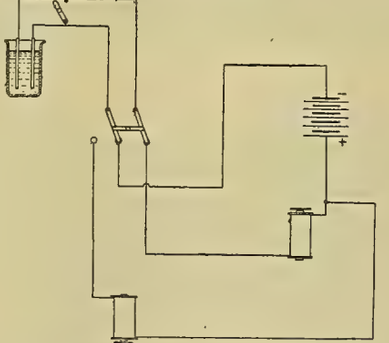
This plate or electrode comprises two members, each having a perforated outside metallic wall or plate and metallic ribs or bars on the inner surface of the wall or plate arranged with the bars in close proximity to each other. A substantially thin metallic wall or sheet is interposed between the members and makes contact with the ribs or bars of both members.

826,199. Switch-operating Mechanism. Arthur E. Stevenson, Buffalo, N. Y. Application filed October 12, 1905.

The combination has a screw and a nut having a screw-threaded engagement. Electrically controlled means are provided for rotating one of the parts to cause axial movement of the other part, and a switch member or the like is connected to and operated by the axially movable part.

826,206. Combined Safety Clutch and Wiring System. Harry A. Williams, Akron, Ohio. Application filed October 22, 1904.

An electric circuit has a number of switches, cords or wires connected to each switch, a main safety switch within the circuit and a clutch mechanism. There are means whereby the clutch mechanism may be thrown into operative engagement by the main switch, or, when one of the cords is under tension, the circuit is broken and the clutch mechanism disengaged.



NO. 826,090.—SIGNALING AND TESTING SYSTEM.

826,220. Telephone System. Charles V. Beaver, Anita, Iowa. Application filed July 5, 1902.

A direct main line of electrical communication extends from one station to another throughout the series and normally free from all instruments, and, therefore, free from the ohmic and inductive resistance of the instruments and from all possible electrical cross-flow therethrough. There are signal-sending devices at the several stations adapted to be brought into operative connection with the main line, and signal-receiving devices at the several stations are located in auxiliary circuits in inductive relation to the main line. Switches connect and disconnect the sending and receiving devices to and from their respective lines.

826,225. Incandescent-lamp Socket. Dudley B. Bullard and John J. Miniter, Bridgeport, Conn. Application filed October 13, 1904.

An electro-horseshoe magnet has binding posts on the magnet, an armature pivotally connected with one of the posts and adapted to simultaneously engage the two limbs of the magnet, a lamp socket attached to the magnet within the circuit and a spring intermediate of the limbs to engage the armature for automatically disconnecting the same from the magnet when the electrical circuit is cut out.

826,231. Electric Apparatus for Preventing Train Wrecks. Carmelo Del Campo, New York, N. Y. Application filed November 15, 1905.

In an electric railway signaling device a bell is located in an electric circuit, which is closed and broken by means of a spring and a button, a vertical lever oscillating on a stud, the lever being provided with a piece of leather attached at the lower end. A chambered plunger is located near the upper end of the lever and controlled by a spiral spring which keeps the lever on its vertical position.

826,248. Circuit-breaker. Edward M. Hewlett, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed May 24, 1898.

A circuit breaker has fixed terminals, a bridging contact, a toggle for closing the contacts, a spring for opening them and a detent for the toggle, the detent comprising a latch and a loose pawl, forming together a toggle. A series trip coil has an armature to which one of the latter is pivoted, the other being pivoted on one of the toggle levers. There are means for releasing the latch toggle by the action of the armature.

826,252. Starting Device for Explosive Motors. Thomas B. Jeffery, Kenosha, Wis. Application filed June 10, 1901.

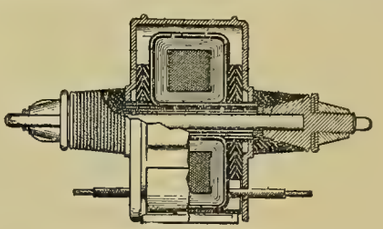
With a shaft of an explosive engine, by whose rotation the engine may be started, and an electric circuit breaker mounted apart from the shaft and movable for varying the time of ignition, is combined a sparking device connected with the circuit breaker of a movable guard for the shaft, which at normal position obstructs the operative engagement therewith of a turning device. There are connections from the guard to the movable electric circuit breaker.

826,253. Sparker-Igniter-Retarding Device for Gas Engines. Thomas B. Jeffery, Kenosha, Wis. Application filed January 9, 1905.

Details are described.

826,256. Railway Block Signal System. Charles M. Kirwan, Baldwinsville, N. Y. Application filed April 18, 1905.

A series of stations divides the railway into blocks, each station having a pair of signal arms, one at each side of the track. Separate electric circuits each include an electric switch, and there are means for controlling the operation of one of the arms, whereby the signal arms at one side of the track are caused to move to their operative positions in advance of the moving train, while the other arms are caused to be moved to their operative positions at the rear of the train. Separate devices on the train close the switches.



NO. 826,283.—TRANSFORMER.

826,272. Electric Metering System. William H. Pratt, Lynn, Mass., assignor to the General Electric Company, Schenectady, N. Y. Application filed February 9, 1903.

The combination consists of a polyphase alternating-current system, with meters for measuring the energy flowing in the system. Each of the meters is provided with two counters or registering devices, one of which is adapted for use when the meter rotates in one direction, and the other for use when the meter rotates in the opposite direction. A polyphase relay operates upon each meter to substitute one counter or registering device for the other when the flow of energy in the polyphase system reverses.

826,283. Transformer. Louis M. Schmidt, Lynn, Mass., assignor to the General Electric Company, Schenectady, N. Y. Application filed August 7, 1905.

In the transformer are an annular core, a winding thereon, an enclosing casing therefor, the casing having openings formed in opposite walls, and a support for the core passing through the openings and through the core. Insulation is provided between the ends of the core and the adjacent casing walls, the periphery of the core and winding thereon being separated from the adjacent portion of the casing by space. (See cut.)

826,287. Electrical Connection. Charles W. Svenson, New Britain, Conn., assignor to the Corbin Screw Corporation, New Britain, Conn. Application filed September 1, 1904.

The device comprises a base, a threaded terminal carried thereby, a clip, a nut operable on the terminal for securing the clip to the base, the clip having yielding side arms, the ends of which approach each other and are provided with recesses, and a flexible conducting-wire member having a spherical tip adapted to be seated in the recesses.

826,296. Trolley. Gurney E. Ward, Abilene, Texas. Application filed August 11, 1905.

A trolley having a spring attachment is described.

826,301. Electrochemical Process of Producing Nitrogen Compounds. John W. Wood, Moulton, Iowa. Application filed February 21, 1902.

This process consists in continuously charging a liquid electrolyte with air under pressure, to furnish it with an excess of nitrogen, and subjecting the liquid to the action of an electric current to dissociate the liquid.

826,302. Trolley Catcher. Montraville M. Wood, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed December 7, 1904.

In a trolley catcher are a winding device, a flexible member for connecting the winding device to the trolley pole and means for moving the winding device bodily and rotatably to pull down the trolley pole when the trolley leaves the trolley wire.

826,307. Electromagnet. Walter W. Brown, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed January 9, 1905.

Combined with an electromagnet is a movable member adapted to be raised thereby and means for retarding the movement of the member. A quick-break switch is controlled by the movement of the member and adapted to decrease the current through the magnet when the member is raised. There are means for restraining the member when the current is decreased, and means for releasing the member when the magnet is deenergized.

826,310. Automatic Telephone Exchange System. Albert M. Bullard, New York, N. Y., assignor to the Western Electric Company, Chicago, Ill. Application filed October 16, 1905.

In an automatic telephone exchange the combination, with a telephone line, consists of a selector individual to the line having a movable contact brush, stationary contact terminals of other lines and electro-magnetic stepping mechanism for trailing the contact brush across

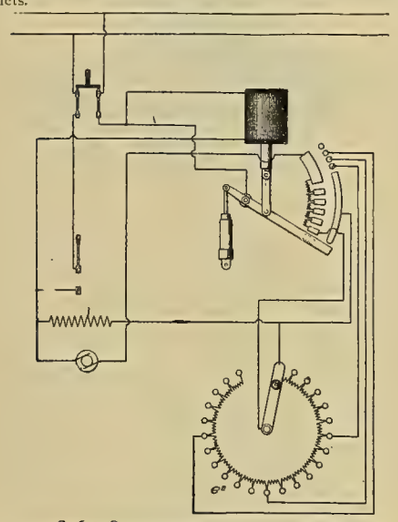
the terminals. A selecting interrupter at the substation is arranged to control the electro-magnetic mechanism to advance the contact brush to the terminals of a wanted line. A relay in a local circuit with the stepping mechanism is adapted to connect the contact brush with the calling line. There is a short circuit for the relay, and a switch at the substation is actuated in the return of the selecting interrupter to its normal position for maintaining the short circuit during the operation of the interrupter, whereby the telephone line is disconnected from the contact brush of its selector during the selecting operation and then connected with the brush.

826,315. Electric-railway Motor. Patrick J. Collins, Scranton, Pa., assignor to the General Electric Company, Schenectady, N. Y. Application filed January 3, 1905.

A field frame has side bars extending longitudinally of the truck frame between the ends of the armatures and the wheels, the field frame having also a transverse partition arranged between each adjacent pair of armatures. Pole pieces are arranged upon each of the partitions, and there are pole pieces at the ends of the field frame.

826,317. Selective Signal System. William W. Dean, Chicago, Ill., assignor to the Western Electric Company, Chicago, Ill. Application filed January 14, 1902.

A number of responsive devices and branch circuits are included in the source of current, a number of relay magnets and armature switches being operated thereby for controlling the branch circuits and a circuit including the source of current with the armature switches in series. Each armature switch is adapted when actuated to cut off all the remaining armature switches farther on in the series, and circuits independent of the armature switches excite the different relay magnets.



NO. 826,318.—SPEED CONTROL FOR MOTORS.

826,318. Speed-control System for Electric Motors. Alexander D. Du Bois, Chicago, Ill., assignor to the Western Electric Company, Chicago, Ill. Application filed April 8, 1905.

The features are an armature starting resistance for the motor, a controlling arm for the resistance, a field resistance for the motor having a variable maximum value, means for adjusting the maximum value of the resistance independent of the starting resistance arm, and means controlled by the arm for bringing the predetermined maximum field resistance into the field circuit. (See cut.)

826,319. Trolley Pole. Pemberton Dudley, Asbury Park, N. J., assignor of one-third to Daniel W. Reynolds and one-third to George W. Patterson, Asbury Park, N. J. Application filed August 11, 1905.

A trolley pole, a trolley fork having a ball-and-socket connection therewith, and a lateral guide for the fork located above its ball-and-socket connection are the features.

826,325. Automatic Door-opening and Closing Device. Cleophas Gamache, Barre, Vt. Application filed March 19, 1906.

A motor is provided for moving the door in one direction, and a coil spring held in a casing and having a flexible connection with the door moves the door in an opposite direction. A movable platform adjacent to the door controls the starting and stopping mechanism of the motor.

826,331. Electric Time Switch. Charles E. Harthan, Lynn, Mass., assignor to the General Electric Company, Schenectady, N. Y. Application filed March 14, 1902.

A gear wheel is loose on its spindle and carries an abutment. An arm is fixed on the spindle and adapted to engage with the abutment. A spring-driven train is provided for driving the gear wheel, and a time mechanism carries tripping devices to release the train at stated times.

826,336. Card Holder for Telephone Transmitters. James L. Kilpatrick, Philadelphia, Pa., assignor to the Western Electric Company, Chicago, Ill. Application filed June 5, 1905.

A card clip is provided with a frame having parallel sides, the edges of the sides and also the edge of the top or outer portion of the frame being turned down, the clip having also an annulus or collar, the clip being stamped from a single piece of metal.

826,350. Selector for Automatic Telephone Exchanges. James L. McQuarrie, New York, N. Y., assignor to the Western Electric Company, Chicago, Ill. Application filed October 16, 1905.

The combination, with a ratchet carrying a selector arm, consists of a plate upon which the ratchet is mounted, an electromagnet for actuating the ratchet, the magnet being disposed upon the rear of the plate with its core piece projecting through an opening in the same, and a bracket mounted upon the front of the plate and providing a support for the core piece and magnet.

826,359. Support for Incandescent Electric Lamps. Adolphe Romain and Jean D'Ayguesvives, Paris, France. Application filed September 6, 1904.

An upper portion is adapted to be connected with the wires of the working circuit, a lower portion has means for supporting a lamp and a middle portion carries means for connecting electrically and in a removable manner the upper and lower portions.

826,362. Governing Continuous-current Motors. Gaston Sautter, Paris, France. Application filed November 11, 1902.

In an apparatus for controlling continuous-curent motors are a motor, a main circuit wherein the motor is included and means for reversing the direction of the current through the motor, in combination with contacts, each normally held under spring tension, the magnets of the contacts arranged respectively so as to be excited by the current generated in the armature of the motor during braking of the motor, whereby when the motor is brought to rest the contacts are maintained by the current from the armature under the influence of their springs until complete stopping of the motor results.

826,367. Aerial Electric Transportation System. George G. Schroeder, Washington, D. C., assignor to the Industrial Transportation Company, Washington, D. C. Application filed November 14, 1904.

An elevated track is adapted to support a carrier, and current wires are located above the track. Trolley arms are pivoted at their lower ends to the carrier, some of the trolley arms extending in front of, and the remainder extending back of, a perpendicular erected through the center of the carrier, each of the trolley arms engaging one of the current wires.

826,403. Telegraph Key. Joseph P. Campbell, Pulaski, Va. Application filed January 29, 1906.

A movable key lever carries one of the contacts, and an auxiliary lever carries the other contact. Connecting means are provided whereby the operation of the key lever will simultaneously actuate the contacts.

826,429. Self-regulating System of Electrical Distribution. Albert S. Hubbard, Greenwich, Conn., and Edward Lyndon, New York, N. Y., assignors to the Gould Storage Battery Company, New York, N. Y. Application filed November 3, 1903.

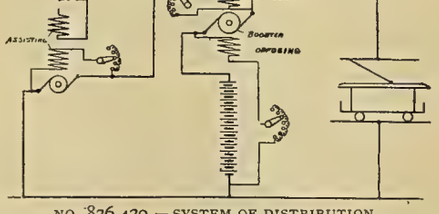
A system of current generation and distribution comprises a generator, a storage battery and booster and a work circuit. A field winding for the generator is in series in the work circuit for automatically raising the generator electromotive force when the load on the work circuit increases and for reducing the generator electromotive force when the load on the circuit decreases. (See cut.)

826,435. Extracting Metals by Electrolytic Means from Ores. Alexander Lénárt, Jr., Budapest, Austria-Hungary. Application filed August 18, 1905.

An upper chamber receives the ore to be treated. A lower chamber, a permeable false bottom between the upper and lower chambers, electrodes of both poles arranged in the lower chamber, diaphragms surrounding the cathodes, means for connecting the cathodes and anodes to the poles of a source of electrical energy and means to feed into and to discharge the cathode electrolyte from the diaphragms are the other features.

826,439. Trolley. Bryan McManaman, Wilkesbarre, Pa. Application filed September 7, 1905.

Details are described.



NO. 826,429.—SYSTEM OF DISTRIBUTION.

826,440. Trolley Stand. Bryan McManaman, Wilkesbarre, Pa. Application filed October 3, 1905.

Details are described.

826,457. Electric Signaling System. Jean F. Webb and Clayton E. Frederickson, Denver, Colo.; said Frederickson assignor to said Webb. Original application filed April 25, 1905. Divided and this application filed November 1, 1905.

In a selective signaling system are a main circuit, a supplemental circuit and a telegraphic circuit, a switch common to both the main and the supplemental circuits, a main source of electrical energy common to both the main and the supplemental circuits, a circuit closer in the main circuit, a step-by-step circuit-closing member connected in the supplemental circuit, a main signal in the supplemental circuit and telegraphic signaling apparatus in the telegraphic circuit, a secondary source of electrical energy in the telegraphic circuit, means connected in the main circuit for operating the step-by-step circuit-closing member and means for releasing the step-by-step member from connection with the step-by-step operating means.

826,472. Telegraphy. Charles L. Buckingham, New York, and Emil Germann, Brooklyn, N. Y.; said Germann assignor to said Buckingham. Original application filed November 2, 1899. Divided and this application filed December 7, 1901.

A message tape is described in which messages are prepared for transmission by the Wheatstone transmitter or other equivalent apparatus, and for reproduction by a page printer, each of the messages being represented by several sections of perforations, the sections being separated by blank spaces whereby Morse or other signals may be transmitted while the spaces between the sections are passing through the transmitter.

826,478. Electric-railway Motor. Patrick J. Collins, Scranton, Pa., assignor to the General Electric Company, Schenectady, N. Y. Original application filed January 3, 1905. Divided and this application filed August 11, 1905.

There is a combined field and truck frame comprising side bars supported upon the axles, the frame having also transverse bars connected to the side bars arranged at opposite sides of each axle. Pole pieces upon the transverse bars are opposite the several armatures, and a partition extends longitudinally of the truck between the armatures on the several axles and is connected to the transverse bars, the bars and partition forming parts of the magnetic circuits.

826,485. Electrical Typewriter Selecting and Operating Means. George W. Donning, East Orange, N. J., assignor to Harry T. Ambrose, Orange, N. J. Application filed May 27, 1903.

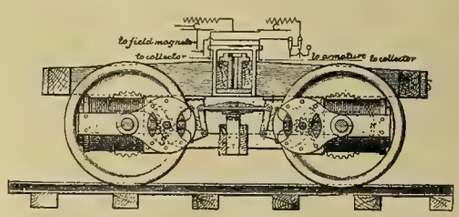
A controlling means is provided for each movable member, and is constructed to be actuated to a number of operating positions, and arranged, first, when actuated to its initial operating position, to move the selecting means into position for engagement with the power bar, and thereupon, when actuated to a different operating position, to cause the power bar to be actuated and operate the corresponding movable member.

826,503. Motor Support. Ezra Haskell, New York, N. Y. Application filed December 14, 1903.

Combined with a swinging crane suitably supported and adapted to serve as a conduit for wires is a bail so connected with the crane as to have free movement. A motor is tiltably suspended from the bail, and wires pass through the crane to the motor.

826,508. Electrically Propelled Vehicle. Rudolph M. Hunter, Philadelphia, Pa., assignor to the Electric Car Company of America, Philadelphia, Pa. Original application filed October 27, 1886. Divided and this application filed November 15, 1898.

There is a motor sleeved on one of the truck axles, a cross bar extending between the bars of the frame and a connection for the free end of the motor comprising a number of oppositely acting springs supported by the cross-bar. (See cut.)



NO. 826,508.—ELECTRIC VEHICLE.

826,526. Reciprocating Brush Device. Harry L. Rambeau, Cincinnati, Ohio, assignor to the Bullock Electric Company, Cincinnati, Ohio. Application filed October 6, 1903.

In a reciprocating device for brushes are a brush yoke, means engaging the yoke, a member having inclined surfaces engaged by the means and additional means for imparting motion to the member.

REISSUE.

12,504. Rail Bond for Steam and Electric Railways. Frank C. Hoffman, Somerville, N. J. Application filed June 9, 1906. Original No. 812,040, dated February 6, 1906.

A rail bond comprises rail sections provided with openings therein in proximity to their meeting ends, split sleeves having overlapping edges and located in the openings. The split sleeves and openings in the rail sections have tapered engagements, and a bond wire with its ends passes through the sleeves, the sleeves serving to be forced or driven into the openings to tightly embrace the enclosed ends of the wire, which action also permits the sleeves to be tightly fitted into the openings in the rails.

PATENTS THAT HAVE EXPIRED.

Following is a list of electrical patents (issued by the United States Patent Office) that expired on July 23, 1906:

407,327. Electric Generator. C. E. Buell, Newark, N. J.
407,389. Automatic Signal for Crossings of Cable Railways. G. H. Wright, San Francisco, Cal.
407,414. Electric Meter. W. McKinney, Schuylkill Falls, Pa.
407,447. Underground Electric Conduit. E. H. Phipps, New Haven, Conn.
407,455. Electric Cut-out. A. T. Smith, New York, N. Y.
407,460. Automatic Telegraph. F. Anderson, Peekskill, N. Y.
407,461. Automatic Telegraphy. F. Anderson, Peekskill, N. Y.
407,462. Automatic Telegraph Recorder. F. Anderson, Peekskill, N. Y.
407,470. Circuit for Electric Railways. H. H. Cutler, Newton, Mass.
407,473. Electro Galvanic Belt. A. Dow, Wooster, Ohio.
407,480. Relay for Quadruplex Telegraphs. C. L. Healy, Brooklyn, N. Y.
407,485. Multiple Wire System of Electrical Distribution. J. A. Lighthipe, Wilmington, Del.
407,490. Electric Signal. G. McIntosh, Stonington, Conn.
407,496. Electrical Railway. S. H. Short, Denver, Colo.
407,581. Selecting Telegraph. M. W. Dewey, Syracuse, N. Y.
407,593. Electric Fixture. J. C. Hollings, Boston, Mass.
407,619. Electric Meter. M. M. M. Slattery, Fort Wayne, Ind.
407,673. Galvanic Shoe. J. S. Mellon, St. Louis, Mo.
407,689. Charging System for Secondary Batteries. A. L. Riker, New York, N. Y.
407,692. Autographic Telegraph. J. H. Robertson, Rutherford, N. J.
407,729, 407,730. Printing Telegraph. C. L. Healy, Brooklyn, N. Y.
407,745. Electrical Railway. S. H. Short, Denver, Colo.
407,746. Water Closet Flushing Valve (Electric). J. W. Stevens, St. Paul, Minn.
407,749. Extensible Upward-pressure Contact Arm. C. J. Van Depoele, Lynn, Mass.

WESTERN ELECTRICIAN

EVERY SATURDAY

Vol. XXXIX. CHICAGO, AUGUST 4, 1906 No. 5

New Metropolitan Station, Paris.

By A. De Courcy.

In a preceding article (Western Electrician, July 4, 1903) the writer took occasion to describe the new central station which has been built at Paris for supplying current to the Metropolitan Subway. This station is one of the largest in the city, and is centrally located on the banks of the Seine. At the time of my preceding account the plant had been provided with a considerable outfit of boilers, direct-coupled groups and minor apparatus, but as it was foreseen that an increase would need to be made in the near future, the station buildings were laid out with this end in view, so that a large boiler plant and an additional series of generating units could be added without changing the main features of the station. Since then the Metropolitan station has had its capacity more than doubled, in order to keep pace with the great extension of the subway, and thus meet the demands for current. It will thus be of interest to note some of the features of the new plant, especially as the outfit which has been recently installed is of a different construction, both as regards the boilers and the engine alternator groups, and thus presents many new features.

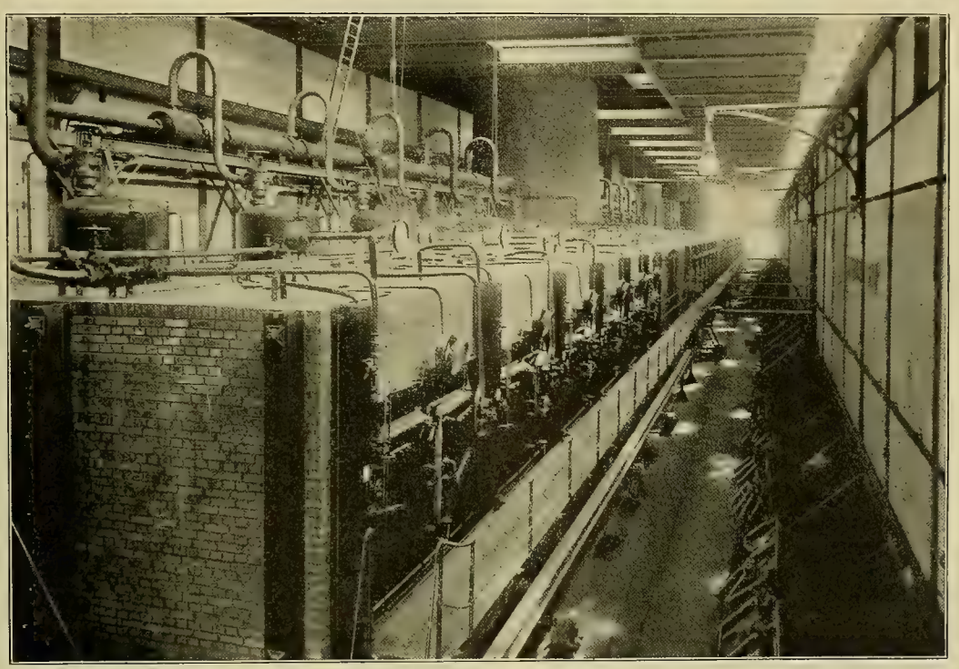


Fig. 1. Boiler Room.

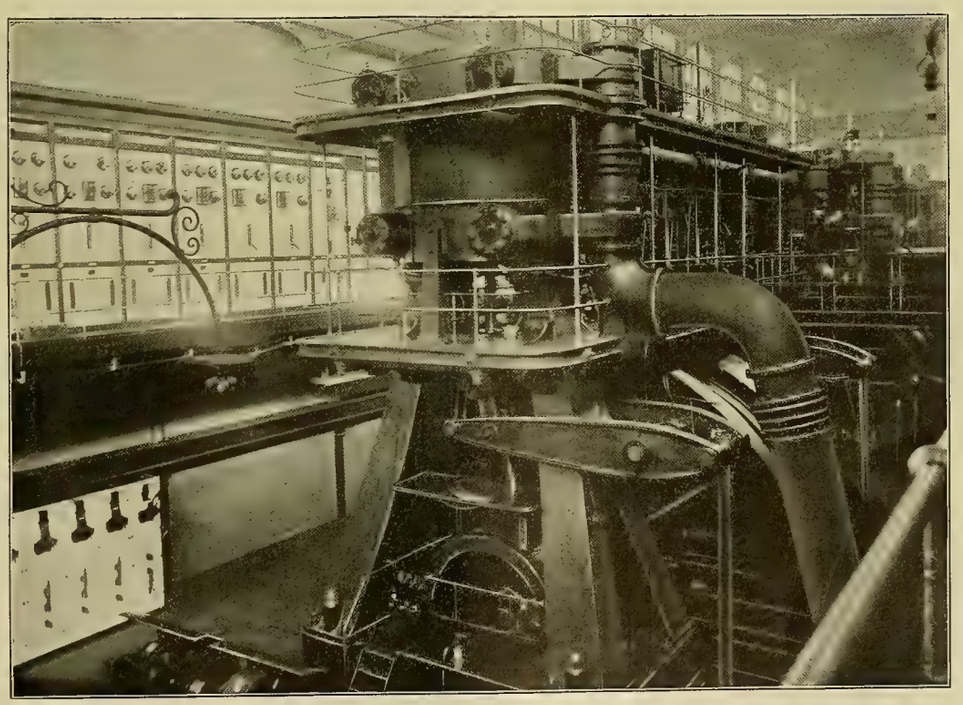


Fig. 2. Engines, Generators and Switchboard.
NEW METROPOLITAN STATION, PARIS.

It will be remembered that the alternators of the station, which are all of the same general type, supply three-phase current at 5,000 volts and 25 cycles. This current is sent out directly upon the feeders without the use of transformers. The underground feeders run throughout the city to a number of sub-stations lying not far from the subway lines, and here the current is received by an outfit of transformers and rotary converters, which latter are designed to give the supply of direct current at 500 volts, which is used upon the third rail of the tracks. When the station was first set running to furnish current for the subway, there was only one section of the underground road actually in operation, and the amount of current needed for running the trains was comparatively small, when one takes into account the final project for the subway, which includes seven or eight different sections, and is to be completed within the next few years. Not long afterward the second section of the road, which is much longer than the first, was finished, and was soon carrying a heavy traffic. Hence more than twice as much current was then needed. More recently the third section of the subway has been opened, thus calling for an additional supply. At the same time, a number of new lines are now actively in construction, so that there was a great need for an additional supply of apparatus in the station.

The first part of the plant was laid out to furnish 6,000 kilowatts, while the new machines which have been erected during the last year are designed for a total output of 6,600 kilowatts, thus more than doubling the former capacity. In order to allow the increase to be made in the most convenient way, without interfering with the working of the station, the buildings were designed in the first place so as to have a long dynamo hall in the center, forming a separate building. In the front half of the building were placed the generating groups forming the first outfit and consisting of four upright direct-coupled engine-alternator sets of 1,500 kilowatts each. Dynamos and engines come from the Schneider Company of Creusot.

Along one side of the dynamo building is the first boiler room, running the whole length, and containing five batteries of six boilers each, making 30 boilers in all, which are used to supply the four engines. When the new part of the plant came to be erected, it was an easy matter to put up a second boiler house, lying along the other side of the dynamo building, and it also extends for the whole length. Here was erected a series of 21 boilers, supplied by the Société Alsacienne de Constructions Mécaniques, one of the leading French companies. In the main building the new alternator groups were installed in the large space which had been left in the rear of the hall, and these units consist of three engine-alternator groups of 2,100 kilowatts each, which were furnished by the above firm, for the engines, in connection with the Compagnie Française Thomson-Houston, which built the alternators at its Paris factory.

A good view of the new boiler plant is shown in Fig. 1. To the left is a long range of boilers, forming a single line, and when fully completed there will be three batteries of eight boilers each. At present there are two such batteries, while the third battery contains but five boilers at present, making a total of 21 units for the whole plant. Along the front runs an iron platform, which allows an easy access to the upper part of the boiler. Lying next the boiler house is a long series of coal bunkers, which correspond with the furnaces. As in the first boiler room, these bunkers are supplied by a set of motor-driven conveyors which bring the coal in from the barges of the Seine. The present boilers, which are of the most recent type designed by the Société Alsacienne, are semi-tubular in construction, and each one is provided with a set of tubes as well as two water-boilers of cylindrical form. The whole system provides some 300 square yards of heating surface, while the fire grates have a net surface of six square yards. Two superheaters are provided for each boiler. One of these is heated by the hot gases of the furnace, and the second by radiated heat. A good draft is afforded by three smokestacks, 180 feet high and 10 feet inside diameter at the top. A set of three Green economizers is used with the boilers. Motor-driven pumps bring the water from the Seine and feed it into two large supply reservoirs. Another set of pumps take the water from the reservoirs to supply the boilers.

In Fig. 2 is shown a view in the main dynamo building. The engines which are used with the new

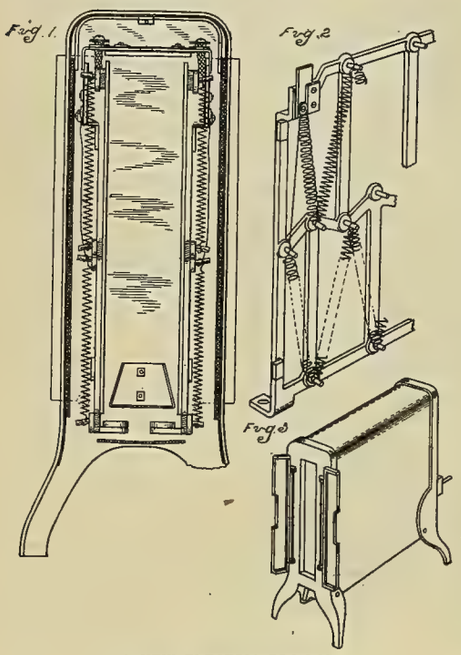
alternators are of the upright Corliss compound type, and have also been supplied by the Société Alsacienne. The cylinders are supported on each side by one of the main uprights of the frame, and there are two main platforms, one at the base of the cylinders and a second at the top of the engine. The heavy base plate of the engine has the uprights bolted to it and carries the bearings, which are cast with this plate. The latter are ball-bearings of an improved form and provided with a water-cooling system. The high-pressure cylinder has a diameter of 46 inches, and the low-pressure, 80 inches, with a 60-inch stroke. The engines operate at 79 revolutions per minute and are rated at 3,200-4,200 horsepower. Their total weight is 420 tons.

A capacity of 2,100 kilowatts is the normal output of each of the three-phase alternators, and this may rise as high as 2,700 kilowatts on heavy loads. These machines, as I have already stated, were constructed at the Paris shops of the Thomson-Houston Company, and are of the most recent design. Here the field poles are mounted upon a heavy flywheel lying between the main uprights of the engine and are surrounded by the main body of the alternator, which holds the well-known form of laminated armature ring with slot winding. These machines deliver 5,000 volts at the terminals at 25 cycles when running at the engine speed of 79 revolutions per minute. Keyed to the shaft is the flywheel, built up of eight cast-steel pieces bolted together and joined by braces. Around the periphery are bolted the field cores, of riveted laminated iron, to the number of 38. The field winding is formed of a 40 by 2.3-millimeter copper strip, with paper insulation, and the whole field is connected in series, being supplied by two steel collector rings, which bring the exciting current. The field has an outer diameter of 6.1 meters and a total weight of 22 tons. The shaft diameter is here 24 inches. Besides the flywheel forming the armature, the engine carries a second flywheel, lying next the alternator, which weighs 90 tons. The width of the wheel rim carrying the field poles is 17 inches, and it is 5.2 inches thick.

The armature casting, of ring form, carries a laminated ring whose bore is nearly 6.1 meters, which, with the above-stated field diameter, gives an air gap of 10 millimeters. Good ventilation is given to the armature by four air spaces. A partially closed slot is used for the armature winding, and there are in all 228 slots, two per pole and per phase. Square-section flexible copper cable, 12.5 by 12.5 millimeters, is used for the winding. The slot measures 37 by 70 millimeters and carries eight conductors. The cable is insulated by oiled and varnished cloth strips, while the slots are insulated with cardboard. In these machines the phases are connected in delta. The total weight of copper in the armature is 2.6 tons, while in the field it is 3.3 tons.

On the tests which were made at the time of installing the new groups, it was found that on a 10-hour continuous run under a load of 2,100 kilowatts, the temperature of the armature did not reach more than 21° C. above air. During a second test the machine was given a run of 10 hours at an overload of 2,650 kilowatts, when, at the end of the run, the armature showed 27 degrees above air and the field 17 degrees. As to the exciting current for the fields, which is furnished from the direct-current bars of the station, it reaches 110 amperes at no load, and 150 amperes at the normal capacity of 2,100 kilowatts.

To keep pace with the increase in the machine outfit, the main switchboard has been also extended considerably. As will be noticed in the rear of the machines (Fig. 2), the board is mounted in a gallery which runs along the main wall. Behind it are mounted most of the apparatus in the space of six feet between the panels and the wall. At present the switchboard contains 31 white marble panels, and upon these are mounted the apparatus for the alternators, the 5,000-volt feeders, the exciters and the other groups in the station.



A NEW ELECTRIC BROILER.

A New Electric Broiler.

Broiling is one of the operations of the kitchen to which electricity may be readily adapted, although one hears less of it, perhaps, than of electric stewing, boiling or baking. George J. Schneider of Detroit has invented the form of electric cooker illustrated by the accompanying drawings, which is particularly designed for use as a broiler and is covered by a recently issued United States patent. The complete device is shown in Fig. 3, while Fig. 1 is a cross-section, and Fig. 2 is a detached view of one of the removable heaters.

Little explanation is needed to make the drawings intelligible. The meat or other food to be broiled is introduced by the doors shown in Fig. 3. The heaters, consisting of coils of high-resistance wire, are arranged on each side of the broiler in the manner indicated in Figs. 1 and 2. To prevent danger of direct contact between the heating conductors and the food there is provided a grating or open frame, shown clearly in Fig. 2, which also forms the mounting for the electric wires radiating the heat. The grating is enameled with a suitable insulating material, and is easily removed for cleaning. When the grating is in position it is connected with the outside source of current by suitable contact pieces. Heat insulation is provided on the inside of the casing, and the radiation from the heating coils passes through the spaces between the grate bars and is projected against the food to be cooked.

Poulsen's Improved Method of Recording Telephonic Messages or Signals.

The work of Valdemar Poulsen of Copenhagen, Denmark, in perfecting means by which telephonic messages may be recorded or "stored up" is well known, as he has received many patents on devices for this purpose. The system has never become popular, however, either from too great complexity or for some other reason. But it is an interesting contrivance, and the fact that the inventor received a patent on an improved system of the sort as late as May 29th of this year is proof that he has not given up faith in its ultimate success.

The patent is on a division of an application filed July 8, 1899, and was filed April 3, 1900, and renewed March 20, 1906.

The principle of the system as described in this later patent, which is believed to be an essential advance in the development of such apparatus, is based on the magnetic excitation of paramagnetic bodies. The solution of the problem is based on the discovery that a paramagnetic body, such as a steel wire or ribbon, which is moved past an electromagnet connected with an electric or magnetic transmitter, such as a telephone, is magnetically excited along its length in exact correspondence with the signals, messages, or speech delivered to the transmitter, and, further, that when the magnetically excited wire is again moved past the electromagnet it will reproduce the messages in a telephone receiver connected with the electromagnet.

The invention finds practical value for telephonic purposes by providing a suitable apparatus in combination with a telephone in which communications can be received when the subscriber is absent, and which, upon his return, can be repeated.

The apparatus is somewhat in the nature of a phonograph, and it embodies a clockwork mechanism to furnish movement of the recording parts. The following description of its working will be understood by following the diagrams.

A bow-shaped frame (Fig. 1) consists of a piece of tubing bent into shape and having its ends connected by an arm (e'), mounted to turn on a spindle. The upper end of the bow has a bearing at the middle of the frame, by means of a short stud, which passes through the bow and enters the frame (b). The rotary motion is imparted to the bow by means of clockwork. A fixed ring (48), carrying two annular electrical contacts (49) on its upper surface, is arranged immediately below the arm (e'), and the arm is provided with a spring-mounted pin adapted to be forced into connection with both of the electrical contacts for the purpose of electrically connecting them together.

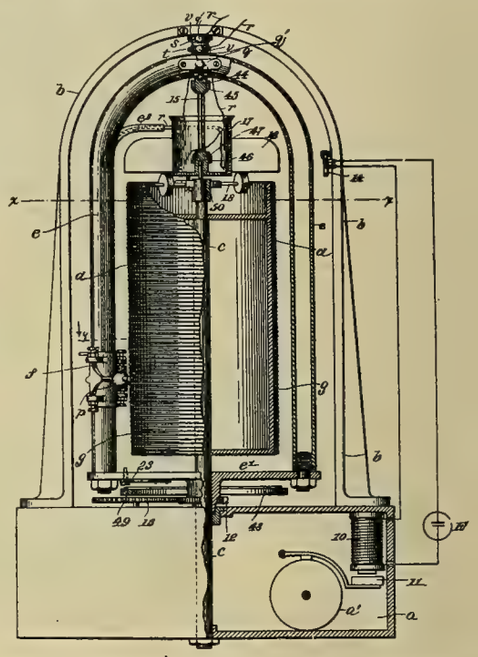


FIG. 1. POULSEN'S TELEPHONIC MESSAGE-RECORDING APPARATUS.

Upon the surface of the cylinder (d) is wound a steel wire (g) in a uniform helix. On one of the arms of the bow is placed a sleeve (f), adapted to slide freely up and down on the bow. This sleeve has pivoted to it a magnet holder. The magnet holder is provided with a tailpiece, which is normally pressed upon by a spring, tending to force the poles of the magnet out of contact with the wire (g).

When the bow (e) rotates it will carry the drum (17) with it; but, owing to the action of the brake (18) and the wings (16), there will be a certain amount of lagging on the part of the drum, which will be permitted by the twisting of the wires (15).

The clockwork is normally prevented from rotating by the weight of the armature (11), which acts upon the brake, as shown in Fig. 1. The brake is released by the electromagnet (10); in a circuit

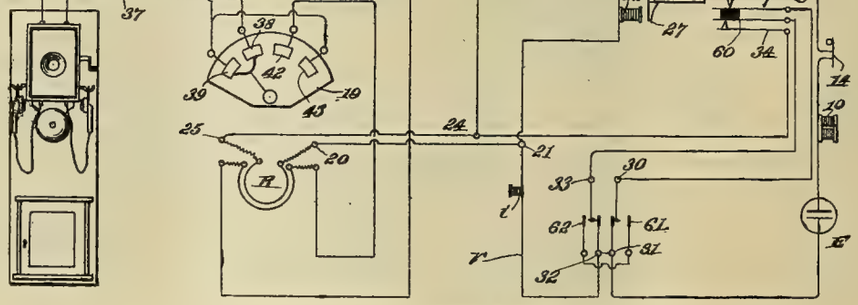


FIG. 2. CONNECTIONS OF POULSEN'S MESSAGE RECORDER.

with battery (E) and a cut-out (14), attached to the frame (b).

The apparatus so far described is a phonograph, the operation of which may now be referred to.

Let it be assumed that speech or signals are being electrically transmitted over the circuit containing the magnet, that the sleeve is at the lower end of the bow, and that the machine is started by closing the circuit of magnet (10). The bow immediately commences to rotate around the cylinder. When the speed is sufficient, centrifugal force acting upon the weight (p) will cause the core of the magnet to be thrown into contact with the wire (g), whereupon the sleeve will be caused to slide upward upon the bow, owing to the spiral arrangement of the wire on the cylinder. At the same time the undulations of current in the circuit of magnet will vary the magnetism of the magnet, which variations will be successively imparted to the wire (g). The message may continue until the sleeve reaches the elevation of the cut-out, whereupon the finger on the sleeve strikes the cut-out and swings it to one side, thus opening the circuit of magnet (10). To reproduce the message which has thus been magnetically recorded, it is only necessary to put a receiving telephone into circuit with the magnet instead of the transmitting telephone and then start the machine again, whereupon the sleeve will travel up on the bow and the poles of the magnet will traverse the wire (g), the successively varying magnetic condition of which will react upon the core of the magnet and cause the same undulations of current to be sent over the line to the receiving telephone as were previously sent over the line to the magnet from the transmitting telephone.

The connection of the apparatus to a telephone is shown in Fig. 2. A switch (19) is provided, having four terminals (38), (39), (42) and (43). These terminals can be connected with each other in three different ways by means of the switch lever. In the position shown in the diagram the two terminals (38) and (39) are connected together. This position establishes the circuit for the ordinary use of the telephone. The current passes through the conductor (35), the conductor (36), to the telephone, and through the conductor (37), terminals (38) and (39), back to the conductor (40). The two conductors (35) and (40) constitute the outgoing and return lines.

If the switch lever is so adjusted as to connect the two terminals (38) and (42), the apparatus can then be used as a phonograph, and the transmitting telephone belonging to the same station can then be used. To clearly explain this, the course of the current should be followed when the terminals (38) and (42) are connected. When the subscriber turns the crank handle of his induction apparatus, a current will pass through the outer coil of the induction coils (R). The current issues from the telephone and passes over the conductor (36) to the outer coil of the induction coils (R), then through the terminals (42) to the terminals (38), and over the conductor (37), back to the telephone. A current is then induced in the inner coil of the induction coils (R), which will take the following course: It passes from the terminal (20) of the inner coil of the induction coils to the electromagnet (22), through the contact (23), conductor (24), terminal (25), back to the inner coil of the induction coils. The electromagnet (22) is thus excited and the armature attracted, whereupon a weighted block (41) is released and falls. By this means contact is made between the contact piece (28) and spring (29), whereby the local circuit of the battery (E) is closed. The circuit is as follows: The electromagnet (10), (Fig. 1), now attracts the armature (11), so that the clockwork is set in motion and the bow rotated. The sleeve, which has been resting upon the pin, begins to rise, and the connection between the contacts (49) is broken. The contact (23) consequently exists only for an instant, so that the circuit of the conductors (20), (21), (22), (23), (24) and (25) is open during the operation of the clockwork and apparatus. Now during the rise of the sleeve, and while the electromagnet is in contact with the steel wire (g) in the manner described, the subscriber can speak into his transmitter, and the spirally wound steel wire will be correspondingly magnetically excited. In exact correspondence with the matter spoken into the transmitter, currents are induced in the inner induction coil. Such currents issue from the terminals (20) and (21), pass through the electromagnet, and the latter is magnetized in correspondence with the matter spoken and transfers its magnetism to the steel wire (g). The matter thus fixed can now be transmitted over the line by using the third connection—that is, by connecting the terminals (42) and (43) of the switch (19). If, for example, the message, "The subscriber is not at home at present, but will return at four o'clock, at which time please ring again," is fixed to the steel wire, the subscriber at the transmitting station now hears through his receiver the message fixed to the steel wire, and knows that in order to speak with the subscriber at the receiving station he must call him up at four o'clock.

West Seattle to Sell Municipal Plant.

The City Council of West Seattle, Wash., has set a price of $30,000 on its street-railway and light plant, and the Seattle Electric Company has signified its acceptance of the terms, the sale being provisional, with the approval of the taxpayers of that city, who will be given an opportunity to vote on the issue. At a committee meeting of the whole of the City Council $30,000 was set as the price for the street-railway and lighting system, and formal action on offering the question to a vote of the citizens will be taken. The Seattle Electric Company will be designated as the purchaser.

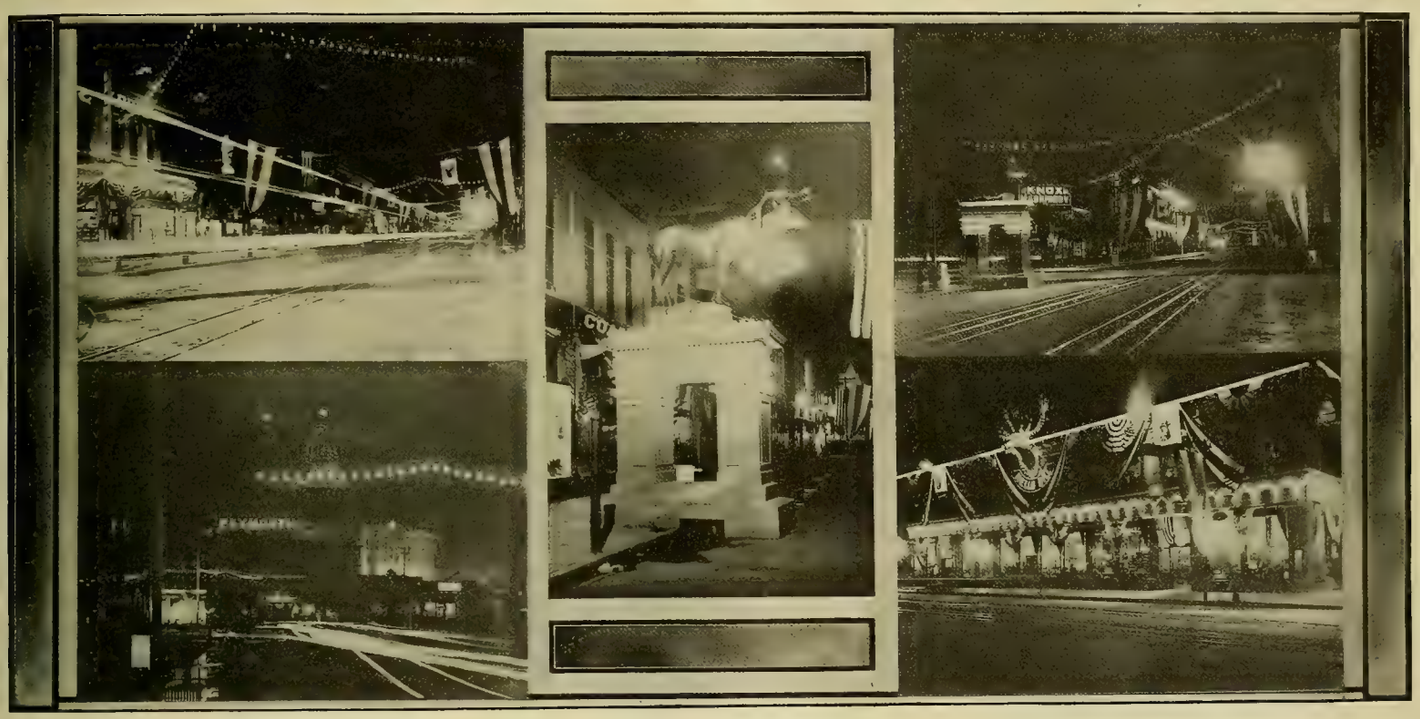
The railway and lighting plant was installed over two years ago, the public voting a bond issue of $18,000 to cover its establishment. This is practically all the money invested, so that a profit will be realized on the sale. The road, 1½ miles long and operating two cars, has been barely maintaining itself, it is said, even with careful supervision by the municipal authorities. The street-railway plant also furnishes light and power to the city. The road was first proposed to obviate the steep climb from the water front to the top of the hill where the town is located. President Furth of the Seattle Electric Company is quoted as saying that if the sale was consummated the line would be extended and improved, but the power plant would be abandoned.

Denver Illumination in Honor of the Elks.

The illumination of Denver during the Elks' convention held there during the week beginning July 16th, was, in the opinion of the visitors to the city, the most artistic and diversified ever seen at any Grand Lodge reunion in the history of the order. The host of visitors was unanimous in declaring that Denver is justly entitled to its widespread fame as the "City of Lights," and every person in attendance at the convention will be a strong "booster" for lights for decorative purposes, so great was the impression made by the elaborate display.

The Denver lodge of Elks spent a considerable sum on its own account to eclipse all other conventions in decorative lighting, and its efforts alone would long stand as a monument to its enterprise. But the merchants of the city loosened their purse strings as they never did before during a convention, and the result was a splendid and most effective illumination of all the large places of business. They vied with each other with considerable spirit to secure the most striking light displays, and their attainments are well illustrated in the pictures shown here.

The welcome arch at the Union Depot (illustrated in the Western Electrician of July 21st) was the first piece of lighting to greet the visitors, and the comments made upon its beauty evidenced the appreciation which it earned from everyone who stepped within the city's gates. Looking up Seventeenth Street there seemed to be a regular roof of multi-colored lights, with the Elk purple lamps as the dominating color. This effect was produced from the strings of lights stretched across the intersections of the streets. This same scheme was followed on Sixteenth and Fifteenth streets, and the whole made the downtown section almost as bright as day.



Looking Down Fifteenth Street. The State Capitol.

The Elk with the Broken Antler.

A View on Seventeenth Street. Office of Denver Gas and Electric Company.

ELECTRICAL ILLUMINATIONS IN DENVER IN HONOR OF THE ELKS.

Announcement is made that the delegates of the United States to the international space-telegraph conference, which will assemble in Berlin on September 3d, will be Ambassador Tower, Brigadier-general James Allen, Rear Admiral H. N. Manney and John I. Waterbury of New York. General Allen, Admiral Manney and Mr. Waterbury were nominated, respectively, by the Departments of War, the Navy, and Commerce.

Dr. Haanel's Report on His Electric Smelting Experiments.

Before the Faraday Society in London on July 2d a paper prepared by Dr. Eugene Haanel and communicated by F. W. Harbord, giving particulars of the electric smelting experiments at Sault Ste. Marie, Ont., was presented. It was entitled "Preliminary Report on the Experiments Made at Sault Ste. Marie, Under Government Auspices, on the Smelting of Canadian Iron Ores by the Electro-thermic Process."

The experiments described were made for the purpose of amplifying the results obtained at La Praz and Livet by the Canadian Commission in 1904, in view of the special conditions obtaining in Canada.

The furnace was of the Héroult type; it absorbed 5,000 amperes at 35 to 40 volts (power factor 0.919), being fed from a transformer of 225-kilowatt capacity. The official experiments, of which a selected number are explained in detail with full chemical, electrical and thermal data, lasted nearly nearly two months, and during that time 150 casts were made, yielding 55 tons of pig iron. The experiments indicated that under normal conditions about 11.5 tons was produced by an expenditure of 1,000 electric horsepower-days; with an improved furnace of, say, 1,500 electric horsepower capacity, a figure of 12 tons should, it is stated, be reached. The mean figure provisionally adopted by the commission was only 7.8 tons per 1,000 electric horsepower-days. The consumption of electrode was about 18 pounds per ton of pig iron; it was greater for white than for gray iron.

The results obtained are summarized as follows:

(1) Magnetite (which is the chief Canadian ore) can be as economically smelted by the electro-thermic process as hematite.

(2) Ores of high sulphur content not containing manganese can be made into pig iron containing only a few thousandths of one per cent. of sulphur.

(3) The silicon content can be varied as required for the class of pig to be produced.

(4) Charcoal, which can be cheaply produced from mill refuse or wood which could not otherwise be utilized, can be substituted for coke as a reducing agent without being briquetted with the ore.

(5) A ferro-nickel pig can be produced practically free from sulphur and of fine quality from roasted nickeliferous pyrrhotite.

(6) The experiment made with a titaniferous iron ore containing 17.82 per cent. of titanic acid permits the conclusion that titaniferous iron ores up to perhaps five per cent. titanic acid can be successfully treated by the electric process.

The paper concludes with an estimate of Dr. Héroult for a 10,000-horsepower plant capable of producing 120 tons of pig iron in 24 hours.

Cheap Current Supply in England.

The following, from an account of the recent tour of the visiting electrical engineers in Great Britain, given in the London Times Engineering Supplement, is of interest:

"In Newcastle, on Thursday [July 5th], the visitors were the guests of the local section of the Institution of Electrical Engineers. Messrs. C. A. Parsons' works were a great attraction, and practically all the shops were shown. They were about as full and as busy as they could be, and the output of turbines and electric generators must be enormous. It was possible to see the continuous-current machines in process of manufacture, and to observe the arrangement of the compensating field-magnet winding (on a modification of the Déri principle), which eliminates the sparking troubles. Four 7,500-horsepower (4,500-kilowatt) three-phase sets were in hand for the Caville station of the Newcastle-upon-Tyne Electric Supply Company. This generating station was inspected in the afternoon, and quite disabused the foreigners of any impression that might still be remaining that the economics of electric power supply were not realized in this country. Electrical energy is supplied from these works at an average price of less than 1d. [two cents] per Board of Trade unit [kilowatt-hour], and the large power consumers obtain energy at an extremely low rate. In fact, a contract has been entered into with the Castner-Kellner Alkali Company, which is erecting works adjacent to the power house, to supply them at about ¼d. per unit. These chemical works will require between 20 and 30 million units a year, and as their load will be some 3,500 kilowatts, this implies a 24-hour, or 100 per cent. load factor. The price of ¼d. per unit is of the same order as the lowest charges of the Niagara power distribution companies—that is to say, although the Newcastle company has to pay between 5s. [$1.20] and 6s. [$1.44] per ton of coal, while the Niagara companies have a practically unlimited supply of waterpower, the lower capital expenditure and the efficient methods of generation and distribution are sufficient to compensate for this. During the daytime the maximum load on the Carville station is between 9,000 kilowatts and 10,000 kilowatts, and the annual output approaches 50,000,000 Board of Trade units. The present plant capacity of the station is 11,500 kilowatts."

Aerial Electric Transportation System.

Aerial systems of electric transportation are not new, of course, but the one recently invented and patented by George C. Schroeder of Washington, D. C., has some features of interest. The object of the invention is to provide such a system having a car or carrier which is adapted to travel upon a suspended cable or track. This car or carrier is fitted with an electic motor which furnishes the motive power. Suspended, preferably, above and extending parallel with each other are four current wires, two of them adapted to act for transmitting the current to the motor and two of them adapted to act as return wires. The motor is provided with four trolley arms, each of which is adapted to come in contact with one of the current wires, while each of the trolley arms is electrically connected with the motor.

The prime object of the system is so to arrange the apparatus that the car may be sent back and forth upon the cable, stopped at any desired point, and made to travel at any desired rate of speed. The movement of the car in either direction is controlled by the manipulation of switches and a pole changer located at either terminal station or a way station. Each car or motor is provided with a means to prevent rocking in the line of travel and also to guide the car around curves. This apparatus also prevents any tendency of the motor to climb or jump the track. The trolley arms are also arranged so as to prevent lateral rocking of the car. The trolley arms are preferably mounted upon a base which is pivoted to the top of the frame of the motor, so that the trolley arms may follow the wires while the motor is rounding a curve in the track.

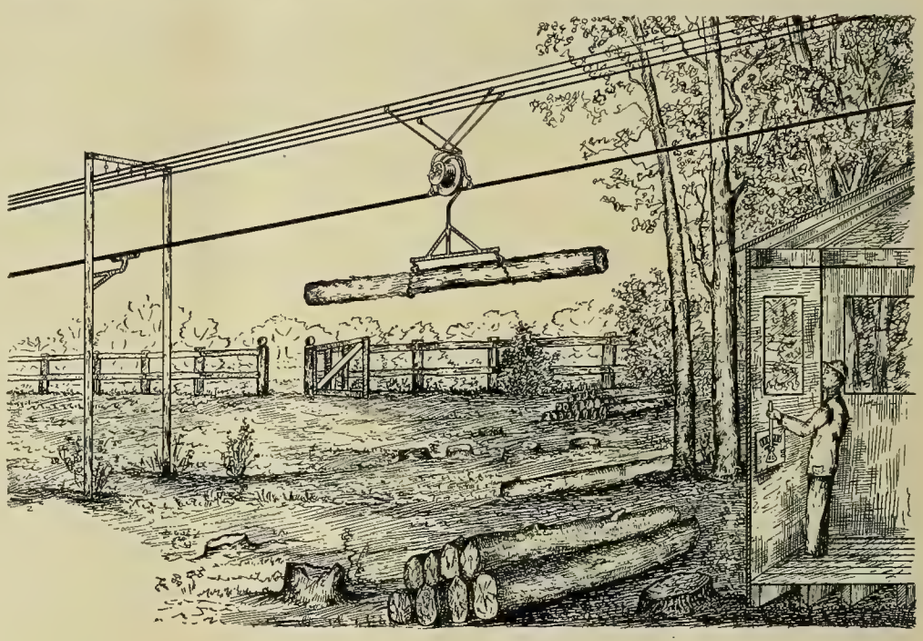


FIG. 1. AERIAL ELECTRIC TRANSPORTATION SYSTEM.

The system is especially adapted for use in logging camps and at mills for bringing in logs from a distance and dropping them at any desired point; also for removing sawed lumber and slabs and other waste from the mill. It may also be used for transporting merchandise and for moving earth from excavations.

In the accompanying drawings, Fig. 1 is a perspective view of the carrier mounted upon the suspended track. Fig. 2 is a diagram, showing the current wires and the mechanism for controlling the system, and Fig. 3 is a transverse sectional view of the electric motor used in the carrier.

The system consists of the suspended cable or track, above which is located the wires (22) and (33), (Fig. 2.) The electric generator (4) is located at any suitable point. The wire (5) connects one pole thereof with the switch socket (6). The switch (10) is adapted to enter the sockets (6) and (8), and the wire (11) connects one of the ends of the switch with the socket (12), and the wire (13) connects the other end of the switch (10) with the socket (14). The wire (15) connects the wire (11) with one of the line wires (2). The wire (16) connects the wire (13) with the other line wire (2). The line wires (22) are connected through the trolley arms of the carrier with the field (17) of the motor (18). The cross-wire (19) connects the socket (12) with the socket (20), and the cross-wire (21) connects the socket (14) with the socket (22). The pole changer (23) (shown in Fig. 1 in the form of a switch) is adapted to be swung into either the sockets (12) and (14) or (20) and (22). One end of the switch constituting the pole changer (23) is connected, by means of the wire (24), with one of the line wires (3), and the opposite end of the switch (23) is connected, by means of the wire (25), with the other line wire (3). The rheostat (26) is located, preferably, upon the wire (25). Both of the line wires (33) are electrically connected, by means of the trolley arms of the carrier, with the armature (27) of the motor (18). The armature (27) is held in a fixed position against rotation, while the field (17) rotates about the armature.

Presuming that the parts are in the positions as indicated in Fig. 2, the current starts from the generator (4), passes along the wire (5) to the socket (6), then through the switch (10) along the wire (11), then along wire (15) to the inner line wire (2), thence through the armature (17) along the outer line wire (2), thence along wire (16) to the wire (13), then through switch (10) along wire (7) back to the opposite pole of the generator (4). At the same time the current passes from wire (13) through socket (12) and along wire (19), to socket (20), thence along one end of the switch (23) to wire (25), thence along the wire (25), through rheostat (26), to the inner line wire (3), thence to the armature (27), thence along the outer line wire (3), thence along wire (24), to the other end of the switch, thence to socket (22), thence along the cross-wire (21) to socket (14), thence back to the generator over the wire (13) and its connections.

By supplying the current to the armature and the field as above described the armature is rotated in one direction. To change the direction of rotation of the armature, the switch (23) is disengaged from the sockets (20) and (22) and turned into the sockets (12) and (14). The current then passes from the generator (4) to the field (17), as above described, while the course of the current through the armature (27) is reversed—that is, the current passes from the socket (12) along one end of the switch (23), then along wire (24) to the outer line wire (3), thence through the armature (27), thence back along the inner line wire (3), thence along wire (25), through the rheostat (26), to the opposite end of the switch (23), thence along the switch to the socket (14), thence along the wire (13) and its connections back to the generator (4). Thus the rotation of the field (17) about the armature (27) is reversed. To cut off the current at any desired point, the switch (10) is disconnected from the sockets (6) and (8), and thus the motor is stopped. The switches (10) and (23) may be included in one instrument, as may also the rheostat (26), such an instrument being commonly known as a "starting box." In any event the switches (10) and (23) and the rheostat (26) should be located near each other, so as to be operated by one person.

The motor (Fig. 3), consists of an outer shell or casing, within which the armature and the field

are housed: Around the periphery of the casing extends a grooved annulus (28), which is adapted to run upon the cable. The disk (29) is so located as to rotate with the casing of the motor. The outer face of the disk is provided with metal rings (30), (31), (32) and (33). The outer ring (30) is connected, by means of a wire (34), with one of the brushes (35) of the armature, and the ring (31) is connected, by means of the wire (36), with the other brush of the armature. The ring (32) is connected, by means of the wire (37),

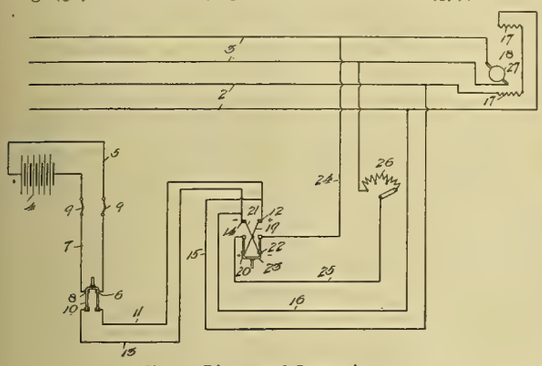


Fig. 2. Diagram of Connections.

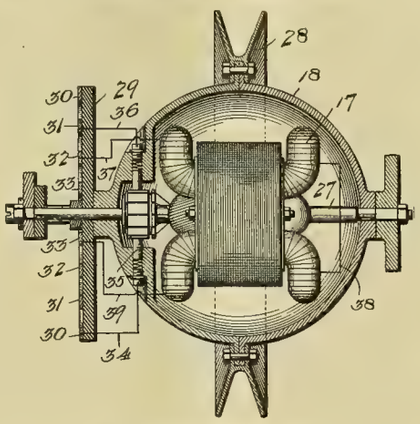


Fig. 3. Sectional View of Motor.

AERIAL ELECTRIC TRANSPORTATION SYSTEM.

with one of the fields (17) of the motor, the wire (38) connecting the fields together, and the wire (39) connecting one of the fields with the ring (33). Thus the electrical connections through the motor are completed.

The Joint Occupancy of Pole Lines.

[From the Question Box of the National Electric Light Association.]

QUESTION.

Do you permit joint occupancy between telephone, telegraph and fire-alarm wires with electric-light feeders? Is such joint occupancy required by the city or town authorities?

ANSWERS.

A. T. Lloyd, Shreveport Gas and Electric Company, Shreveport, La.: We permit joint occupancy of our pole lines and believe in it. If two telephone companies, a traction company, a telegraph company and an electric-light company must have separate pole lines, it mars the beauty of all the streets, increases the danger from crosses between wires and hastens the time when everything of the kind must be put underground.

E. H. Mather, Portland Lighting and Power Company, Portland, Maine: There is less danger of accidents to persons and property from joint occupancy of poles by telephone, telegraph and electric-light companies, provided the electric-light wires are placed on the upper cross-arms, than under any other form of construction. Under this plan the leaning of poles one way or the other does not cause cross contacts, and telephone and telegraph linemen have no occasion to go up poles far enough to come into contact with electric-light wires. The telephone and telegraph wires can do but little, if any, damage in case they break and fall to the streets.

William B. Jackson, Madison, Wis.: In three towns in which the writer has had operating experience the joint occupancy by the telephone, telegraph and fire-alarm wires with the electric-light feeders was approved and the writer believes that such joint occupancy is far more desirable than the use of two or more pole lines upon the same side of the street, as is seen in many towns. In none of these towns referred to was the joint occupancy required by the city authorities, though the electric company frequently made efforts to have such a requirement.

The Colorado Springs Electric Company, Colorado Springs, Colo.: We are required to furnish space on our poles for fire and police-patrol wires. Aside from this the telephone company uses our poles, and vice versa, in many instances by mutual agreement.

W. K. Sparrow, Brooklyn Edison Company, Brooklyn, N. Y.: Joint occupancy is required in many cases by the city in order to reduce the number of poles on streets. We construct these combination poles under the following specifications:

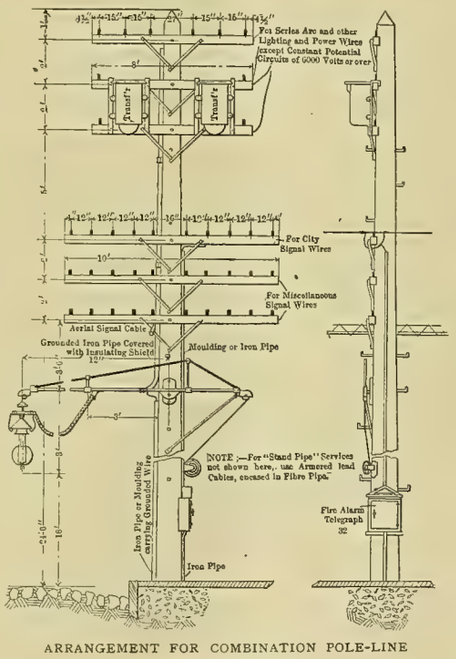
1. Poles to be chestnut, peeled, roofed and painted, 45 feet in length and set 6½ feet in ground.

2. They shall carry in the three upper gains, which shall be, respectively, one foot, three feet and five feet below the peak of the pole, cross-arms to accommodate electric-light and power wires and, when necessary, transformers (same to be placed on insulated attachments).

3. In the remaining gains, of which there shall be three, placed, respectively, 10 feet, 12 feet and 14 feet below the peak of the pole, shall be placed the standard 10-pin cross-arms of the New York and New Jersey Telephone Company, the pole pins of which shall be removed, leaving sufficient clearance for a lineman to pass through without interference. The upper arm to be used by the police and fire departments, and the remaining arms for other signal purposes.

4. In the event of necessity for electric-light and power wires to pass down the pole for any purpose whatever, the wires shall themselves be properly insulated and contained in a properly grounded iron pipe, or other grounded metallic shield to be securely attached to pole. The ground wire extending from the enclosing pipe to the ground to be properly encased in a wooden molding or iron pipe from the point where it leaves the pipe enclosing the electric-light and power circuits to a point six inches below the surface of the ground.

5. In the event of necessity for adding an aerial cable to the line, the cable shall be hung from a messenger wire (supported on one side of the pole); and the messenger wire and cable sheath



ARRANGEMENT FOR COMBINATION POLE-LINE CONSTRUCTION.

shall be suitably grounded at points about 1,000 feet apart.

The diagram herewith shows requirements.

F. Tobey, Jr., Kingston Gas and Electric Company, Kingston, N. Y.: We do. The city authorities require it in the case of fire-alarm wires. We also think that by trying to confine the number of poles on the streets to the minimum we best serve our own interests.

F. M. Vander Voort, Alliance Gas and Electric Company, Alliance, Ohio: The New York and New Jersey Telephone Company requires power or lighting wires to be five feet below their lowest cross-arm, the use of 10,000-volt insulators and transpositions. I doubt the efficiency of the transpositions.

QUESTION.

In case of joint occupancy of pole lines, what requirements do you make as to the responsibility for accidents, standards of construction, etc., that are imposed on the telephone and telegraph companies?

ANSWERS.

E. H. Mather, Portland, Maine: In case of joint occupancy of poles by telephone, telegraph and electric-light companies, each corporation should be liable for accidents caused by its own lines. Standards of construction should be agreed upon, so as to make pole lines uniform in appearance and repairs simple.

F. S. Francis, Bell Telephone Company, Philadelphia, Pa.: In cases of joint occupancy on poles with electric-light companies, our general practice is to hold each company responsible for the condition of its own construction and for accidents that may be caused by the presence of that construction. In the majority of cases, the ownership and maintenance of the pole itself and the consequent responsibility are vested definitely in one or the other of the companies. In the few cases where a pole is owned jointly, a special agreement covering the maintenance and responsibility is entered into with the electric-light company.

W. E. H., Newton and Watertown Gas Light Company, Newton, Mass.: In case of joint occupancy of pole line each company is responsible for accidents due to defects in their wires or works. It has been easy for us to agree on standards of construction before building a joint line, but where a line belonging to one party is already built and the other party wishes to come in and make it a joint line, the party coming in last must rebuild the line, so that it may be strong enough to accommodate both parties to the agreement.

QUESTIONS.

Do you operate telephone circuits over the same pole line that carries high-tension transmission? Is the telephone service satisfactory? What precautions are employed at the instruments?

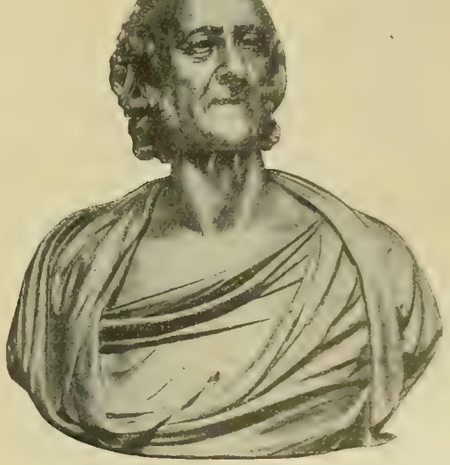
ANSWERS.

Thomas Gray, Honk Falls Power Company, Ellenville, N. Y.: We have 26-mile, 33,000-volt transmission line of three No. 5 hard-drawn copper in triangle 36 inches apart. On the poles, 30 inches below the 33,000-volt wires, we have a private telephone line, No. 10 galvanized iron, spaced 20 inches, transposed every third pole. We use Connecticut Electric Manufacturing Company's telephones, and have excellent service. We bring telephone line into building and to booth on regular high-tension Thomas insulators. The booths are set on high-tension insulators, and are kept away from walls. We also have a small platform, insulated same as booth, which we use as an "isle of safety" to stand on before entering the booth. Some time ago the telephone line came into contact with the 33,000-volt wires. Our man stepped into the booth at generating end to find out what the matter was, and got what he calls a "breeze" from the magneto handle as from a plate machine, but suffered no harm or discomfort whatever, although the telephone was "scrapped."

We keep two telephones in the booth and switch over if burnt out.

Bronze Bust of Volta Presented to British Electrical Engineers.

In a report of the progress of the visiting electrical engineers in England printed in the Western Electrician of July 14th mention was made of the bronze bust of Alessandro Volta, presented to the Institution of Electrical Engineers at the banquet at Hotel Cecil, London, on June 25th. Herewith is an illustration of the sculpture, reproduced from the London Electrician. The bust was brought over from Italy, and was presented to the Institution by Mr. Guido Semenza in the name of the



BRONZE BUST OF VOLTA PRESENTED TO BRITISH ELECTRICAL ENGINEERS BY ITALIAN SOCIETY.

Associazione Elettrotecnica Italiana. The gift was intended as a reminder of the friendship which has long existed between Italy and England, and which on many occasions has found expression in electrical circles. Mr. John Gavey, president of the Institution, thanked the Italians for the gift, and he spoke of the recent visit to Italy, when members of the Institution made a pilgrimage to the tomb of Volta. Mr. Gavey's remarks were supplemented by Prof. S. P. Thompson, who made an eloquent address.

WESTERN ELECTRICIAN

EVERY SATURDAY.

PUBLICATION OFFICES:

507 Marquette Building, - CHICAGO.

TELEPHONE, MAIN 1746.

Eastern Office, 150 Nassau Street, New York.

Telephone, 5220 Beekman.

Trade Supplied by Western News Co.

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SUBSCRIPTION, in advance, postage prepaid, $3.00 for a full year of 52 numbers; in clubs of four or more, $2.50, with free extra copy for eight subscriptions; foreign countries, $5.00 a year; single copies, 10 cents. When change of address is requested, the **old address** as well as the new should be given.

CORRESPONDENCE relating to electricity or any of its practical applications is cordially invited, and the co-operation of all electrical thinkers and workers earnestly desired. Clear, concise, well written articles are especially welcome; and communications, views, news items, local newspaper clippings, or any information likely to interest electricians, will be thankfully received and cheerfully acknowledged.

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REMITTANCES.—All checks, drafts and other remittances should be made payable to the order of the publishers, the **Electrician Publishing Company,** and addressed to the offices of publication, Suite 507, Marquette Building (204 Dearborn Street), Chicago, Illinois. U. S. A.

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DATES AHEAD.

International Association of Municipal Electricians (annual convention), New Haven, Conn., August 15th to 17th.

Ohio Electric Light Association (annual convention), Put-in-Bay, Ohio, August 21st to 23d.

Colorado Electric Light, Power and Railway Association (annual convention), Denver, September 18th to 20th.

Illinois State Electric Association (annual convention), Springfield, Ill., September 19th and 20th.

Central Electric Railway Association (outing), Robinson Park, near Fort Wayne, Ind., September 26th.

Old Time Telegraphers and Historical Association, and United States Military Telegraphers (annual meeting), Arlington Hotel, Washington, D. C., October 9th, 10th and 11th.

American Street and Interurban Railway Association (annual convention), Columbus, O., October 15th to 19th.

SINCE the transmission of 60,000-volt current from Niagara Falls to Syracuse, N. Y.—a distance of about 160 miles—was begun, there have been reports of trouble on the Western Union telegraph lines, manifested principally at Buffalo, and causing some interruption to business. It was conjectured that the disturbances might be due to induction from the high-tension line, and a Buffalo reporter sought out Mr. W. A. Sawyer, the Western Union manager in Buffalo, and asked him what he thought of it. "Yes," said Mr. Sawyer, according to the newspaper account of the interview, "we had some slight interruptions, but nothing has occurred seriously to hamper the usual prompt transmission of all our business. We are now investigating the matter, but nothing has developed so far to warrant a positive statement as to the origin of the trouble. We are in correspondence with the power people, and they as well as we are taking a great deal of interest in the case. As I have said, there have been no developments up to this time which point positively to the power transmission line or any other source as the cause of the slight interruptions we have had." The point brought up is a very interesting one, and it will be instructive to observe if the high-potential circuits are found to have caused the trouble, and if so, what measures are taken to remedy the difficulty.

DON'T TAKE CHANCES with electric currents of high or medium potentials. Don't get overconfident. Don't be careless. Don't "get gay." Don't try to "show off" before non-technical visitors. Better be on the safe side always. Better be even a little fussy about it and alive than make a slip, carelessly or daringly, and get killed or badly burned.

Examples which show the need of such admonitions arise only too often. Here, probably, is one, told by the Niagara Falls correspondent of the Western Electrician:

"Samuel Weil, superintendent of the Electrical Lead Reduction Company, was killed in that company's plant, on the lands of the Niagara Falls Power Company, shortly before nine o'clock on the morning of Saturday, July 28th. No person was in the room with Mr. Weil when the accident occurred. It is understood that there had been trouble with the current during the night and that when Mr. Weil arrived he was examining the switchboard when he received the shock from the 2,200-volt circuit. He was found within a few minutes of the accident, and although doctors worked over him, they were unable to bring him back to life. Mr. Weil was not an electrical engineer, but he had been with the Electrical Lead Reduction Company so long that he was advanced to the important position of superintendent, and was considered to know all about the apparatus there in use. He was 32 years old, married, and is survived by his mother, wife, one son, two sisters and six brothers. The funeral services were held on Monday afternoon and the burial was in Riverdale Cemetery, Niagara Falls, the interment being under Masonic auspices."

Of course the death of this unfortunate man may have been due to some cause which he could not have foreseen or which was beyond his control, but it is much more probable that he did not take sufficient precaution or was momentarily careless. When men accustomed to high-tension electrical apparatus, as this man was, lose their lives, it behooves all engaged in electrical work to remember that in this business particularly eternal vigilance is the price of safety.

BEARING on recent railway accidents in Great Britain, both on steam and electric lines, it is interesting to quote a paragraph from a late letter from our London correspondent. "The public mind," he writes, "is much exercised at present at the apparent want of security in any of our means of transit. Tramway, motor 'bus and railway have each, within a few weeks, experienced accidents, the results of which can only be shuddered at, and in no case can it be said that any satisfactory explanation has been forthcoming. A searching inquiry was held into the recent electric tramway accident in London, and a good deal of contradictory evidence was given as to the condition of the brakes. It is in this direction that engineers must yet concentrate all their attention, if only in an endeavor to devise something that will do much to neutralize a danger that must always be present, namely, the failure of the human element. In the end the jury in the tramway case returned a verdict that the driver was not sufficiently trained. But this will hardly soothe the public, for similar accidents appear to have been happening all over the country during the past month."

There are those who declare that railroad accidents occur in groups, and that, after a period of comparative immunity, if such a casualty is reported, others may be expected soon. England has had recent experience with a group of such accidents, and those persons who assert that there are cycles of periodicity in these happenings will note the fact. Three is usually mentioned as the mystic number of accidents occurring in a group, so that, if this fanciful theory is correct, John Bull may expect a period of tranquility in this direction until the next cluster of trouble is encountered by the lapse of time. But engineers will have little respect for this superstitious fatalism, and will continue to endeavor to devise and place apparatus that will make safety in travel at all times increasingly secure. If proprietors and managers will co-operate with them in spending money for the best obtainable men and apparatus, and will arrange their methods of operation with the idea of securing safety first and dividends next, then we may expect that in all countries railroad accidents will become rarer and less serious, although it is probably too much to hope that they will entirely disappear so long as railroads are operated by fallible human beings.

AMONG its accomplishments the Co-operative Electrical Development Association has a right to take pride in its prize competition, conducted under the auspices of the National Electric Light Association, for papers on the organization and conduct of new-business departments of central stations in cities of 50,000 population and less. As to larger cities, the idea is, no doubt, that the central-station companies doing business there, with their greater resources and more complete organizations, are less in need of new-business suggestions.

Three prizes were offered by the Co-operative Association—a first prize of $500, with second and third of $300 and $200, respectively. These prizes were worth striving for, and showed that the association attached real importance to the subject and was willing to back up its views with the liberal appropriation of $1,000. In presenting the winner of the first prize—Mr. M. S. Seelman, Jr., of the Brooklyn Edison Company—a draft for $500 at the Atlantic City convention of the National Electric Light Association last June, Mr. J. Robert Crouse of the Co-operative Association took occasion to remark that his association was well satisfied with the result of the competition and was confident that it could not have spent $1,000 so advantageously in any other way.

Twenty-two papers were received, and in addition to the three prize-winners four other essayists received honorable mention. The names of all these gentlemen have already appeared in the Western Electrician, and a month ago we published an abstract of Mr. Seelman's very excellent paper. In this issue we give Mr. Kennedy's paper, slightly abridged. This took the second prize, and is scarcely less meritorious than the first prize-winner.

We can cordially recommend to all readers of the Western Electrician in the commercial side of the industry—and to all readers, for that matter—an attentive perusal of this good paper. The field is well covered; the ideas are judicious and show good judgment; the style of writing is capital. Mr. Kennedy must be a good new-business promoter if he can talk to customers as well as he can write to his fellow electrical men. He deserves the prize he won, and the Co-operative Electrical Development Association deserves the gratitude of the electrical community for offering the incentive which drew out this instructive essay. But central-station men should not only read it; they should "mark and inwardly digest."

Steinmetz's Alternating-current Railway Motor.

The object of an invention recently patented by Charles P. Steinmetz is to provide a motor having an altered speed torque characteristic, the better to adapt it for certain kinds of work—such, for instance, as railway work or other applications requiring a large starting torque.

When a direct-current series motor is supplied from a constant-potential source and when the load on the motor is increased, so as to require greater torque, the speed falls sufficiently to reduce the counter-electromotive force of the motor by the necessary amount to permit a flow of current for giving the required torque. As the load is still further increased, the speed is still further reduced, until at zero speed the flow of current is limited only by the ohmic resistances of the motor circuit and the torque is enormous. With an alternating-current motor, on the other hand, the counter-electromotive force due to rotation and the ohmic resistance are not the only impedances opposed to the flow of current. The counter-electromotive force of self-induction of the motor circuits is an important factor. The self-induction of the armature increases as the speed of the motor decreases and tends to counterbalance the decrease in counter-electromotive force of rotation due to the decrease in speed. Therefore, when the load increases by a certain amount the speed of the motor decreases a greater amount than it would decrease in a similar direct-current motor in order to obtain the requisite current flow for supplying the required torque, since the current increases with decrease of speed at a slower rate than in a direct-current motor. For certain classes of work the alternating-current motor is therefore less suitable, since its speed with increase of load does not hold up as well as in a direct-current motor.

In any motor, whether alternating or direct current, having what may be termed "series" characteristics—such, for instance, as the series motor, whether direct or alternating, and the repulsion motor for alternating-current—the field strength increases with increase of current. The increase of field strength tends to balance the drop in counter-electromotive force due to decrease of speed with increasing load. Evidently if this increase of field strength with increased current flow could be reduced, the speed-torque characteristic of a motor would be altered, so that for a given decrease in speed a greater decrease in counter-electromotive force would result with greater increase in current flow and a consequently greater increase in torque—that is, by reducing the increase in field strength with decreasing speed in an alternating-current motor the speed-torque characteristic may be altered so as to conform more closely to that of a modern direct-current railway motor. This result may be accomplished by so proportioning a portion of the magnetic circuit that saturation is reached with a certain predetermined current flow, so that a decrease in speed to produce a current flow in excess of the predetermined value will produce no corresponding increase of field strength, so that a small decrease of speed will produce a large increase of torque, as has been heretofore explained.

One feature of the invention consists in securing the desired saturation of a portion of the magnetic circuit of a motor of the type in which the field is approximately uniformly distributed around the armature by removing a portion of the iron of the field or stator adjacent to the armature coils short-circuited by the rotor brushes. By this means not only is the desired saturation obtained, but the magnetic field at the coils undergoing commutation is weakened and the commutation consequently improved.

The smaller increase of torque for a given decrease of speed in an alternating-current motor as compared with a direct-current motor of a similar type, which for low speeds is disadvantageous, is also frequently disadvantageous at high speeds, since the smaller decrease of torque with increase of speed may result in a serious overloading of the motor at high speeds. In order to prevent this overloading, means may be provided for accomplishing the reverse of the object of the arrangement for altering the torque characteristics at low speed—that is, for increasing the field strength as the motor speed increases. The field strength of the motor could, of course, be increased by increasing the potential impressed on the motor; but this would also increase the flow of armature current and would simply overload the motor more than before. By the invention an auxiliary winding is employed, arranged to increase the field strength of the motor at high speeds without increasing the flow of armature current. By connecting this winding in series with the main field coils of the motor for high speeds, a greater increase of counter-electromotive force with a given increase of speed is obtained, with consequently a greater decrease in current and torque. In order to prevent the auxiliary coil from affecting the current in the armature, it is essential that it should be arranged non-inductively with reference to the armature winding, and since a winding placed with its opposite sides adjacent to the armature brushes is in a non-inductive position relative to the armature, it is possible to utilize the recesses formed by removing a portion of the stator iron adjacent to the brushes, as has been heretofore described, for receiving the auxiliary coil.

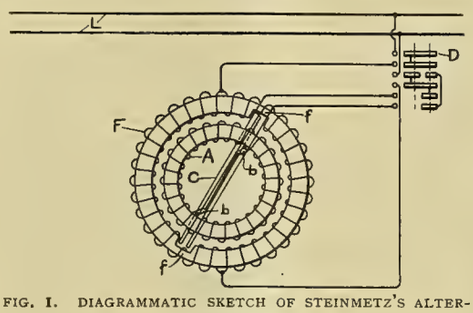


FIG. 1. DIAGRAMMATIC SKETCH OF STEINMETZ'S ALTERNATING-CURRENT RAILWAY MOTOR.

Fig. 1 shows diagrammatically a motor arranged in accordance with the invention and provided with a controlling switch for connecting the auxiliary coil in circuit. Fig. 2 is an explanatory diagram showing the variation in speed-torque characteristic produced by means of the invention.

In Fig. 1, (F) represents the field winding, and (A) the armature winding, of an alternating-current motor. The armature winding is provided in the usual manner with the commutator brushes (b b), It will be seen that the iron of the field magnet is cut away at (f f), so as to form two recesses adjacent to the commutator brushes. These recesses not only serve to give a weak field for the coil undergoing commutation, but also serve to produce a saturation of the field-magnet structure at these points when the current in the field winding rises to a certain amount.

Referring now to Fig. 2, (1 1′) represent approximately the speed-torque curve of an ordinary repulsion motor. If the magnetic circuit of the motor becomes saturated by the current which flows in the motor winding when the speed falls to an amount indicated by the point (3) on the curve (1 1), upon further decrease in speed the fall in the counter-electromotive force of rotation will no longer be partially balanced by an increase in field strength, so that a small decrease in speed will result in a comparatively large decrease in counter-electromotive force, a comparatively large increase in current and a comparatively large increase in torque.

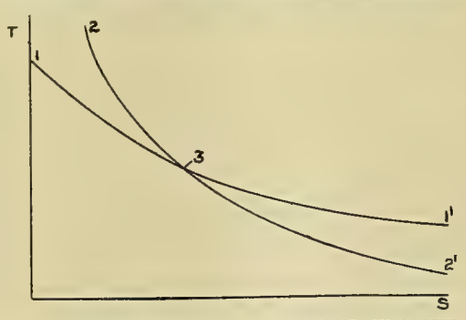


FIG. 2. CURVES SHOWING VARIATIONS OF CHARACTERISTICS OF STEINMETZ S MOTOR.

In other words, the speed-torque curve will be steeper than would have been without saturation—that is, the torques for the different speeds below point (3) will be indicated by the curve (3 2). Thus the torques for the low speeds are increased by the saturation of a portion of the magnetic circuit.

(C) represents an auxiliary coil or winding which is placed in the recesses in the field magnet adjacent to the commutator brushes. It will be seen that this coil is in non-inductive relation to the armature winding—that is, it can induce in it no current by transformer action; but it is most effectively disposed for producing a flux which generates an electromotive force in armature winding, due to its rotation. For a given current strength in coil (C) this induced electromotive force will increase with increase of the motor speed, and if the coil is properly connected the electromotive force induced thereby will assist the counter-electromotive force induced by the main field winding (F), so as to produce a greater increase in counter-electromotive force, and consequently a greater decrease in current flow and in torque for a given increase of speed. In other words, the speed-torque curve will be made steeper at high speeds by the introduction of the auxiliary coil (C), as indicated by the curve (3 2′). Consequently, by means of the saturation of the field coil at low speeds and the introduction of the auxiliary coil at high speeds, the speed-torque characteristic of the motor may be altered from the curve (1 1′) to the curve (2 2′).

In Fig. 1 is shown a controlling switch (D), adapted to cut the auxiliary coil into and out of the circuit of the field winding. In the first position of switch the field winding alone is connected to the line wires (L), as will be seen by tracing out the circuit. In the second position of the switch the auxiliary coil is included in series with the field winding, so as to increase the field strength of the motor.

At low speeds, by reversing the current in the coil (C) so as to make it demagnetizing, the magnetic field can be reduced and the speed so increased, giving a similar effect as produced above by saturation.

International Electrotechnical Commission.

Reference was made by the London correspondent of the Western Electrician in the letter published last week to the organization in London of the international commission to standardize the nomenclature and ratings of electrical apparatus and machinery. This commission, it was explained, was the outcome of action taken at the St. Louis International Electrical Congress, and at the meeting held in London during the recent visit of American and Continental electrical engineers Lord Kelvin was chosen president and Col. R. E. Crompton honorary secretary of the commission.

It may be added that in November last the Institution of Electrical Engineers of Great Britain appointed an executive committee, under the chairmanship of Mr. Alexander Siemens, to draw up a set of proposed rules and to prepare the necessary steps for the preliminary meeting in London. In addition to Mr. Alexander Siemens, Sir William H. Preece, Col. R. E. Crompton, Mr. John Gavey, Dr. R. T. Glazebrook, Mr. R. K. Gray, Mr. Charles P. Sparks and Mr. C. H. Wordingham were members of the committee. After several sittings a set of draft rules was prepared and circulated to the countries which had signified their intention to send delegates. This preliminary meeting was held at the Hotel Cecil on June 26th, with Mr. Siemens in the chair.

The draft rules by which the organization and work of the commission is to be regulated were very carefully considered. Several important amendments were introduced, and at the adjourned meeting on June 27th the meeting finally adopted the rules, subject, of course, to ratification by the authorities by whom the delegates were appointed. Until this ratification has been obtained the rules cannot be published.

It is intended that the work of the commission shall proceed by correspondence and that the efforts of the members will be addressed in the first instance to the standardization of nomenclature so that the electrotechnical terms used shall be common to all countries, and it is hoped then that a similar standardization of physical formulas which must be equally common to all countries may be reached.

The following is a list of delegates other than those from the United Kingdom: America (Institute of Electrical Engineers), Dr. F. B. Crocker, Dr. A. E. Kennelly and Mr. C. O. Mailloux; Austria (Elektrotechnischer Verein in Vienna), Prof. Carl Pichelmeyer and Dr. E. Rosenberg; Belgium (Société Belge d'Electriciens), Mr. Leon Gerard; Canada (local standards committee), Dr. R. B. Owens and Mr. L. A. Herdt; France (Société Internationale des Electriciens), Prof. Paul Janet, Mr. Paul Boucherot and Mr. C. David; Germany (Verband Deutscher Elektrotechniker), Dr. E. Budde and Mr. G. Dettmar; Holland (Koninklijk Institut van Ingenieurs), Prof. E. Feldmann and Mr. W. Smit; Hungary (minister of commerce), Mr. Joseph Vater and Mr. D. Harsanyi; Italy (Elettrotecnica Italiana), Prof. L. Lombardi and Mr. Guido Semensa; Spain (Spanish government), Prof. Juan Alonzo y Millan and Prof. Blas Cabrera Felipe; Japan (Denkigakukwai) (Electrical Society of Japan), Dr. Ichisake Fujioka; Switzerland (Association Suisse des Electriciens), Prof. J. L. Farny and Mr. K. P. Tauber. Norway, Sweden, Denmark, Argentine and Mexico have not yet appointed their representatives.

THE SMALL CENTRAL STATION.

Practical Hints on Its Construction and Operation.

CHAPTER V. (*Continued*).

OPERATION OF BOILERS.

Operation of the Boiler Plant.—As is shown by statistics, very close to 30 per cent. of the total maintenance cost of electric-lighting stations is in fuel. So it behooves the operator of such a plant to see that his fuel is handled with intelligence and economy. A good fireman is decidedly a skilled workman, and the conditions under which he must work should be as conducive to his health and comfort as possible. His sympathy and help should be enlisted in all matters relating to the operation of the boilers, and every facility given him that he may know how one day's work compares with that of the next.

The following table shows the

COST OF LABOR PER HOUR TO GENERATE 100 HORSEPOWER OF STEAM UNDER ORDINARY CONDITIONS.

	Eight-Hour Run.				Twelve-Hour Run.			
Size of Boilers in Horsepower.....	75	100	200	300	75	100	200	300
Number of Boilers, 1	$0.33	$0.25	$0.13	$0.08	$0.22	$0.17	$0.08	$0.06
Number of Boilers, 2	.17	.13	.12	.07	.11	.09	.08	.05
Number of Boilers, 3	.11	.16	.08	.06	.08	.10	.05	.04
Number of Boilers, 4	.16	.12	.06	.06	.11	.08	.04	.04
Number of Boilers, 5	.13	.10	.05	.05	.08	.07	.04	.04

A valuable aid will be found in the use of a flue thermometer or other instrument for determining the temperature of the escaping gases. Several readings taken each day and recorded on the log with the daily coal consumption will show quickly enough the presence of soot or scale on either side of the heating surface in the increased temperature of the escaping gases. Standard practice has shown that a flue temperature of 450 to 500 degrees is permissible with the best grades of coal and for good economy, but this temperature, of course, is dependent upon the fuel used. Ordinarily, however, an increase of 100 degrees above the economical temperature represents a loss of at least five per cent. of the heat furnished by the coal. The worth of such readings is entirely dependent upon the regularity with which they are taken, but they permit of a much more intelligent operation of the plant, and the saving will pay for the expense and trouble in a short time.

Mechanical stokers have been employed with greater or less efficiency, but this depends so much upon the grade and kind of coal used and upon the design of the stoker itself that no general recommendation can be made. It is a subject well worth investigating, however, and to be given consideration in connection with the conditions of draft space, capacity of plant and nature of the coal to be used.

Other patented forms of furnaces, notably the down-draft, have been used with satisfactory results, especially in the burning of low-grade coals. Their success depends, however, upon the ability of the fireman, the draft provided and the amount of work required of them compared with the capacity of the boiler. They do not add to this capacity, although, properly built, their use shows an economy in fuel in a more complete combustion, which is itself a preventive of smoke.

Using the stack gases to heat the feed water has been previously mentioned. These gases have been used similarly to warm the air supplied to the furnace and have shown a resultant economy. This economy is not large, however, and so far has passed as an interesting experiment only and has not been adopted as the best practice.

Very close to 3.6 gallons of feed water are used in the development of one boiler-horsepower per hour. Figured on a basis of 100 horsepower, the requirement would be six gallons per minute. But the demand is not uniform, and service might be demanded which is 50 to 75 per cent. in excess of this. A safe provision is so to size the feed-water pipes that they will deliver 10 gallons per minute for every 100 horsepower of boiler capacity without too great speed of flow and consequent loss by friction.

All pipes conducting live steam should be lagged with some good covering—and that covering kept in repair—for the reduction of the loss of heat due to radiation. Exhaustive tests have been made with various coverings and under conditions the duplicate of those met daily in actual practice. The results of these tests show a net saving in the use of wool and felt coverings of from $1.05 to $1.15 per square foot of pipe surface each year. This is figured on a basis of coal that will evaporate seven pounds of water per pound of coal and will cost about $2.75 a ton on the grates.

Tests.—A test of at least 10 or 12 hours' duration should be made upon the whole plant, boilers, engines, generators, etc., upon its completion, and at least as often as once a year thereafter. Such annual test, being conducted in a thorough and comprehensive manner with frequent readings of the instruments and with the plant running in its daily service, will result in bringing to light wastes

AVERAGE COST OF LABOR PER DAY TO GENERATE STEAM UNDER ORDINARY CONDITIONS, USING COAL.

Single Shift.

Size of Boiler in Horsepower...	75	100 to 150	200 to 250	300
Number of Boilers, 1.....	$2.00	$2.00	$2.00	$ 2.00
Number of Boilers, 2.....	2.00	2.00	3.75	3.17
Number of Boilers, 3.....	2.00	3.75	3.75	4.00
Number of Boilers, 4.....	3.75	3.75	4.00	6.00
Number of Boilers, 5.....	3.75	4.00	4.00	6.00

Double Shift.

Number of Boilers, 1.....	$4.00	$ 4.00	$4.00	$ 4.00
Number of Boilers, 2.....	4.00	4.00	5.75	6.00
Number of Boilers, 3.....	4.00	5.75	6.00	6.00
Number of Boilers, 4.....	5.75	6.00	7.50	7.75
Number of Boilers, 5.....	5.75	6.00	7.75	10.00

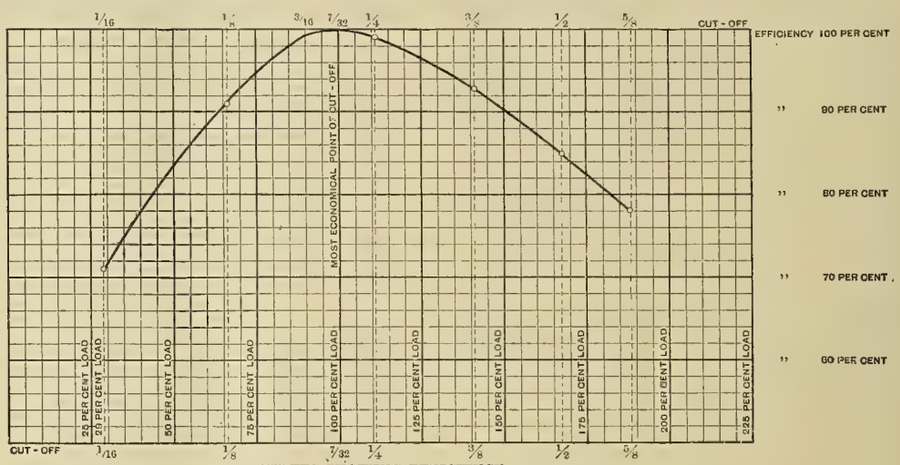


FIG. 4. **CURVES SHOWING EFFICIENCY IN STEAM CONSUMPTION per DELIVERED HORSE POWER per HOUR**
Under Varying Loads and Steam Pressures.
Single Cylinder Condensing Engine.
STEAM PRESSURE 60 POUNDS.
Points marked ° show where indications were taken.

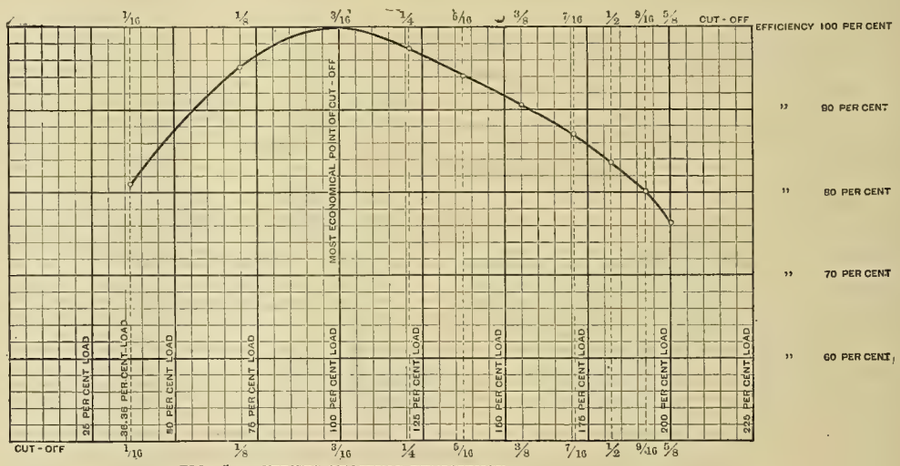


FIG. 5. **CURVES SHOWING EFFICIENCY IN STEAM CONSUMPTION per DELIVERED HORSE POWER per HOUR**
Under Varying Loads and Steam Pressures.
Single Cylinder Condensing Engine.
STEAM PRESSURE 80 POUNDS.
Points marked ° show where indications were taken.

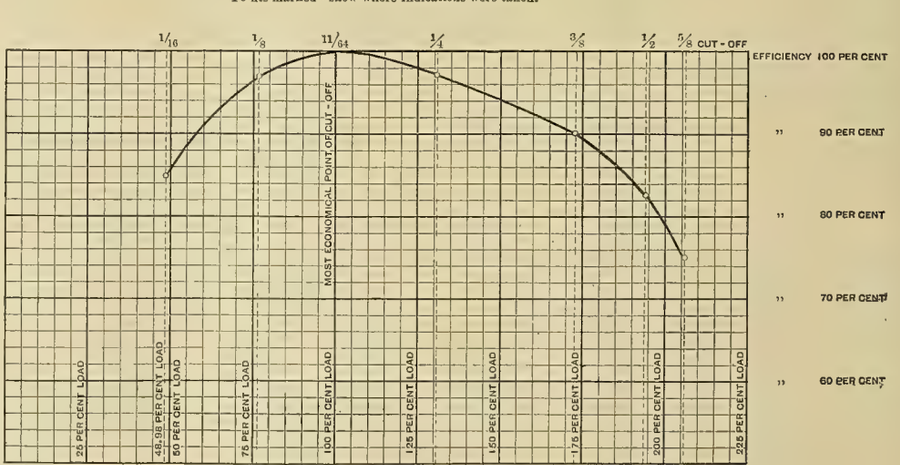


FIG. 6. **CURVES SHOWING EFFICIENCY IN STEAM CONSUMPTION per DELIVERED HORSE POWER per HOUR**
Under Varying Loads and Steam Pressures.
Single Cylinder Condensing Engine.
STEAM PRESSURE 100 POUNDS.
Points marked ° show where indications were taken.

which, if corrected, will pay for the cost of the test many times over.

In addition to this annual record of performance, the boilers should be tested at least every week, and indeed it is not a bad plan to place a water meter in the feed-water pipe and keep a log of each day's service in the amount of water evaporated and the number of pounds of coal required to evaporate it. Such an arrangement makes a very satisfactory check upon firing as well as upon the grade of coal furnished from day to day. And these records, together with three or four readings of the temperature of the flue gases each day, should go to the office to be placed on file, where they may be consulted and compared with other like records. The effect of keeping an eye on the boiler-room is bound to be a better service, which in the saving of coal will quickly pay for any expense incurred in installing the meter and in keeping the log.

CHAPTER VI.

Steam Engines.

In planning a lighting plant where the power to be used is steam, the type of engine to be used must be determined early, for upon that hinges the whole steam plant in size and arrangement. This choice is influenced by the working conditions which are to be met and by the financial investment which the size of the plant will warrant. Careful judgment must be exercised in making this choice, which lies between the simple or compound, high-speed or Corliss. The engine which is most economical in its steam consumption is not necessarily the most economical investment, for all questions of room, flexibility, amount of investment and cost of producing steam have greater or less weight. However, the amount of steam which these various engines consume in the production of a horsepower-hour is the basis upon which their relative economy is founded, and this is the recognized common ground upon which they are first to be compared.

The size of units to be employed in the station is another matter which must have weight in the determination of type. For manifestly it would be poor economy to employ a low-speed engine driving through a line of heavy shafting and belting for the sake of a low consumption of steam per indicated horsepower in the engine. No less would it be of doubtful economy to invest in a high-priced engine of high efficiency in steam when the cost of coal delivered under the boilers is low.

Since different engines require different amounts of steam to produce a horsepower, the standard by which the horsepower of an engine is gauged is the amount of water required per horsepower per hour. This, according to Dr. Thurston, in good engines is equal to the constant 200 divided by the square root of the steam pressure,

$$\frac{200}{\sqrt{\text{pounds pressure}}}.$$

In the best engines this constant is as low as 150. This gives for high-grade engines, working, say, at 80 pounds steam pressure, $\frac{200}{\sqrt{80}}$, or 22.25 pounds water, and in the most economical engines, working at 100 pounds steam pressure, $\frac{150}{\sqrt{100}}$, or 15 pounds water per horsepower per hour. However, it is shown in tests made in operating stations that in regular practice at 80 pounds steam pressure a fair average shown is as follows:

Single-cylinder non-condensing high-speed engines—30 to 36 pounds water per horsepower per hour.
Corliss engines—26 pounds water per horsepower per hour.
Compound condensing high speed—21 pounds water per horsepower per hour.
Compound condensing Corliss—16 pounds water per horsepower per hour.
Reducing this to coal (one pound coal evaporating seven pounds water):
Single non-condensing high-speed—four to five pounds coal per horsepower per hour.
Corliss—3½ pounds coal per horsepower per hour.
Compound condensing high-speed—three pounds coal per horsepower per hour.
Compound condensing Corliss—two and one-quarter pounds coal per horsepower per hour.

Compound engines have a supposed economy over single-cylinder of 12 per cent., but experience with compound engines would indicate that this economy is not obtained except where a nearly constant full load and high steam pressures are carried, or the engine is used condensing. Triple-expansion engines do not come within the limit of this series of articles, except in direct-connected work running from 150 horsepower up, when the makers of these engines promise the highest efficiency.

For the purpose of giving a fair idea of the relative economy of both types of engine the accompanying charts are presented.

It is admitted that in the many stations throughout the country the local facilities, quality of fuel and supplies, physical condition of the lighting plant, efficiency of construction and economy of operation, all vary indefinitely; yet there is an average set of conditions that will apply to a majority of the lighting stations; and it is under that average set of conditions that these curves were plotted several years ago by Mr. B. J. Arnold, past-president of the American Institute of Electrical Engineers. The curves in Figs. 4, 5, 6 and 7 show the efficiency in steam consumption per delivered horsepower per hour under varying loads and different boiler pressures of 60, 80, 100 and 120 pounds, respectively.

On these curves the lowest water consumption per horsepower-hour has been assumed as 100 per cent. efficiency, and curve plotted each way from this point, showing the increased water consumption or decreased efficiency as the point of cut-off varies.

Efficiency in steam consumption in all these curves varies inversely as the number of pounds used per delivered horsepower-hour, and, as before stated, the number of pounds at the most economical point of cut-off is taken at 100 per cent. efficiency.

The facilities were lacking to make a test at 150 pounds pressure, otherwise the curve of efficiency would show a still greater gain in economy. The most economical point of cut-off under each

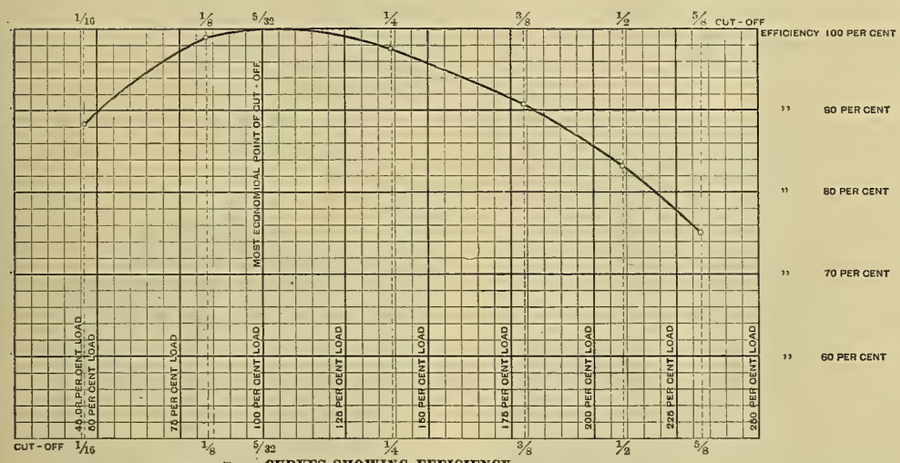


FIG. 7. CURVES SHOWING EFFICIENCY IN STEAM CONSUMPTION per DELIVERED HORSE POWER per HOUR
Under Varying Loads and Steam Pressures.
Single Cylinder Condensing Engine.
STEAM PRESSURE 120 POUNDS.
Points marked ° show where indications were taken.

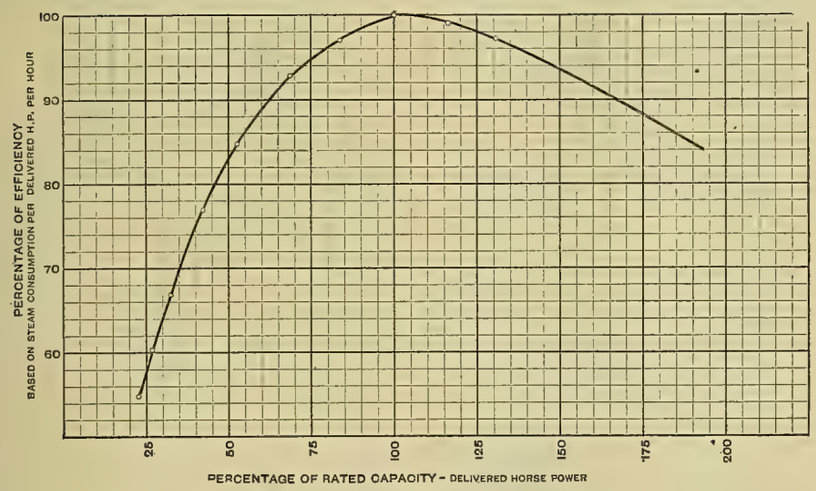
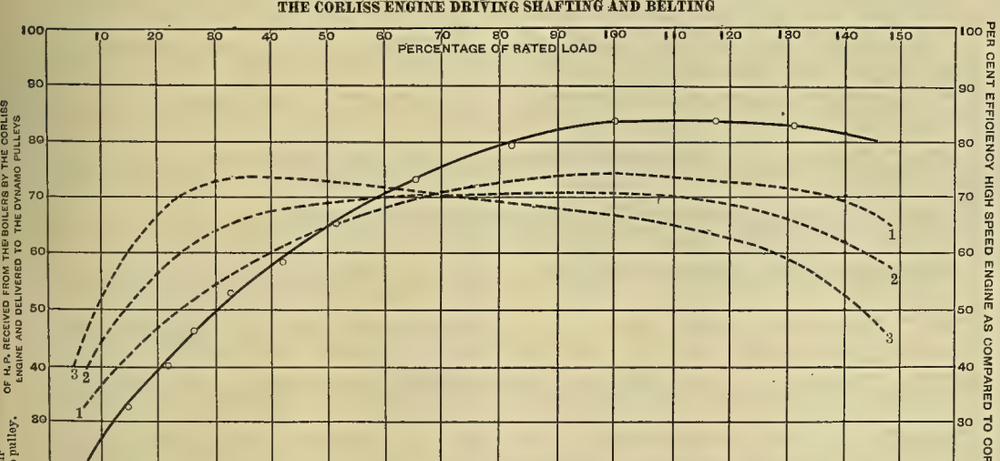


FIG. 8. SIMPLE NON-CONDENSING ENGINE.
Curve showing Efficiency working at varying loads.

FIG. 9. EFFICIENCY OF HIGH SPEED ENGINES BELTED DIRECT AS COMPARED WITH THE CORLISS ENGINE DRIVING SHAFTING AND BELTING



CORLISS	13	9	7	6	5.4	5	4.7	4.5	4.3	4.2	4.2	4.2	4.3	4.4
1 H.SPEED	9.5	8	6.5	5.9	5.5	5.2	4.9	4.8	4.7	4.7	4.7	4.7	4.8	5	5.5
2 " "	7.8	6.4	5.4	5.2	5.1	5	5	5	5	5	5	5.1	5.3	5.6	6.2
3 " "	7	5.2	4.8	4.7	4.8	4.9	5	5.1	5.2	5.3	5.4	5.6	6	6.7	8

The coal consumed per H.P. per hour delivered to Dynamo pulley.

Curve Corliss engine
1 " 1 H.Speed engine of equal H.P.
2 " 2 " " engines each of one half the H.P.
3 " 3 " " " " one third " "

steam pressure and the relative point of cut-off to the percentage of load are clearly shown.

The curves present an object lesson that demonstrates the economy of high steam pressures, and of varying the steam pressure with the load.

Fig. 8 gives the efficiency under varying loads of a single-cylinder non-condensing engine more commonly used than any other type. This curve was taken from the indications of an engine of 80 horsepower working under 80 pounds steam pressure, the dots showing the points at which indicator cards were taken. The engine running light required eight per cent. of the indicated horsepower, so that it is near the average case. The line marked 100 per cent. of load is at the rated power of the engine as given by the maker, and it may be noticed that the water consumption is greater as the engine varies from its load either under or over.

Fig. 9 shows the relative economy of single-cylinder high-speed engines as compared with a single-cylinder Corliss engine, working under the average set of conditions. Dotted curve No. 1 shows a high-speed engine of the same size as the Corliss. Curve No. 2 shows the load divided in two engines, each one-half the capacity of the Corliss. Curve No. 3 shows the load divided in three engines, each one-third the horsepower of the Corliss. It will be noticed that the curves are longer than in the previous charts, although they figure alike. This of course is due to plotting the per cent. of the load in squares of 10 instead of 25 so as to have the per cent. of efficiency and load of equal proportions.

The Corliss engine consumes eight per cent. of the steam delivered by the boilers in turning itself and flywheel over. The shafting and belting consume 12 per cent. of the horsepower of the engine. Thus the horsepower delivered to the dynamos is 84 per cent. of the horsepower delivered by the boilers under ordinary conditions.

The frictional load of the high-speed engine averages five per cent.

The average coal consumption is one pound of coal for every seven pounds of water evaporated; the average Corliss efficiency 26 pounds water per delivered horsepower per hour, the average high speed being 32 pounds water per delivered horsepower per hour.

It is under this set of conditions that the comparative curves of efficiency of the Corliss and high-speed engines are shown in Fig. 9.

[*To be continued.*]

A String of Electric Locomotives.

In October last the first half of the 50,000-mile endurance run of the first high-speed electric locomotive No. 6000, built jointly by the General Electric Company and American Locomotive Company, was completed on the test tracks of the New York Central lines in Schenectady, as noted in the Western Electrician at the time. On June 12th this

EIGHT 100-TON ELECTRIC LOCOMOTIVES IN A ROW.

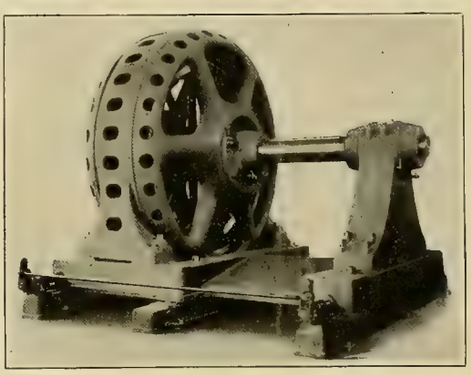
locomotive completed the second half of this exhaustive service test. The maintenance expense per mile for the complete 50,000-mile run is reported as $0.0126. This figure includes all maintenance expense on motors, brake shoes, tires, inspection and other miscellaneous items. Moreover, the operating conditions were much more severe than those to which the 35 electric locomotives, which have been ordered, will be subjected. The test locomotive hauled a train averaging from 200 to 400 tons over a six-mile track, and high-speed running under these conditions involved higher braking and accelerating duty than in regular operating service.

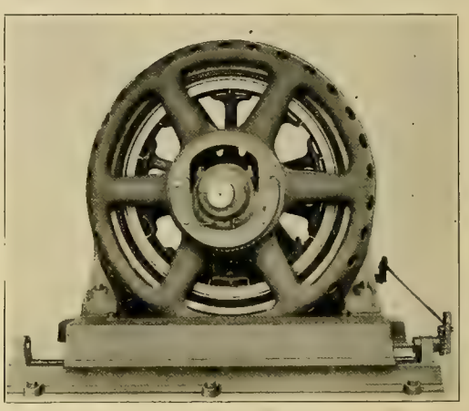
The accompanying picture illustrates eight of the 35 100-ton, 2,200-horsepower electric locomotives which the manufacturers named have built for the New York Central Lines, following the same design as the locomotive No. 6000, which has made such a satisfactory record. There are in all 14 machines now complete. Of the eight locomotives shown, Nos. 3401 and 3402 have been shipped to New York. The remaining locomotives are well underway at the shops of the General Electric Company and American Locomotive Works, and it is expected that the complete number, 35, will be ready for service in early October.

The illustration gives a graphic idea of the substantial proportions now attained by electric railroading.

Induction Motors for Reduction Plant at Anaconda.

Some unusual features are embodied in the four large induction motors to be installed as a part of the electrical equipment at the reduction plant of the Anaconda Copper Company at Anaconda, Mont., mention of which was made in the Western Electrician of February 10th. These motors were designed and built at the electrical works of the





TWO VIEWS OF 1,200-HORSEPOWER 60-CYCLE INDUCTION MOTOR FOR ANACONDA COPPER PLANT.

Allis-Chalmers Company in Cincinnati and are part of the equipment for the 10,000-ton concentrator of the Washoe smelter, a new part of the $9,000,000 reduction plant of the Anaconda company. This plant is to operate with power supplied by the two stations of the Helena Power Transmission Company, on the Missouri River near Helena, nearly 100 miles from Anaconda. In addition to power being furnished for the smelter and street railway of Anaconda, the improvements now in progress will, when completed, make it possible for the mines of Butte to utilize Missouri River power.

The output of copper from the Washoe smelter, which has been equipped throughout with electrical drive, is from 15,000,000 to 17,000,000 pounds per month. Formerly all the power required was supplied by steam engines, and a certain amount of steam power will probably always be used, as some of the steam boilers utilize the heat contained in the waste gases from the furnaces. However, this power, obtained from a by-product, is not nearly sufficient to operate the whole plant, and all additional power is in the future to be supplied by electricity.

A second huge dam is being built across the river, near Helena, by the Missouri River Power Company, by which the waters will be backed up to form a lake near the capital city. The transmission of power at a pressure of 70,000 volts over a double line to Anaconda, nearly 100 miles distant, involves a pole line and accessory equipment, which will be one of the most important electrical developments of the West.

A sub-station at the smelter contains the step-down transformers for lowering the pressure to 2,200 volts for distribution to the various parts of the plant. The Anaconda company has also recently purchased a waterpower plant located at Flint Creek, about 31 miles from the smelter, and capable of supplying about 1,500 kilowatts. The power from this plant will be used principally for the operation of blowers and air compressors in the smelter power house.

The concentrating plant is the first unit to be driven by electric power exclusively, the four large induction motors being used for this purpose. The mill as a whole is divided into eight sections, four on each side of the engine room. Two induction motors will be installed in each half of the mill, and connected to the main shaft by rope drive and friction clutch pulleys. Each motor has a 1,200-horsepower output at 360 revolutions per minute, synchronous speed, and will furnish power sufficient to operate easily two mill sections.

These large motors, two views of which are given herewith, are notable not only on account of their large size, but also because of their having squirrel-cage rotors, something unusual in motors of this size. Their guaranteed full-load efficiency is 91 per cent., and full-load power factor 92 per cent. Squirrel-cage motors were chosen for this installation because the conditions under which they have to start are favorable and also because of the higher power factor of this kind of motor as compared with the wound rotor type. The motors, being connected to friction clutches, start up light, and, as the mill runs continuously, it is not expected that the motors will be started at all frequently. The power system of the Missouri River Power Company is so large that the occasional starting of one of these motors will not cause undue disturbance, while the higher power factor under ordinary running conditions is a decided advantage. Tests show that those motors exceed the guaranteed power factor of 92 per cent. and that the starting current taken from the line will not exceed full-load running current when starting the motor with its ropes and friction pulley connected.

Starting is effected by an oil-immersed controller cannected to an auto-transformer which lowers the applied voltage at starting. The controller has six steps, so that the motor can be brought up to speed gradually. Since the motors are arranged in pairs in the mill, one controller is provided for each pair of motors, and the necessary instruments, switches, etc., are mounted on two two-panel marble switchboards placed near the motors. The controller is operated by means of a hand wheel on the front of the board.

The main switches and also the transfer switch for connecting either motor to the controller are of the oil-immersed type and interlocked with the controller handle in such manner that it is impossible to close the main switch of either motor while the controller is at the "on" position.

In addition to the four large motors, there is also provided a 200-horsepower variable-speed 60-cycle 2,080-volt induction motor for operating the pumps in the mill.

For the equipment of the sub-station the Allis-Chalmers Company has furnished three synchronous motor-generator sets of 300 kilowatts output each, and one small induction motor-generator set for starting and exciting the synchronous sets. The 300-kilowatt sets are driven by 12-pole 2,080-volt 60-cycle synchronous motors, and run at a speed of 600 revolutions per minute. The direct-current generators for these sets are compound wound for 550 volts and are easily able to carry 50 per cent. overload for two hours without heating more than 55° C., and without sparking. These units will be used for operating direct-current crane motors throughout the plant and also for furnishing power to the Anaconda street railway. During parts of the day the load will be quite light, and it is intended to operate the synchronous motor with over-excited fields, so as to compensate to some extent for the lagging current caused by the induction motors.

Automatic Feeder Regulators.

Proper voltage regulation of individual feeder circuits for both power and lighting is recognized as an important factor in the economical operation of a power plant. Such regulation may be controlled by the station attendants, or automatic methods of regulation may be adopted. For automatic regulation of feeder circuits the General Electric Company manufactures two forms of voltage regulators which are of special interest, known respectively as type BR and type IR. The general principle of operation of both these forms of regulators is similar in that they are in effect variable-ratio transformers or compensators having two separate windings. The primary or shunt winding is connected across the line, while the secondary or series winding is connected in series with the line to be controlled. While both forms of regulator boost or lower the voltage by changing the transformer ratio, the method used in the two cases are quite different.

In the BR type of regulator the windings are assembled on a shell-type core, and taps are brought out from the secondary winding to stationary slip rings. The various combinations of turns producing the voltage change are made by the controlling mechanism of the regulator. In the IR type of regulator, on the other hand, the secondary and primary windings are assembled upon separate cylindrical and concentric sheet-iron cores. The series or secondary winding is arranged in slots on the inside circumference of the stationary outer core, and the shunt or primary winding is placed in similar slots on the outside circumference of the movable inner core. The change in the angular position of these cores varies the flux distribution and so produces the boosting and lowering in the voltages. The coils on both stationary and movable cores are in effect polar windings, and both are similarly wound. With a given pole of the primary opposite a given pole of the secondary, the regulator will boost the line voltage, while, if dissimilar poles are opposite, the voltage will be lowered.

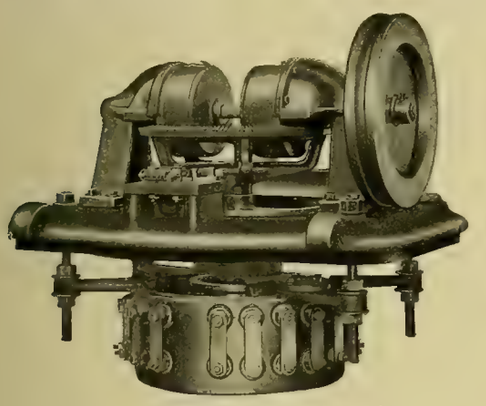


Fig. 1. Switching Mechanism of BR Regulator.

The mechanical arrangements of the regulators are compact and simple. In the BR regulator, in which there is no moving core, the connection changes are made by a rotating switch. The moving member of this switch carries a series of fingers, each of which is connected to a corresponding stationary collector ring by means of a suitable brush, and the ring is connected to the line through a preventive resistance. This resistance allows a small exchange of current between the fingers and thereby rpevents any break in the circuit when passing from one step to another. The switch is operated on a vertical shaft by a bevel gear, which in turn is driven by magnetic clutches on the horizontal shaft, the switch rotating in one direction or the other, depending upon which clutch is excited.

In the IR type of regulator the mechanical arrangement is exceedingly simple. The movable or primary core is mounted on a vertical shaft, the upper end of which carries a worm gear segment, while the other end rests in a step bearing. Both primary and secondary windings are brought out by means of flexible cables, with the exception of large regulators for rotary converters, which have the secondary arranged with bus-bar terminals. The entire arrangement is simple and substantial in construction and, with the exception of the windings, is practically indestructible.

Both types of automatic regulators are operated by polyphase motors, but the method of control is different. In the IR or movable core regulator the operation is as follows: Across the potential transformer in the feeder line is placed a contact-making voltmeter, the regulator being in series with the line. As the line voltage rises or falls the contact-making voltmeter responds, making contact on one of two points, respectively. These contacts in turn close the circuits in a relay switch which starts the polyphase motor. This relay switch operates the motor in either direction, according to the "boost" or "lower" position taken by the contact-making voltmeter. The motor then revolves, adjusting the main circuit voltage by changing the angular position of the cores, as described, until the line voltage becomes normal. At that instant the contact-making voltmeter opens, in turn opening the relay switch and the motor circuit.

In the BR type of regulator the contact-making voltmeter forms an essential part of the control, but the relay switch is omitted. In this type of machine the driving motor, which may be of any type, revolves continuously, but operates the revolving-switch mechanism only when the magnetic clutches on the horizontal shaft are energized. A single motor may operate a number of regulators. The contact-making voltmeter, responding to the rise and fall of the line voltage as in the case of the IR regulator, sends a direct current through one or the other of the clutches. These clutches then rotate the switch by means of the mechanical arrangement of the bevel-gear drive, as explained. If it is desired to compensate for line drop and maintain a constant potential at some distant point on the feeder it is only necessary to provide the relay with a compensated winding, connected in series with the line, or through a suitable current transformer. The compensated winding on the relay is arranged with two sets of dials, so that a very close adjustment can be obtained within the limits for which the device is designed. In the IR regulator, where there is considerable inertia in the moving parts, a magnetic brake operates when the motor circuit is opened, which prevents hunting, but this device is not required on the BR type, since the parts are light and stop when released by the clutches.

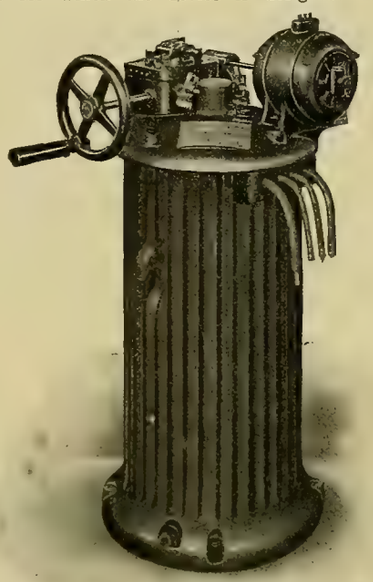


Fig. 2. IR Type.

AUTOMATIC FEEDER REGULATORS.

Each of these regulators has its individual application according to the operating conditions. The BR regulator is particularly designed for feeder circuits where the fluctuations in voltage are very rapid. Such conditions are imposed when both lamps and induction motors are operated on the same circuit. The rush of current taking place when a large induction motor is thrown on the line makes the lamps flicker unpleasantly unless a quick-acting regulator is provided. The BR type of regulator meets these conditions and smooths out the fluctuating voltage curve, as it operates over its full range from lower to boost in six seconds. The IR type, on the other hand, is well adapted for lighting circuits where the load comes on more gradually and such quick regulation is not essential, as, for example, the regular lighting load at a power station, which increases rapidly toward nightfall.

While both these types of regulators have good efficiencies and power factors, the maker declares that these are of relatively small importance. The manufacturing company says: "Take, for example, the IR type of regulator. Feeders seldom require a regulation exceeding 20 per cent., and a regulator having even as low a power factor as 85 per cent. does not have any appreciable effect on the line. Such a regulator would have a magnetizing current and a reactance exceeding 25 per cent., and assuming that the regulator is arranged for a 10 per cent. boost and lower, and that the power factor on the line is 100 per cent., the effect of the regulator having this low power factor and with full load on the line, will only reduce the power factor on the line 0.2 per cent. In other words, the power factor would become 99.8 per cent. With a five per cent. boost and lower regulation under the same conditions, the line power factor would be 99.9 per cent. It is therefore evident that the reactance in the regulator has a negligible effect on the power factor of the system as a whole."

Both types of regulators are built in standard sizes for 60 cycles and 2,200 volts to boost and lower the voltage either five per cent. or 10 per cent. above and below normal. The BR regulator is usually built in sizes from 11 to 22 kilowatts, while the IR types for single or polyphase circuits range in size from 5.5 kilowatts to 44 kilowatts.

Of the accompanying cuts, Fig. 1 shows the switching mechanism of the BR regulator, Fig. 2 the IR regulator and Fig. 3 the BR regulator complete.

Progress of the Stanislaus Power Project.

The Stanislaus Electric Power Company has completed a lot of preliminary work in the vicinity of its proposed 40,000-horsepower electric transmission plant, which is to be installed at Stanislaus, Cal. About 1,000 men are at work under direction of the company's engineers, who make their headquarters at Vallecito, Cal. Excavating has been commenced for the foundations of two large rock-filled concrete dams that will impound the waters of the Stanislaus River at Kennedy's Meadows and Relief Camp. The ultimate storage capacity of the reservoirs at these two points will be one billion gallons each. The contracts for three or four three-phase generators of about 5,000 kilowatts each, and a like number of waterwheels, will be let by Sanderson & Porter, who have general supervision of the project.

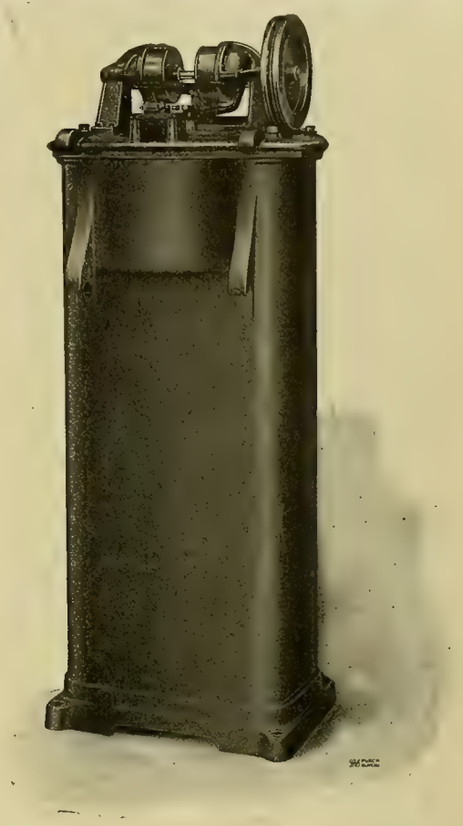


Fig. 3. BR Type.

The power company has completed a traction-engine road, 14 miles in length, from Angels to Stanislaus, and has a 125-horsepower Holt steam traction engine in operation. It will haul in machinery from the railway station. A similar engine is running in Tuolumne County, where the company is rebuilding and widening 40 miles of the Mono road so as to adapt it to heavy traction hauling. The cement and heavy materials for the construction of its flumes and dams will be taken in by this route, extending from Middle Camp to Kennedy's Meadows. Although the late season has retarded the hydraulic work, from present indications the transmission of power to San Francisco will be accomplished within two years. The company has also commenced grading a narrow-gauge railroad, 15 miles in length, which will extend north and west from Middle Camp, connecting there with the Sugar Pine branch of the Sierra Railway, now nearing completion.

Zinc Production of the United States.

The production of zinc in the year 1905 amounted to 203,849 short tons, according to a report prepared by Charles Kirchhoff and published by the United States Geological Survey. This is an increase of 17,147 short tons over the production of 1904. The production of zinc has more than doubled since 1897, when it amounted to 99,980 tons. After January 1, 1907, the collection of statistics on lead, zinc and quicksilver for the United States Geological Survey will be in the hands of J. M. Boutwell, assistant geologist. During the present field season Mr. Boutwell will visit the principal producers of ores of these metals, the most promising camps where these ores are mined and the central smelters of the country.

SELLING ELECTRICITY.

Under this heading will appear, from time to time, articles, suggestions and examples which will be of assistance in the constant effort to increase the existing demand for electric current and to create new demands.

The New-business Department in Central Stations of Smaller Cities.[1]

By S. M. Kennedy.

There is no standing still in the electrical business, and a central station is either going ahead or falling back. As a matter of fact, a really healthy electric company should be behind with its new work most of the time, should be rushed with orders and straining to keep up with them. It is not meant by this that there should be inefficient methods, or insufficient help, but that the pressure of constantly increasing demands for electric energy should be impatiently pushing forward the orders awaiting their turn for attention.

The great problem which central-station managers are trying to solve is one of equalization. It is highly desirable to increase the sale of electric energy in every legitimate way, but some ways are more profitable to a company than others. In a growing city it is an easy matter to build up a "peak." But it takes efforts and brains to broaden the "peak," to build up a day load and to reduce the difference between the peak load and the minimum demand. These are prime reasons for the existence of a "new-business department." It is to this department that the central-station manager must look in order that he may obtain a proper load for every hour of each day, and every day of the year

A new-business department is no longer considered an experiment or a fad; it is a necessity in the operation of a central station. The generator is the heart of the plant, but the new-business department is the lungs. A man cannot get along without a heart, neither can a central station. A man can get along with only one lung, or part of a lung, but he will die if the part shrinks up too much—and so will a central station. For cities of 50,000 population and under, the staff of a new-business department proper, may consist of from one to 12 individuals, depending altogether on the size of the city, the local conditions, and the rate of speed with which certain objects are to be attained.

It is safe to say that no city on this continent, no street, no block, and no house can claim to be properly illuminated, or to have all the electricity-consuming devices which might be used with advantage. It is safe to say that in every city of any size there are hundreds of horsepower in steam and gasoline engines being operated at a greater cost than necessary, just because their owners have wrong ideas about electric energy and are not aware of the great advantages to be derived from its use. It is safe to say that there are many electric appliances which could be installed in each household now using electric light.

In every community there are many thousands of dollars in revenue waiting to be picked up from the sale of current, the production of which would not increase the central-station plant investment to the extent of one cent. As a matter of fact, the people really want to know all about the possible advantages of electricity, and this curiosity should be stimulated and satisfied by the central station, as it is entirely in line with the growth of its business. More light and more power can be sold to consumers, as well as non-consumers, but it must be done by hard work. Men with a knowledge of salesmanship and business methods are required successfully to spread the news of electrical possibilities, to swell the number of consumers, and increase the amount of individual consumption. This is the kind of work cut out and waiting for the new-business department.

More Light.

In a city of 20,000 population, a company may have 3,000 consumers, all using light. Perhaps the manager contentedly leans back in his office chair and, in answer to an inquiry, says: "Yes, business is good; we keep adding to our consumers right along, and must soon increase the capacity of our plant." And at the same time his load curve may probably resemble the spire of a church as much as anything else! His 3,000 customers could probably be increased to 4,000. They are all using light. Splendid! What do they want, first? More light! It is an axiom in this business, that the more opportunities there are for using light, the more light will be used. Some of the residences are without porch lights, hall lights, portable lights, cellar lights, outhouse lights and outdoor lights. The stores want more inside lights and more electric signs. The factories and workshops need more arc and reflector lamps. Good light makes cheerful and efficient workmen, and good workmen deserve good light.

And More Power.

What next! Do those householders know of all the electric appliances which add so much to the comforts of life? Well, maybe they do know of some of them—but not from the central-station office. And yet those housewives are ready to use electric toasters, chafing dishes, irons, sewing-machine motors, plate warmers, coffeepots, curling tongs, broilers and a dozen of other conveniences. But they must be told about them.

Anything else? Yes. Just POWER. But spell that word with capitals, for it usually means day load, and that is what our friend the manager is looking for. That city of 20,000 is using lots of power in intermittent and constant operation. How much of it electric? Is the manager going to sit down until new factories start, and wait for the promoters to come to his office and inquire what can be done? If he does, he will probably have few inquiries. Is he going to wait until those existing power users, who have steam and gasoline plants, meet with accidents and then expect to have them ring him up for information? Well, maybe he'll have a few calls, but he'll have fewer orders.

What must be done to obtain these valuable kinds of business? Educate, Instruct, Demonstrate, Persuade. If you want to sell more light, show your customers that they need more. If you want to derive the increased income from the use of electric appliances without increasing your investment, you must create a demand for the appliances. If you want power consumers to hold your plant down during the daylight hours, then show the power users in your city the advantages of electric energy. They must learn of the convenience, cleanliness and reliability of electric motor-driven power. They must be shown the saving in insurance, interest and depreciation. They must have all these things explained and demonstrated to them. They must become interested, then anxious, then hungry.

Electric Irons Lent to Customers.

The company with which the writer is connected operates in one city with a population of 225,000 and in 17 other cities with populations varying from 4,000 to 25,000, and has upward of 30,000 electric consumers. About 18 months ago it was decided to stimulate the sale of electric laundry irons for use in private dwellings, some hundreds having already been installed in various laundries on the system and found to be giving great satisfaction. Within 12 months there were installed in residences over 1,600 irons, which were all paid for by the consumers using them. Careful data was compiled, and it was conservatively estimated that the average monthly income from each iron was 65 cents, or equivalent to eight dollars a year. It was also apparent that those who had the irons were highly pleased, and, in numerous instances, were inquiring for other appliances. But many did not have the irons that would gladly use them, who could or would not spend the money to buy them. Now here is what the company discovered: Electric irons were good things—day load; lighting rates; no increased plant, line, transformer or meter investment; average income at least eight dollars a year, 1,600 of them installed! Why not 10,000? But the people won't buy them! Well, let's see! Every thousand irons out increases the annual income $8,000; 10,000 irons would mean $80,000! Just like finding it! What was to be done? Invest a little money. Take a little risk. Loan the irons to customers who will use them.

That is what our company has done. The first order placed was for 3,500 irons, and within 12 months from the time the plan was put into effect the company will have loaned not less than 7,500 irons, and there will probably be in use on our system altogether 10,000 electric irons in 1907. That is one way of getting new business and making it easy to obtain more.

Buying Old Plants.

One more reference to the means adopted by the same company to obtain power business. It often happens that a power user may be interested in electricity, but he has his money tied up in a steam or gasoline engine and does not wish, or thinks he cannot afford to invest more. During the last two years our company has purchased such plants, in units averaging 20 horsepower each, to an aggregate of over 1,000 horsepower. These engines have been resold and shipped to territories away from the company's lines, and their former owners are now invariably strong advocates of electric energy. But engines have only been purchased in this manner where there was no other way of obtaining the electric power business. Owing to the lower cost of motors, most of these exchanges were made without loss to the company, although in some cases it was figured out that an initial loss must be met in order to obtain profitable and permanent power business.

Ways and Means.

And now we come to the question of ways and means. How is the public to be educated, instructed and persuaded? What is it that the new-business department must do to begin with, and what must it continue to do? The answer is:

Advertise.
Solicit.
Exhibit.
Systematize.
Foster existing business.

The new-business department cannot be divorced from the other departments of the company. It must of necessity keep in touch with the operating and construction ends, must be close to the accounting side, and in constant communication with the customers' department. The manager of the new-business department may not be an engineer, but he must have absorbed a considerable amount of technical knowledge. He may not be an accountant, but he must know how to figure. He may not be a meter reader, a collector or a troubleman, but he must know what are the difficulties in each position. And, above all, he must know the public. He must know its failings, its prejudices, its needs and its opinions.

Advertising.

In the conduct of a new-business department the subject of advertising is ever present. It is one of the mainstays and must receive careful attention. But let us take it for granted that the manager acknowledges the importance of advertising. The next question is, What are the best methods of publicity? Probably, more than anyone else, the man who advertises must put himself in the place of those whom he wishes to reach. With this idea before him, he will understand how to attract the attention of the public, where to place his advertisements, and when the psychological moment arrives to produce the best results. For the reason that the public cannot be all reached in the same way, it follows that all honest advertising is good. Some people never look at the advertisements in the daily papers, but will eagerly scan each advertising page in a magazine. Others never see an ad in a periodical, but yet their eyes catch the notice on a billboard, or the card in a street car. Again, there are others too absent-minded to note anything on billboard or in car, but put a circular or letter in their hands, and it will be read from beginning to end. Consequently, if you wish to reach every class, use every medium of attracting their attention. You don't require to go after all at once; but go after them somehow.

Newspapers.

Newspaper advertising pays in many ways, its returns being visible and invisible. It frequently happens that considerable space is taken in order to propitiate the press. The friendship of your local papers is important. Foster that friendship, but do not neglect the space you take just because you think it is there always, and the ad may be changed at the same time. If your ads are built right, if they attract attention and *say something*, they will help your business and increase your income. It is a good plan to tell one thing at a time, to change the copy frequently, so that it may not become stale, and to use a snappy, concise style which will gradually draw a regular following of readers, who will look for your ad in the paper just to see what you have to say.

What you print will be read by consumers and non-consumers. Say something to each. The first named should be using more current. Point out to them where they need more. The others need to begin. Show them where they will be better off. Create the desire. You do not require to be an advertising expert. Know your own business. Be thoroughly acquainted with the public needs. Talk in the ad as you would to a prospective customer sitting in your office. Attract attention; then be short, direct and crisp, and let your words show that you believe in what you say, and they will carry conviction with them.

Circulars, etc.

The mailing of circulars separately or along with bills is a successful way of arousing interest, but the circulars require to be carefully prepared, printed on good paper and always artistic. Neat booklets or folders should be interchanged with the circulars, and each should draw attention to one subject only. Billboards are splendid for special announcements, and catch the eyes of many who will not read the papers. He who runs may read a poster—and many read and remember. Street-car advertising is also valuable to impress an idea on the public. If a man is sitting in a car for 10 or 15 minutes, and one of your ads is opposite to him, he will read it, whether he wants to or not. And if what you say is catchy or important, he will not forget it.

Other Forms of Advertising.

"Follow-up" letters are a dignified and desirable means of drawing the attention of selected people to a subject which should be of special interest, and are always productive of good results. These letters should have a personal touch to them, and should be neat and attractive in style and diction, avoiding altogether the appearance of a general circular. By this means the individuals you wish

1. This is an abridgment of the paper awarded the second prize ($300) in the recent competition of the Co-operative Electrical Development Association. Mr. Kennedy is connected with the selling department of the Edison Electric Company of Los Angeles, Cal.

to reach are talked to without chance or hap-hazard.

It has been found that one of the best ways of drawing attention to a subject with existing consumers is to use the backs of monthly bills. If you wish to advertise electric appliances useful in a home, put a snappy notice on the backs of the bills. If you wish to have merchants consider window lighting, electric signs or fans, talk to them briefly on the backs of their bills. Say something different each month. Somehow every man and woman will look at an electric bill to see the amount. When they see the amount let them also notice a bold line reading "See Other Side." They'll turn the bill over and read your ad. That's what you want them to do.

The new-business manager should do his advertising well—thoroughly, intelligently and systematically. If he cannot do it himself, or have someone on his staff who can, he had better pay an adsmith to take the details of the whole matter off his shoulders. But let him advertise, and do it right.

Soliciting.

Advertising in the electric business is principally to arouse curiosity and invite investigation. Its object is to induce the reader to ask questions, and prepare the way for getting business. But it requires a personal interview to close a contract; and the prospective consumer must either hunt someone up, or someone must hunt him up, in order to bring matters to a desirable climax. It is a good plan for a representative of the company to do the hunting. The man who reads the ad might have good intention, but a bad memory.

"The best cause requires a good pleader," and the best managed new-business department requires good solicitors. There are some lines in which a solicitor requires only to be a good talker. Not so in selling light and power. A good talker is all right, but he must first be honest, earnest and straightforward, and what he says must carry with it the ring of the truth. The solicitor goes out among the public. He meets the people in their homes, offices and places of business. He does not represent himself; he represents the company, and the public is going to judge the company by the action and words of the solicitor. Often he is the only one about the company whom the customer knows. The president, directors and officers may be men of standing—great men in the community—but the average customer does not know anything about them. He judges the officers by the kind of men they send out to talk to him. Do not think that any kind of a man can solicit. Have men you *know;* men who can make friends; men who can mix well and men who wear well.

Regular Solicitors' Meeting.

Solicitors should be trained and instructed. It is well for the manager of the new-business department to gather his staff around him at least three times each week, to discuss matters in hand, to answer questions and smooth out difficulties. New conditions are constantly arising, which require to be met; information is constantly coming in, which requires to be distributed. Reports about new buildings, new-building permits and new tenants must be dealt with, and often a daily meeting is necessary—and advantageous. Direct solicitation is the safest and surest way to obtain business, and the solicitor must be equipped for his work. The electric company has much to do to overcome competition, indifference and inertia, and it is through the solicitor that a large amount of this active and passive opposition may be removed. He must educate and demonstrate. He must make the public realize that what his company is selling is something in which everyone should be interested; something that lessens the cares and responsibilities of life; something that is superior to everything else for doing similar things; something that reduces work, lightens labor and saves their pocketbooks from certain ravages.

Solicitor's Tactful Work.

It is essential that solicitors should not be too technical in their talks with prospective consumers. There is nothing to be gained in befogging a man by injecting into a conversation a mixture of amperes, ohms and volts. The solicitor is not selling kilowatts; he is selling light. He is not selling amperes; he is selling heat and power. If he has acquired technical knowledged, let him forget it when talking to an ordinary man or woman, and he will sell electric current with less trouble. Those engaged in the electric business are apt to forget that the public does not know as much about it as they do. It is a fact that a very large percentage of the community does not know of the conveniences and simplicity of handling the current—even when they have it for lighting their homes. Many people have a fear of electricity, on account of its mysterious nature, some thinking it as dangerous as lightning. Here is where the careful work of the solicitor may do good every day. He can point out the safety of electricity in the home, the impossibility of upsetting electric lights, and, consequently, the reduction of fire risk; the dispensing of matches where there are children and careless people; the abundance of pure air, the saving of doctors' bills and the convenience of the many wonderful electric appliances which are adapted for home use.

To the merchant, the solicitor points out the advantages of electric light for showing his goods. For keeping his ceilings and store clean, by an absence of smoke and smut. For reducing the heat in summer, and permitting good air at all times. For improving the decoration of his windows and keeping them clean, winter and summer, so that the public may see what he wishes to display. And then he shows him the score of electrical devices which may be operated to advantage inside his store, and help him make money. And, lastly, the solicitor takes his merchant to the door and points out how and where an electric sign will work for him while he sleeps; how he can burn his name and business into the public mind, and how the company will take care of the sign, turn the current on and off at the proper times, and relieve him of all responsibility in the matter.

The power user has much to learn, and to a great extent the solicitor must be his instructor. The solicitor goes into a factory in a crowded part of the city, and what does he see? Probably 50 per cent. of the power generated is wasted and dissipated in shafting and belting before the machine commences to work. Probably 10 times as much space as is necessary is given up to engines and boilers, and valuable space, too. Probably twice as much money invested in the power end as there should be, and, consequently, twice as much interest and insurance and four times as much depreciation continually piling up. He probably finds plenty of noise, smell, dirt and inconvenience, to say nothing of high-priced skilled labor to keep the wheels moving. Little by little the solicitor can show that electrically driven machinery represents economy of power by means of direct-connected units; that motors occupy little space, and may be taken off the floors and stuck on the walls and ceilings; that they cost less than half the price of any other kind of power machinery; that they are clean, noiseless, convenient and reliable, and do not require skilled labor to operate them.

Appliance Showroom.

The work of the solicitor may be greatly aided by the company having a showroom in which all kinds of electrical appliances, big and little, may be seen and their usefulness and convenience demonstrated. The public may thus become familiar with the workings of the different apparatus, and the solicitor will have an advantageous place to which he may invite prospective consumers, and there explain the actual operation of what he wishes to sell. Too much care and attention cannot be given in the arrangement and fitting up of this room.

Does the Station Practice What It Preaches?

But the manager of a central station must show his belief in what he produces and sells, by using freely what he wants others to buy. He preaches that an electric sign is the best kind of an advertisement. Does his company use one? He advocates a well-lighted store and a brilliant window. But how about the company's office? Is there plenty of light, and is it burned far into the night? Has he electric fans, footwarmers and radiators installed for the benefit of employes and customers? What is the use of his saying "that trade follows the light" if he does not illuminate his own premises? If he has no electric sign over his office, what is the use of his preaching that the same law which draws the moth to the flame of the candle, also draws the buying public to the brilliantly lighted store. Let deeds, as well as words, show that he has plenty of confidence in his own product.

System.

The manager of a new-business department will find that System is a good servant for him to employ. The larger the business transacted, the better must be the system, and that system is best which substitutes knowledge for guesswork, and economizes time, labor and money. There must be system in advertising, and system in laying out the work for solicitors. There should be system in noting the results of advertising and the returns which solicitors bring in. There will be inquiries, leads and prospects, the data concerning which requires to be kept up to date and accessible. There should be system in handling what has to be done and what has already been accomplished. System should be used in noting sales, proposals and contracts, records of buildings to be constructed, names of owners, contractors and tenants, and the particulars regarding the probable requirements of each. In records of prospective power consumers complete information is necessary about present installations, kind of machinery, maker's name, horsepower, use and hours of operation. In all branches of the new-business department's work, system is needed, but not the kind of system which becomes a tax and a burden.

Care of Customers.

The longer he is at his work, the longer he is dealing with the people; and the longer he is trying to sell electricity, the more will the new-business manager be impressed with the fact that the best advertisement is a pleased customer, and the best possible solicitor is a consumer who is satisfied. All the work of his department is practically wasted if the new business taken on is not properly cared for.

It is a regrettable fact that, as a rule, there does not seem to be a proper sympathy between the public and the electric company. They do not seem to understand each other. The public is too liable to think it is being overcharged or imposed upon, and the employes of the company to think that public kicks too much. And the fact is still further to be regretted, because the companies are largely responsible for this condition. Employes are not trained to be courteous and polite, to put themselves in the customer's place, and understand why they ask questions about what they do not know, and why they "kick" when those who are taking their money do not give them proper attention and civil answers. The importance of this subject cannot be overestimated, because it is up to the company to do everything possible to establish and maintain friendly relations with its customers.

The new-business department must be backed by good service, and "good service" only begins with the production of the current. Good service requires that there shall be polite and attentive clerks, collectors, meter readers and troublemen; that complaints shall be listened to and promptly investigated, and the settlement of disputes and adjustment of claims shall not be sidetracked and postponed beyond reason. The very existence of a company depends upon the good-will of its customers, and for this reason, inattention and discourtesy on the part of any of its employes should be considered unpardonable.

If a man is a consumer, look after him. If he has a complaint or is in trouble, give his case immediate attention. His general opinion may be that corporations have no souls, but he will find that individuals in the corporation have, and it is by the work of the individuals that he is going to judge your particular corporation. If a man is a power user, he is depending on that power to help him earn his daily bread. He may have a large number of employes, or he may be operating a motor by himself. In either case, if the power goes off, or some trouble occurs with his service, he is put to inconvenience and expense until the trouble is rectified. As a rule when he has trouble with his motor or service, the first thing he does is to call up the electric company. The first thing the electric company should do in such a case is to give this man's trouble the right-of-way.

Whether the cause of the trouble is the fault of the company or the consumer does not matter; the fact that the consumer is shut down is sufficient reason to see that he may be running again as quickly as possible.

It is this kind of treatment that makes friends for the company. It will be found that one of the most successful ways of convincing prospective power users that the energy you have to sell is the energy they need, is to take them to plants which are being operated by electric power for similar purposes to what they would use it. Then have these consumers who have been using power for some time tell the prospective customer how electricity works; what are the advantages and troubles (if any) and what is the cost of operation. The prospective customer is liable to think that the agent of the company is prejudiced, and you cannot blame him. Besides, the man who is trying to sell him a steam or gasoline plant has probably told him something just the opposite to what your agent has said. But if he is going to run a machine shop, or a planing mill, or a foundry, or a peanut stand, take him or send him to some of your customers who have been running similar plants with your electric power, and if you have treated your customers right they will honestly help you to win others, and frequently put themselves out of the way to do it.

Results.

There is nothing problematical about the results to be obtained by a new-business department if it is operated with diligence, intelligence and perseverance. Let the department manager cultivate among his assistants a spirit of pride in the work. Let him encourage and "enthuse" them, so that a healthy emulation may exist—an emulation to excel one another for the benefit of the company's business, and to pull together, so that the successes of today may be but the stepping-stones for the achievements of tomorrow. Let there be politeness, attention and courtesy in all ranks and at all times, and under such conditions the central station will surely prosper and the tiny stream of new business which once had to be coaxed and persuaded, will eventually begin to flow as a river and continue to grow in force and volume day by day.

The new Union Telephone Company of Dodgeville, Wis., has been incorporated with a capital of $50,000 by Orville Strong and others.

The Indianapolis, Newcastle and Toledo Electric Railway.

The state of Indiana, already noted for its interurban railways, will soon have added to those now in successful operation a new line of electric railway between Indianapolis and Newcastle, Ind., as the main terminals, with branch lines to Greenfield, Anderson, Muncie, Winchester and Richmond, the total mileage of which is as follows:

	MILES.
Indianapolis to Newcastle	45
Maxwell to Greenfield	5
Shirley to Anderson	16
Newcastle to Muncie	20
Newcastle to Winchester	28
Newcastle to Richmond	26
Total	140

The engineering features of the road include the building and equipment of a main power station, located near Newcastle, and 10 permanent and one portable sub-stations, one sub-station being installed in the main power-plant building. The main power station will contain units of 1,000 kilowatts each, two Allis-Chalmers steam turbo-generating units being installed for present use to supply 25-cycle alternating current to the line by a system of step-up transformers operating at 33,000 volts. A line voltage of 33,000 volts was adopted, not only to meet the engineering requirements of the present system, but also because the voltage at the frequency selected would enable the system to mesh properly with practically all of the other similar systems now operating in Indiana, should future conditions so demand.

All transmission, both high-tension and railway service, will be carried on pole lines, no third-rail construction being considered advisable. Seventy-pound A. S. C. E. section T rails, heavily ballasted, will permit of high-speed train operation.

The schedule so far prepared contemplates hourly runs between Indianapolis and Richmond, with connections for branch roads laid out to provide the most thoroughly satisfactory service. An express service is allowed for, as well, and two 50-ton electric locomotives will be provided for freight haulage and switching purposes.

The contract for the entire construction of buildings and roadbed has been awarded to the Electrical Installation Company of Chicago. Complete Allis-Chalmers power and electrical equipment will be installed in the main power station and three rotary-converter sub-stations, which will be built at once, the building of the remaining sub-stations being delayed until later.

Copper Market.

One authority on the copper market says that transactions have not been heavy the last couple of weeks, but the price of copper at which it can be bought from the principal sellers continues at 18½ for electrolytic and 18¾ to 18⅞ for Lake. A year ago the quotations were 15 and 15⅝ cents, respectively. Holders are well sold for August and September, and are therefore not pressing sales. Some copper was reported a little under the regular rates, but expert authorities professed to see in the cheap offers a determined plan to affect values unfavorably by sending broadcast lower quotations in the hope of being able to manipulate the market for a decline. Increased activity is expected by the time the trade is ready for autumn business. The numerous propositions of magnitude already assured make it absolutely certain, it is said, that an enormous amount of copper will be required in legitimate enterprises for the balance of the year. Domestic consumption is at a phenomenal rate, especially for the summer season, and the aggregate melting at the copper wire and brass plants of the country is very large. Manufacturers are working under pressure to meet the requirements of their customers, and while such a state of affairs continues to exist there is but little prospect of reduced prices for the raw metal.

Franchise Percentage Offer in Des Moines.

The Des Moines City Railway Company, Des Moines, Iowa, the validity of whose franchise was attacked some time ago by the Civic League, has submitted a proposition to the people. For a franchise running 15 years it offers to pay the city a proportion of its gross receipts, beginning with four per cent. in 1906 and running up to 7½ per cent. in 1920. In 1921 a new agreement shall be made by arbitrators, one selected by each party and the third by the judge of the federal court. At no time after 1917 shall the city's share of the gross receipts be less than 7½ per cent. unless the company gives commensurate return in reduced fares.

Connection has been made by the Washington Water Power Company of Spokane, Wash., with its new power plant at Post Falls, Idaho, and a 2,000-horsepower current has been generated and turned on the feed wires for its electric car and lighting system. Eventually six generators are to be installed in the plant, with a possible development of 18,000 horsepower.

Trick Telephone for Amusement.

A patent has just been granted to John W. Trickett of St. Joseph, Mo., for a trick telephone, the object of which is to provide a simple, substantial instrument for "surprise and amusement," to quote the inventor's words, and from the use of which no material damage can occur. The form of the invention in its outward appearance is made as nearly an exact duplicate of the telephone instrument generally in use as is practicable, consisting of a back piece to which is secured a false back having openings and to which is hinged the pivot board. The pivot board rotates on hinges and carries an electrically released spring-actuated discharging mechanism for discharging a cartridge, a transmitter case, in which is an electrically released spring-actuated ejector tube for ejecting a harmless missile, and a magneto case on which an electrically operated alarm bell is mounted. The pivot board also carries a pivotally attached spring-actuated hooked bracket, from the free end of which is removably suspended the mock receiver, the weight of which depresses the free end of the bracket onto an electrode for closing at this point the alarm circuit.

When the mock receiver is removed from the bracket the lifting spring draws the bracket from one electrode upward against another electrode, thus closing the releasing circuit. To the false back is attached the battery box, provided with electric conductors for an alarm circuit, and a releasing circuit and a push button.

In the transmitter case is slidably mounted the ejector tube, having a flange, which is releasably engaged by the lower extremity of a plunger rod slidably mounted in a tube and flange and abutting against the back piece at its rear end. In the front end portion of the tube is placed a harmless missile, preferably common white flour, and on the tube the removable perforated cap or cover for releasably retaining the missile in place.

The free edge of the pivot board is secured to the false back by a fastening upon which the setting and loading operations are complete, and the instrument is ready for use to "surprise" a person. The operator presses the push button, sounding an alarm bell, upon which the operator lifts the receiver from the bracket, indulges in a mock telephonic conversation into the mouthpiece, and afterward calls the victim to the instrument, hands him the mock receiver, then goes to a distant push button, and while the victim is vainly trying to receive a telephonic message by holding the mock receiver to his ear and shouting into the transmitter, the operator presses a distant push button, closing the release circuit, and the victim gets his "surprise."

A good deal of time and attention has evidently been given to the working out of this toy—more so, probably, than the discomfited user will think it is worth.

Ohio Telephone Notes.

A lot in Hartwell has been purchased by the Cincinnati and Suburban Bell Telephone Company and plans are being prepared for an exchange building which will accommodate the entire Millcreek Valley section.

A company was recently formed among the business men of Barberton to take over the Bell telephone exchange, it is said, as it has a very small business.

A party of New York city officials is expected at Columbus within a few days to look over the automatic exchange of the Citizens' Telephone Company. The Atlantic Telephone Company has applied for a franchise in New York, and these gentlemen are informing themselves upon the subject before giving the application consideration. Members of the Board of Estimate will accompany the party.

A 15-pair toll cable has been laid from Sandusky to Cedar Point, across the bay, to take care of the summer-resort business by the Bell Telephone Company. This business through the season is heavy, requiring five automatic and one manual pay station. One additional toll operator is required at the Sandusky end through the summer.

Employes of the Cleveland Telephone Company had their annual outing at Luna Park Saturday. At the same time an outing of the employes of the Burke Electric Company of Erie, Pa., was scheduled at this park. C.

Indiana Telephone Items.

The Farmers' Mutual Telephone Company of Moorefield, just incorporated with a capital stock of $5,000, proposes to erect and operate a telephone system in Switzerland County, with principal exchange in Moorefield. Clarence Cotter, Scott Donner, C. N. Brown and A. K. Smith are the directors.

The Columbia Electric Manufacturing Company of McCordsville has entered into a contract with the Knightstown Promoting Company to remove the factory to Knightstown. The Columbia company makes a specialty of manufacturing telephones.

The City Council of Anderson and the managers of the Central Union Telephone Company have agreed upon a plan of placing the company's wires underground in Anderson.

It is announced that the Citizens' Telephone Company of Columbus has purchased the Hope Independent Telephone Company plant, which was owned and operated by O. W. Bowman and Simon Nading. It is said the investment represented $25,000 and that the amount paid was in the neighborhood of that figure. The Central Union Telephone Company also made a bid on the property.

Telephone News from the Northwest.

The Citizens' Telephone Company of Mankato, Minn., has laid a new cable containing 1,000 wires.

The Wisconsin Telephone Company will expend $50,000 to $60,000 in cable work and improvements to its system in Eau Claire, Wis.

The trial court at Crookston, Minn., has held in favor of the town of Thief River Falls, Minn., and against the Northwestern Telephone Exchange Company, which sought a writ to restrain the city officials from interfering with the company placing poles and stringing wires for a local system.

The Northwestern Telephone Exchange Company has bought the local exchange at Minneota, Minn., and will rebuild it.

Plans have been completed by the Mississippi Valley Telephone Company to build a complete new system at Keokuk, Iowa. The estimated cost is $100,000.

W. O. Brand has resigned his position as manager of the Vinton and Benton County Telephone Company of Vinton, Iowa.

N. A. Lee of Verndale, Minn., is negotiating for the purchase of the local telephone exchange, which has been out of use since a fire which damaged the exchange last spring, and proposes rebuilding it.

The St. Croix Falls (Wis.) telephone exchange has been incorporated with a capital stock of $25,000. T. H. Thompson heads the new company.

The council at Clinton, Iowa, has passed an ordinance requiring all telephone wires in the business section to be placed underground. The Iowa Telephone Company will comply with the new rule and will put in a conduit system at a cost of $150,000. R.

GENERAL TELEPHONE NEWS.

The Mississippi Valley Telephone Company will rebuild its system in Keokuk, Iowa, at a cost of $100,000.

The Jackson County Home Telephone Company of Tecumseh, Neb., has increased its capital stock from $50,000 to $100,000.

The Home Telephone and Telegraph Company of Ponca City, Okla., has been incorporated with a capital of $100,000. It will put in a system at Ponca City.

The Pawnee City (Neb.) Telephone Company is building a toll line to Table Rock, Neb., to connect with the Western Telephone Company's Lincoln-Kansas City line.

Representatives of Independent telephone systems in the state met at Greensboro, N. C., July 26th and formed an association. About 25,000 telephones were represented.

The Southern Bell Telephone Company is building a handsome $100,000 telephone building in Atlanta, Ga., making the fourth modern exchange in that city. The new building is on Auburn Avenue.

District managers of the Central Union Telephone Company held a meeting in Bloomington, Ill., recently. About 30 managers were present at the meeting, which was held at the Hillis House. It was said at the meeting that Peoria, Ill., has more telephones than any city of its size east of the Rockies.

The members of the Nebraska Independent Telephone Association of the fifth district met at Beatrice recently and elected C. W. Bartlett, Jr., of Fairbury, president, and C. W. Pool of Tecumseh, secretary-treasurer. There are 40 Independent telephone companies in this district representing an aggregate capital of $1,500,000.

The International Independent Telephone Association of America will continue its headquarters in the Electric Building, Cleveland, Ohio, during the coming year. Mr. J. A. Harney will be in charge and prepared to give information and assistance to all members. Maps, statistics and supplies, such as signs, shields, stationary and Independent novelties can be secured at the headquarters.

A sweeping reduction in rates of from 15 to 25 per cent. has been announced for the city of Washington and the entire District, from the offices of the Potomac Telephone Company, which is the Washington and Baltimore branch of the Bell Telephone Company. The reduction is said to be rendered possible by the vastly increased business that has been secured. A cut in suburban rates of 50 per cent. is also announced.

Riedler on the Steam Turbine.

Dr. Riedler of Charlottenburg presented a paper on steam turbines to the German Society of Engineers at the recent fiftieth principal meeting at Berlin. The whole subject of steam turbines as applied to land and marine service is reviewed, and, outside of the technicalities of the subject, it possesses an interest as being a German opinion of the past, present and future of this type of prime mover.

At the outset of his remarks the author deals with the history of the turbine, and of the earlier attempts to utilize the kinetic energy of a steam jet by applying it directly to the vanes of a rotor. Among these he mentions the first 10-horsepower machine of Parsons, which had a speed of 18,000 revolutions per minute, and that of Laval, which revolved at 40,000, both of which speeds were too high for general application. In the case of the Laval turbine, he explains how Laval overcame the difficulty of balancing a rotating mass at such a high velocity by suspending it upon a flexible shaft so that it would automatically find and rotate about its center of gravity.

As for the principles upon which the working of steam turbines is based, they may conveniently be divided into three classes—(1) the reaction, (2) the impulse, and (3) a combination of both, such as is employed in the Parsons turbine. In this turbine the steam is slowly expanded through a succession of vane rotors, the pressure drop being gradual from one end of the turbine to the other. Turbines of this character are the most general, and the speed of the first machine has been very much reduced, so as to bring it down to a satisfactory figure for driving dynamos, and for marine work, which requires a much lower speed of shaft than that which can be satisfactorily used for electrical machinery.

The author enumerates the various firms which manufacture turbines of the different well-known types. The Parsons turbine, besides being made in England, is constructed by Brown-Boveri of Baden and Mannheim, with branches in Paris and Christiania; also by other firms. The Curtis turbine, developed by the General Electric Company in the United States, is also made by the Allgemeine Elektricitäts Gesellschaft in Berlin. This turbine has a vertical shaft, and the steam is directed upon the rotor blades by nozzles, in which it attains a high velocity. The number of pressure stages in this turbine varies; the first had two, but they are constructed now with four or even five for the larger sizes.

No evidence is wanting to prove the complete success of the turbine as a substitute for the stationary piston engine. Various methods have been tried for the regulation of turbines so as to maintain a constant speed under varying loads. The throttle governor, which is placed in the admission pipe, and which lowers the steam pressure entering the engine, has always had a bad reputation, especially for piston engines. Parsons used from the beginning a method which is now very generally employed. The governor actuates the opening of a valve which has an oscillatory motion, and the extent to which it is opened depends upon the load upon the turbine. The steam is thus admitted to the turbine in a succession of gusts, the frequency of the gusts being dependent upon the speed of the turbine and the intensity upon the degree of opening of the valve as controlled by the governor.

In conclusion, the author says that for efficiency there is no question about the value of the turbine. The large piston engines of 4,000 to 6,000 horsepower as used for driving electric generators are the last of their kind. With a steam consumption of 6.8 kilogrammes per kilowatt-hour for units of 1,000 kilowatts, and of 6.5 kilogrammes for larger sizes, the turbine is assured of a future which is no longer threatened by the piston engine. It is not, indeed, the engine of the future, but of the present.

Electrical Extensions in Puebla, Mex.

The properties of the Puebla (Mexico) Tramways Company which were recently purchased by a Canadian syndicate comprise about 20 miles of track. C. H. Cahan, representative of the Canadian syndicate, says that the 20 miles of existing track will be electrified and about 25 miles more added to the system. The same syndicate has also purchased the properties of La Compania Anonima del Alumbrado Electrico de Puebla. The plans for improvements and extensions of these two systems call for an expenditure of about $6,000,000 gold. These two companies were among the interests of the firm of Werner, Beit & Co. of London. The lines are operated by mules and have been a paying investment.

Puebla has a population of 90,000 people. The largest cotton mills in Mexico are situated near the city and the new owners intend to extend the suburban lines to these great industries, handling freight as well as passengers. The Mexican Light and Power Company, which has its generating plant at Necaxa, and is now furnishing electric power and lights for Mexico City, El Oro and other places, is closely affiliated with the new owners of the Puebla street-railway systems and the electric-light and power plant of the town. The transmission line of the Necaxa plant will be extended to Puebla. It is estimated that 10,000 horsepower could easily be sold in the city for manufacturing purposes, exclusive of that necessary for operating the consolidated street-railway system.

The Illumination of a Working Office.

E. R. Roberts, in the publication known as The Nernst Glower, says that in the lighting of working offices he would emphasize one point which is not usually conceded by the architect, viz., the unfitness of bracket lights for this particular purpose. The location of these brackets usually makes them ineffective for either general or local illumination, and being directly in the line of vision, they are frequently more of a hindrance than otherwise in visual work. When local illumination is a necessity, a shaded incandescent lamp, mounted on the desk and to the left of the worker will prove more effective and economical.

In a general office of light finish and fair dimensions whose floor area is, for example, 40 by 60 feet, and where flat-top tables and desks predominate, superior results will be obtained with a system of general illumination entirely. Such a system would involve the use of medium-sized units fitted with diffusing globes and mounted directly on the ceiling of ordinary height, a sufficient number of units being used to break up all shadows. Selecting the three-glower Nernst lamp, with its high efficiency and natural downward distribution of light, as an especially desirable unit for this purpose, one of these lamps should be allowed for every 200 square feet of floor area.

In the small office, however, with roll-top desks, placed back-to-wall around the sides of the room, the above treatment is not always applicable, and individual desk lights will often be found necessary, unless the desks can be placed in such a position with respect to both the natural and artificial light sources, that the worker will never be handicapped by his own shadow. With desk lights properly located and shielded, a moderate general illumination should also be provided by one or two Nernst lights at the ceiling, allowing 500 square feet of floor surface for three-glower lamps or 400 square feet per four-glower lamp. This general illumination will be sufficient for ordinary work in any part of the room.

While the drafting room is to be classed as an office, yet somewhat different treatment than that outlined above will be required. Theoretically, one might be led to believe that a system of general illumination is the ideal for this purpose, yet actual experience indicates that, with a reasonable expenditure of energy, such a method is impracticable.

The draftsman, as he bends over his work, requires the light to shine in under him rather than down upon him, and will usually welcome a system of individual lights in preference to an overhead system. In this particular case we are more than usually justified in respecting the wishes of the laymen. The one-glower Nernst unit fitted with a dense opal or small sand-blasted globe and a porcelain-lined reflector which shields the eye is recommended as an excellent unit for this purpose. A trolley support for this lamp with a track running parallel to and over the upper edge of the drawing board will constitute a useful adjunct, permitting the draftsman to change the position of light at will.

Superimposed upon this localized lighting, a relatively low general illumination for coarse reading purposes and to prevent a gloomy effect, may be furnished by three or four-glower Nernst lamps placed at the ceiling in the manner heretofore described.

BOOK TABLE.

Convict Labor. Twentieth Annual Report of the Commissioner of Labor. By Charles P. Neill, Commissioner. Washington, D. C.: Published by the Department of Commerce and Labor of the United States. 1906. Pp. (9 by 5½ inches), 794.

Twice before has the subject of convict labor been made the subject of investigation by the Department of Commerce and Labor. The earlier reports showed that the convict product as a whole was very small when compared with the entire product of free labor in the United States. The present report, which is very extensive, was begun in 1904 by the Bureau of Labor. The report concerns itself with the penal institutions rather than the prisoners. It deals with the number of convicts employed in productive labor in the United States, the industries in which they are at work, the system under which their work was done, the value of their labor, the value of the product turned out, and the number of free laborers that it would require to do the same amount of work. Also the subject of penal and reformatory laws is gone into very exhaustively. It does not appear that convict labor affects the electrical industries, except possibly in the case of a few light and power plants in institutions operated by inmates, where otherwise possibly a score of outside electrical workers might be employed.

QUESTIONS AND ANSWERS.

Proper Allowance for Temperature Contraction in Stringing Wire or Cable.

Question.

A. I. M., Chicago: If it is desired not to have a strain of more than 700 pounds in a steel wire weighing 1.215 pounds per foot after a decrease in temperature of 100° F., is three feet a proper sag in a span of 102 feet?

Answer.

The problem is to determine the exact amount of tightening of the wire in terms of strain on the poles and sag at the center of the span. Formulas will be given from which other problems relative to stringing of wire may be solved:

Let d = sag at center of span = 3
x = ½ length of span = 51
L = exact length of wire in span
w = weight per foot of wire or cable = 1.215
t = tension or strain in wire and on poles

$L = 2x\left[1 + \frac{2}{3}\left(\frac{d}{x}\right)^2\right]$ = 102.235 feet = actual length of wire before contraction.

The co-efficient of expansion for steel is .0000065.

Decrease in length for 100° = 102.235 × .0000065 × 100 = .0664

Length after contraction = 102.235 — .0664 = 102.169 feet.

The tension $t = \sqrt{\frac{x^3 w^2}{3(L - 2x)}}$ = 621.5 lbs.

The sag $d = \sqrt{\frac{3x(L - 2x)}{4}}$ = 2.54 feet.

Therefore three feet is a sufficient sag to take up the wire contraction and give a strain of less than 700 pounds.

In any span of wire supporting itself or uniformly loaded along its length the following formulas apply. The weight per foot, of course, is the weight of the strand, plus that of the cable it carries in the case of a messenger carrying lead cable:

$L = 2x\left[1 + \frac{2}{3}\left(\frac{d}{x}\right)^2\right] = 2x\left[1 + \frac{1}{6}\left(\frac{wx}{t}\right)^2\right]$

$t = \frac{wx^2}{2d} + \frac{d}{6} = \sqrt{\frac{x^3 w^2}{3(L - 2x)}}$

$d = \frac{wx^2}{2t} = \sqrt{\frac{3x(L - 2x)}{4}}$

The letters are the same as used in the code given above.

Height of Telephone Poles.

Question.

K. K., Quincy, Ill.: Which are the more desirable poles in long-distance telephone construction, high or low? If low, do the earth currents injure or improve the talking qualities of the line, and if so, how?

Answer.

All things considered, low poles are more desirable than high poles, because cheaper and more easily procured. However, the higher the wires are from the ground and the farther apart on the cross-arms, the smaller will be the capacity of the line, and, other things being equal, the better will be the transmission. But it is much more feasible to compensate for the capacity of the line by "loading" it with inductance coils than to increase the height of the poles for the purpose of reducing the capacity.

Earth currents are injurious to the talking qualities of the line, as is any other kind of electrical disturbance. The exactness of reproduction of sound in the receiver depends upon how perfectly the electrical wave has retained its form and amplitude and frequency during the process of transmission.

Any current of electricity induced from the earth, paralleling trolley lines, or other sources is superimposed upon this "conversation wave," changing its form and consequently the character of the sound it produces in the receiver.

Over 178 tons of iron were recently poured in one day at the West Allis foundries of the Allis-Chalmers Company. This quantity, which included a single casting, requiring 118 tons, is the heaviest pour run for several months. The big casting is a duplicate of the enormous slide and bed plate now being finished for the Carnegie Steel Company, Sharon, Pa., as a part of a 4,000-horsepower rolling-mill engine. The pouring operation alone on this casting consumed nine minutes. Four ladles of 25 tons capacity each, one of 13 tons and four of five tons capacity, were used in the operation.

CORRESPONDENCE.

Great Britain.

London, July 18.—The agreement between the Postoffice and the Glasgow corporation for the transfer to the state of the municipal telephone system there is generally regarded as the beginning of the end of municipal telephony in Great Britain. The view held by competent authorities is that municipal telephones have been a failure, not from the point of view of the service given in those places served by a municipality, nor perhaps even from the point of view of finance—although this is a very doubtful matter—but from the laxity on the part of the large body of local authorities to take advantage of an opportunity afforded in 1902, practically to take in hand the telephone systems of the country. Really, however, such a failure was inevitable, for it was clearly impossible to have a multiplicity of local telephone services worked in such a manner as to produce harmonious and efficient working. However this may be, the opportunity has been offered but refused to all intents and purposes, for only five corporations set up municipal telephone systems. Glasgow had the shortest license of all, expiring in 1913, and with the hint from the government that no municipal licenses would be renewed, some little difficulty has been foreseen in carrying on the undertaking. The system is to be parted with at a loss of about $75,000 to the taxpayers, albeit an offer from the National Telephone Company to purchase at the capital expenditure was made and refused, so strong are the socialistic proclivities of the Scotch city. However problematic the financial future of municipal telephones may have been, Glasgow may lay the flattering unction to its soul that a $125 service by the company has been reduced to $50 as a result of the municipal competition. What the future attitude of the Postoffice may be none can say, but it can safely be assumed that the city of Glasgow, with its deep-rooted communistic principles, would never have been tempted to part with any of its municipal undertakings—and they are very many—except under the very strongest possible pressure.

With the recent fiasco of the London electrobus still in our minds, and the offers that were said to have been made by well-known battery makers for the upkeep of the batteries, it is interesting to read that no less a worthy firm than the Electrical Power Storage Battery Company hopes shortly to put an electrically driven omnibus upon the streets of London. How soon we are not told, but that the period depends largely upon other factors than the battery is clearly indicated, for in spite of the general view that the battery is the main drawback, the chairman of the company is reported to have said that the success of the vehicle does not depend on the cost of the upkeep of the accumulator alone. If it did, from his experience with other vehicles, he could safely say that there was no reason why electrically propelled omnibuses should not be the solution of the much-discussed question of motor vehicles for such purposes in crowded traffic. At any rate, no one will attempt to discredit a genuine electrically propelled 'bus when it comes along.

The City of London Corporation has decided to promote a scheme of electrically driven ambulances specially constructed for the narrow streets which abound in the city.

A glaring instance of how electric supply has been and is still being hampered in England was afforded a few days ago when the facts were first made public. The Lancashire Electric Power Company sought to supply electrical energy to railways, canals, large manufacturers, etc., over a large area in which are a number of local authorities owning electricity works and which scented in the proposal some competition. The company was willing to fight the matter out on its merits before a committee of Parliament, but the municipalities brought such pressure to bear upon their members of Parliament that the latter utilized their positions absolutely to block the bill until it was amended to suit the wishes of the various authorities. The bill was then shorn of its principal clauses, the promoters confessing that it was virtually no bill at all, or one that was nearly worthless. In practically all the other "power" bills the clauses in question are inserted, and the anomalous position is created that a canal company, for instance, running into both Lancashire and Yorkshire is able to get a cheap supply of power in Yorkshire from the power company and yet is compelled to take its energy in Lancashire from eight local authorities, a condition of things which no one can say is economical.

The terms of an agreement between the Admiralty and the Marconi Wireless Telegraph Company, entered into in 1903, have just been published. The agreement binds the two parties for 11 years from April 1, 1903, with a termination of the agreement at one month's notice should the company's patents be proved invalid at any time.

A receiver and manager has been appointed in connection with the South Wales Electrical Power Distribution Company. As a matter of fact, however, the possibility of the company going into liquidation is more apparent than real, for it has recently been granted powers to raise a further $5,000,000 of capital. It was the first power company to start operations and seems to have been working at a loss so far, but it has a most promising area. G.

New England.

Boston, July 28.—The New York, New Haven and Hartford Railroad Company's directors have decided to equip the Meriden and Waterbury branch with an overhead trolley between Meriden and Westfield, Conn., and to build an electric railway in the highway between Westfield and Middletown, Conn., thus connecting Meriden and Middletown with an electric railway.

The Windsor Locks (Conn.) Electric Lighting Company's stockholders have authorized a consolidation of the company and the Enfield Gas Company, to form the Northern Connecticut Light and Power Company, which will rebuild the Windsor Locks electric-light plant.

The Cambridge (Mass.) Electric Light Company has voluntarily reduced the cost of arc lights furnished the city from $96 to $90 a lamp-year. A short time ago the company reduced the price from $100 to $96 a year.

The Lowell Electric Light Corporation has petitioned for the Massachusetts gas and electric-light commissioners' approval of an issue of 3,250 shares of new stock, the board to fix the price at which it shall be offered to stockholders. The proceeds are to be used in meeting the company's floating indebtedness. The company's capital is now limited to $650,000.

It is reported that the Edison Illuminating Company of Boston will issue new stock amounting to over $1,000,000 next fall. The company's stock now amounts to $11,488,100.

The machinery in the Dana Warp Mills at Westbrook, Maine, is now driven by electric power, and the plant is lighted by electricity.

The Massachusetts gas and electric-light commissioners have issued an order reducing the price of electricity furnished by the Quincy Electric Light and Power Company. The reduction is from 20 cents a kilowatt-hour to 17 cents. Customers of the company had petitioned for the reduction and for better service. The commissioners found that owing to the low rate for street lighting the company was receiving but 11 cents for its entire output. The commissioners intimate that the company should increase its price for street lighting, but state that they have no authority to order such an increase.

The Macalaster-Wiggin Company of Boston has been incorporated. It has a capital of $40,000 and will deal in electrical apparatus. Fred A. Wiggin, Fred S. Macalaster and Joseph A. Wiggin are the incorporators.

Dennis S. Newhall, an employe of the General Electric Company in Lynn, Mass., died at his home in Saugus, Mass., on July 22d. He was 64 years old.

It is reported that the Consolidated Railway Company is negotiating for the purchase of the control of the New London and East Lyme Street Railway Company, which owns an electric railway between New London and Niantic, Conn., via Waterford. B.

New York.

New York city, July 28.—The experimental runs, mentioned last week, made by the New York Central Railroad with the new electric locomotives and cars which will be installed for local service were highly successful and satisfactory, according to Vice-president Wilgus of the road, who was present at the tests. No effort was made to run the locomotive at its full speed, which is 60 miles an hour while drawing a train of 15 cars. The short stretch traversed—between Highbridge and Kingsbridge—made that impracticable. The speed, however, that was made proved again to the New York Central officials not only the availability of the new motive power, but also its advantages over the steam locomotive. The trials were not so much to test the capabilities of the new engines, which have been tested and are now known, as to educate the engineers and trainmen in the operation of the locomotives and cars. Great progress is being made by the construction force of the New York Central in the preparation of the Grand Central Palace for the accommodation of the electric suburban trains. These trains will enter the building below the street floor, which will be turned into a waiting room, ticket offices and other necessary departments. Until the new Grand Central Station is ready, the Grand Central Palace will be used as a terminal for suburban traffic. This will probably be for about two years.

The Cahill telharmonic system for the production of music electromechanically is now being established in New York, and the first set of apparatus is in process of construction under the supervision of J. G. White & Co., the wiring being done by the Lord Electric Company of Boston. This plant is being installed in the large Park & Tilford store on West Thirty-ninth Street, immediately opposite the Casino, and will be operated by a 200-horsepower motor, taking current from the Edison sub-station in the immediate vicinity. The dynamophone, or telharmonium, from which the alternating currents that furnish the music are derived, is practically completed, the keyboard has been set up, and the relay racks are all ready. In all probability music can be heard from this remarkable invention next week. Mr. Oscar T. Crosby, of the Cahill Telharmonic System, a well-known engineer, will be at the exhibition plant almost daily. The first plant comes to New York and the second is now being constructed for the Pacific Coast.

The new plan of cooling the Subway station at the Brooklyn Bridge, involving a draft of air, the temperature of which will be lowered by water pumped from two driven wells at the north end of the station, will be put into operation early next month. The cooled air will be forced by electric fans through ducts which will run along the ceiling of the subway above the station platforms. In this way it is expected that the temperature will be reduced from eight to 10 degrees. The temperature of the water will be from 52 to 62 degrees, and the combined water output of the wells will be 40 gallons a minute. The coils which will receive the water will have a surface sufficient to cool 75,000 cubic feet or more of air a minute. The four fans will be nine feet in diameter.

The grave of Russell Sage is equipped with an automatic electric burglar-alarm system. The steel receptacle containing the casket weighs six tons and cost complete $22,000. C. I. C.

Southeastern States.

Charlotte, N. C., July 28.—It is stated that work has been started on the Nashville-Chattanooga electric railway, or rather on the big dam at McMinnville, Tenn., and that the Illinois Central is interested in the line, which will carry both steam and electric cars. C. H. Fisk is the principal promoter. The power development is on Caney Fork River, known as the Great Falls Power Company.

The stockholders of the Nashville Railway and Light Company have authorized an issue of $15,000,000 five per cent. bonds, half to be placed on the market at once, $6,000,000 to be used in retiring old securities, and the remainder for improvements and extensions. A committee was named to report later on the Newman properties proposition, embracing seven large systems.

The Birmingham Railway, Light and Power Company has declined the franchise offered by the City Council of Ensley, and it is also said that the electric line now building toward Ensley will be stopped at Fairview until satisfactory arrangements can be made.

The committee on lights of the council of Alexandria, Va., has decided to report in favor of the proposition by Edward E. Mandeville of Philadelphia for an electric-light and power franchise for 30 years.

The new machinery for the electric power plant of the Charlotte street railway, at Charlotte, N. C., will begin to arrive in the early fall. The company will adopt the use of gas engines instead of steam for generating current to propel its electric cars. L.

Ohio.

Cleveland, July 28.—The Cleveland Electric Railway Company has made application for an extension of franchises for its 27 lines for 25 years on the basis of seven tickets for 25 cents, transfer privileges entitling passengers to go any place on the lines, such extensions as are deemed necessary and the construction of rapid-transit lines where needed.

The Little Miami Light, Heat and Power Company of Cincinnati has been incorporated by Walter C. Taylor, H. U. Farrei, Henry S. Rockwell, C. W. Spicer and Edward Schlesinger. It is proposed to "harness" the waterpower of the Little Miami River between Morrow and Plainville for the production of electrical current for light and power. An auxiliary steam plant will be used. At first current will be furnished to the towns and villages between Morrow and Plainville. The power will be furnished by means of a series of dams between the points named. There are perhaps a dozen towns and villages between these places and near them that can be reached easily with transmission lines from the various power stations that are to be built.

It is reported that about two miles of track is being constructed near one of the large electrical manufacturing plants upon which experiments with the invention of Mayor Tom L. Johnson of Cleveland will be made. The car that he has worked out is suspended from steel runners on tracks of angle iron, so arranged that the cars cannot get off. By means of magnets above the tracks and in the roof of the car it is floated, as it were. Mayor Johnson believes that he has a car that will travel at the rate of 400 miles an hour.

The Lake Shore Electric Railway Company has advanced the wages of motormen and conductors one cent an hour, commencing July 1st. This was done in consideration of the fact that the men worked hard when the company was not in good condition financially and stayed with General Manager F. J. Stout, although there was much to make dissatisfaction at the time.

Frank DeHass Robinson, who was interested some years ago in the street-railway business in

Cleveland, is preparing to ask for franchises on a number of unoccupied streets, both on the East and West sides of the city. It is stated that he will offer to operate the lines on a three-cent fare with universal transfers. Mr. Robinson is one of the incorporators of the Cleveland Traction Company, which was organized some five or six years ago. O. M. C.

Michigan.

Grand Rapids,, July 28.—The Benton Harbor-St. Joseph Railway and Light Company has submitted a proposition to the city of Benton Harbor to light the city on an all-night schedule. The old contract calls for a moonlight schedule, 1,200-candlepower light at $45 per light per year. The company proposes to furnish 2,000-candlepower lamps on an all-night schedule at $55 per light. The city has 125 arc lights.

Surveyors for the proposed Detroit and Grand Rapids motor road report a feasible route between Ithaca, Carson City, Palo, Long Lake and Belding, and into Grand Rapids.

The Owosso City Council has turned down an application of J. A. Thick for an electric-road franchise. Thick objected to a provision for the use of his tracks by another road, should one desire to enter the city.

The chances for a trolley road to enter Pontiac from the north are dead for the present, the line in which Congressman Henry Smith and ex-Governor Rich are interested being given up because of the failure of eastern capitalists to furnish the funds. Mr. Rich and his associates have expended $40,000 on the upper end of the road. However, the construction work may yet be done.

The $7,500,000 bond issue of the Michigan United Railways is to be apportioned, $4,000,000 to take up previous issues of bonds, $2,000,000 for the acquiring of new lines, $1,000,000 for the building of the Lansing and Jackson line and $500,000 for the building of a power plant. The power plant will not be constructed at present, the company depending on other concerns for its current. B.

Indiana.

Indianapolis, July 28.—In addition to three roads in operation in Evansville, the Evansville and Eastern Traction Company, which is to operate between Evansville and Rockport, is pushing the line to a speedy completion. The grading is done and the steel bridges about ready for the rails. Within a year there will be a central traction station for Evansville.

The Marion, Bluffton and Eastern Traction Company opened its line for service between Marion and Van Buren on July 27th. The power is being secured from the Marion Light and Heat Company's plant.

The power house of the Northern Indiana Railway Company at Osceola, near Goshen, wrecked some months ago by a windstorm, is to be rebuilt.

Construction work has been begun on the interurban line between Hammond and Kensington, which is to be one of the important links in the Chicago, Lake Shore and South Bend road. Work will also be begun this month from Hammond to Indiana Harbor, where the company already has a line operating to East Chicago.

Announcement is made that the Indianapolis, Newcastle and Toledo Electric Railway Company is in the market for 10 new and modern interurban cars. The construction and equipment of the company's line is in the hands of the Electrical Installation Company of Chicago.

The court has granted Charles L. Henry, receiver for the Indianapolis and Cincinnati Traction Company, permission to issue receiver's certificates with which to meet the indebtedness of the company and to raise money to complete the Greensburg and Connersville extensions. Mr. Henry gives out a statement showing an increase of 28 per cent. in receipts during the first six months of 1906 over the corresponding period for 1905. S. S.

Illinois.

Peoria, July 28.—Work on the construction of the Alton, Jacksonville and Peoria Electric Railway was commenced at Alton this week. It is expected to build as far as Jacksonville and have cars running by winter. The route from Jacksonville to Peoria has not been definitely settled.

Mayor Dunne of Chicago delivered a speech here tonight at one of the parks. In the speech he predicted that the municipal ownership of the street railways in Chicago would surely come.

Illinois traction officials are now at work on a new schedule for the interurban run for the through service which will be started August 1st. Cars will then be run through from Decatur and Bloomington. The time between the two cities will be two hours and 30 minutes. The present time is nearly four hours on account of doubling back each way at Clinton.

President W. B. McKinley and General Manager L. E. Fischer of the Illinois Traction Company have purchased a private car for their exclusive use which it is said will be one of the handsomest in use on any electric line.

Three electric roads are now seeking entrance to Springfield. They are the Springfield and Southeastern, Springfield and Western, and the Charlestown-Mattoon and Springfield. Two of these are expected to be merged into the first system, and the erection of a union station is planned.

The Illinois Traction Company has announced that it will run a line of refrigerator cars on its interurban system.

Mayor Devereaux of Springfield has introduced a resolution to control the light plant in that city. The city owns the light plant known as the Municipal and leased it to the Capital Electric Company, the lease expiring June 1, 1905. The Springfield Light, Heat and Power Company as successor to the Capital company has failed to turn the plant back to the city and has secured an injunction restraining the city from taking possession.

The municipal light committee of Mason City has accepted the bid of Rudolph, Kleybolt & Co. of New York for the $11,000 in 4½ per cent. bonds required to construct the municipal lighting plant. The plant will be commenced at once and is expected to be running by November 1st.

The Interstate Telephone Company is completing a new line between this city and Trivoli; from there it will be extended and connect with several farmer lines and also the exchange there.

The Du Quoin Rapid Transit Company of Du Quoin has been incorporated with a capital of $50,000 to operate an electric railway. The incorporators are H. E. Ross, William R. Hayes and J. H. Ward.

Manager McQuinston of the Monmouth Telephone Company announces the completion of the line between Monmouth and Burlington. V.

Texas.

Austin, July 27.—The Galveston, Harrisburg and San Antonio Railway, a Southern Pacific line, has recently equipped all of its freight trains which run on the line between San Antonio and El Paso with telephones. An ordinary telephone receiver and transmitter, with all of the usual connections, is placed in the caboose of the train. The wire from the instruments is connected with a long pole which carries a metal hook on the end, which can be thrown over a telegraph line at any place where the train happens to stop. Connection is thus made with the dispatcher's office. The device is especially useful in case of wreck or other accident, in which case instant communication can be made with the headquarters of the line. The sending of a telephone message over the same wire does not hinder the transmission of a telegram at the same time.

It is reported that very satisfactory results have been obtained by the Galveston, Harrisburg and San Antonio, and it is likely that the system of using telephones will soon be extended to include all divisions of the Southern Pacific. The Mexican Central has for some time been experimenting with telephones in much the same way, the dispatcher's offices being all supplied with telephones as well as telegraph instruments. The telegraph wires are used for sending the telephone messages. No direct communication with the trains, however, has ever been effected. W. D. H.

Northwestern States.

Minneapolis, July 28.—The Mississippi Electric Power Company denies that it has any intention of abandoning work on the proposed dam at Clearwater, Minn. Soundings are now being taken, and as soon as the government officials pass on these soundings the actual construction work will be started.

The Grandfather Falls Power and Logging Company of Merrill, Wis., has begun work on its proposed power plant and dam across the Wisconsin River. The contract for construction has been let to John O'Day.

The required stock asked by eastern capitalists to be subscribed locally has been taken at Mankato, Minn., and the promoters will be asked to begin work at once on the proposed street-car system.

The Beloit (Wis.) Council has granted a 35-year franchise to the Rockfort and Interurban Electric Railway Company for a street-railway system. The company agrees to have the line in operation by December 1, 1907.

Thomas Keegan has succeeded J. W. Booth as manager of the North American Telephone Company at La Crosse, Wis.

The concrete dam across Black River at Greenwood, Wis., is nearing completion. It will furnish power for the municipal electric-light plant.

An ordinance is before the Minneapolis City Council providing for city inspection of electric meters.

The Iron River (Wis.) Water, Light and Power Company's plant was destroyed by fire, the loss being about $50,000. The plant is to be rebuilt at once.

S. C. Page, Jr., has resigned as superintendent of the electric-light system at Sleepy Eye, Minn., to accept a position with the Twin City Rapid Transit Company at Excelsior, Minn. R.

Pacific Slope.

San Francisco, July 26.—The Coast Counties Light and Power Company, at a special meeting of its stockholders, held in San Francisco, on July 21st, authorized the issue of $1,000,000 of bonds in denominations of $1,000, and will give a mortgage of all of its properties as security. This company is subsidiary to the Pacific Gas and Electric Company. These bonds will be issued to acquire and extend the plants of three lighting companies in Santa Cruz County.

The United Railroads linemen, who struck in a body a week ago on all of the company's San Francisco electric street-railway lines, are still out. They demand an eight-hour day without any reduction of wages. A nine-hour day has been granted the inside wiremen and shopmen by the company, in order to prevent their joining the strikers. Since the strike, line repairs have been made where trouble existed on the lines by the chief electrician and a very few non-union linemen who have been protected by armed guards.

Articles of incorporation of the Union Home Telephone and Telegraph Company have been filed in Los Angeles, Cal., with a capital stock of $1,000,000, by J. M. C. Marble, A. K. Detwiler, John Van Liew, J. F. Fishburn, F. Wachter, John E. Marble, G. B. Ellis, James Baldwin and A. B. McCutcheon. The company has been organized for the purpose of taking over and combining the home telephone plants in several of the Southern California cities. So far, 10 of these outside companies have been absorbed, and it is understood that options on a number of others have been secured. Of the 10 companies taken over, five have completed plants in operation, the San Pedro, Long Beach, Santa Ana, San Bernardino and Ventura Home Telephone and Telegraph companies. Uncompleted plants of which control has been secured are those at Anaheim, Fullerton, Corona, Colton and Highlands.

The Spokane County Electric Company has been incorporated at Spokane, Wash., with a capital stock of $10,000, by D. L. Huntington, H. L. Bleeker and H. W. Collins. The company has been organized for the purpose of furnishing light to a number of towns in the Palouse country, including Rockford, Fairfield and Latah. The Washington Waterpower Company is believed to be interested in the new company.

Orders have been received at the Mare Island navy yard at Vallejo, Cal., authorizing Master Electrician George Hanscom to make a number of tests of the wireless plants on the coast. If they are satisfactory, it is likely that all vessels carrying passengers up and down the coast will be equipped with wireless apparatus.

The San Joaquin Power Company is preparing to construct two power plants in the Tule River District, Fresno, Cal., costing $10,000. A.

PERSONAL.

Henry Thompson, formerly president of the Metropolitan Street Railway Company of New York city, died at Strawberry Hill, his home in Stamford, Conn., on July 18th.

Leonard Hurtz has resigned his position as superintendent of the municipal light plant at Lincoln, Neb., and will take up the general managership of the Lincoln Telephone Company.

Lee Huff has succeeded N. W. Thompson as manager of the Nebraska Telephone Company's exchange in Lincoln, Neb. Mr. Thompson has been promoted to a position in the general office in Omaha.

W. B. Tarkington of Monroe, Mich., general manager of the Detroit, Monroe and Toledo Short Line Railway Company, has accepted the position of master of transportation of the Milwaukee Electric Railway and Light Company.

Captain Robert W. Hunt, president of the American Institute of Mining Engineers, together with several other members of the Institute, was recently presented to King Edward of England. Captain Hunt is the head of the firm of Robert W. Hunt & Co. of Chicago.

Preston H. Hadley of Bellows Falls, Vt., died in that town on July 17th. He had been treasurer of the Fall Mountain Electric Light and Power Company since its organization, and was prominent in business and municipal affairs of the town. In 1898 he was a member of the Vermont Legislature.

Prof. W. D. Pence, dean of the engineering school at Purdue University, Lafayette, Ind., has resigned to accept a position as dean of the school of engineering at the University of Wisconsin at Madison. Prof. Pence is considered an expert in civil engineering, especially on drainage problems.

Charles Addison Bragg, district office manager of the Westinghouse Electric and Manufacturing Company, Philadelphia, Pa., died in that city on Sunday, July 29th, after an illness of over two months duration. Mr. Bragg was one of the pioneers in the electrical business, he having been associated with the United States Electric Lighting Company as early as 1882. His connection with the Westinghouse Electric and Manufacturing Company began in the year 1889, when he was made the manager of the Philadelphia office, which position he filled successfully up to the time of his death. Mr. Bragg possessed a most genial disposition, which endeared him to all with whom

he came in contact. He was born and reared in Franklin County, Missouri. Following his early education, he attended Yale College, from which he was graduated. He was 56 years old. Mr. Bragg is survived by his wife and one daughter.

G. W. McClure, master mechanic of the traction lines of the Michigan United Railways at Lansing, Mich., has resigned his position to accept the general superintendency of the Norwich and Westerly Railroad Company, at Norwich, Conn. The road is in the course of construction and will be a fast interurban line.

Albert W. Fiero of Chicago, a member of the firm of Robert W. Hunt & Co., engineers, died at Battle Creek, Mich., on July 28th. He was 57 years old and came to Chicago from Joliet. After working as an engineer on various railroads, he became one of the founders of the firm of Robert W. Hunt & Co. in 1888.

James F. Jackson, member of the Massachusetts Railroad Commission, has returned from Europe, where he has been examining safety appliances in use on steam and electric railways. Commissioner George W. Bishop was with him, but has not yet returned. The State Legislature authorized the trip. Commissioner Jackson will make no statement regarding his trip until he makes his official report to the Legislature.

Thomas A. Edison started on August 1st, if his plans were carried out, on a 2,500-mile automobile trip. He was to be accompanied by his wife, his daughter Madeline and son Charles. Three automobiles will carry the party, one machine being loaded with camping equipment and provisions. Mr. Edison's tour, as planned, will be through Northern New York and New England, and then up through Canada, where Mr. Edison will continue his researches into the cobalt deposits of the country.

W. F. Hessel of Chicago has just assumed the position of general sales manager of the Stuart Howland Company of Boston. Mr. Hessel has been identified with the electric supply business for the last 10 years. During the last four years he has been sales manager of the Western Electric Company, manager of the Standard Electric Company of Cincinnati (which is the Ohio branch of the Western Electric Company) and western sales manager of Pass & Seymour of Solvay, N. Y. His friends will regret to learn that he has decided permanently to make headquarters in the East.

Calvin W. Rice of the New York office of the General Electric Company, and very well known and well liked by electrical men, has accepted the invitation of the American Society of Mechanical Engineers to become secretary of that honorable body on the retirement of Prof. Hutton in December. In the meantime Mr. Rice is acting as assistant to the secretary. Prof. Hutton, who is very highly esteemed by the members of the society, and whose services have been of the greatest value in the upbuilding of the organization, will no doubt be made honorary secretary after his unselfish service of nearly a quarter of a century. Mr. Rice is a younger man, but has had nevertheless a wide experience. He is a graduate in engineering from the Massachusetts Institute of Technology. He has had a complete experience in machine-shop practice, operating all manner of tools, having worked up from the bench through various positions. For several years he installed and operated complete steam, hydraulic and electric plants in Colorado and Montana, and later he was electrical engineer of the subways of the city of New York and also of one of the operating departments of the New York Edison Company. For the last three years he has been consulting engineer for the New York office of the General Electric Company, making a specialty of the steam turbine and engaged in the engineering in connection with all manner of prospective propositions. Mr. Rice is a member of the American Institute of Electrical Engineers, American Society of Mechanical Engineers, the Institution of Electrical Engineers of Great Britain (having been proposed by Lord Kelvin), the American Association for the Advancement of Science, and other societies and clubs. The new secretary is personally popular as well as technically well equipped, and is admirably fitted for his new position.

CALVIN W. RICE.

ELECTRIC LIGHTING.

W. H. Reber has been granted a franchise for an electric-light plant in Butte, Mont.

The Woodstock Heating and Lighting Company, a new corporation, with a capital stock of $35,000, has been granted a license to operate in Woodstock, Ill. The incorporators are D. I. Joslyn, George L. Murphy and W. S. McConnell. The main object of the new company is to furnish electric light for the city of Woodstock.

Clay Center, Kan., has voted bonds for the purpose of installing an electric-light plant.

The city of Appleton, Mo., will issue bonds for the construction of an electric-light plant.

E. J. Keisling & Son have asked the city of Richmond, Mo., for an electric-light franchise.

Ottawa, Kan., has let the contract for the remodeling and improving of the municipal light plant.

The Center (Texas) Electric Light and Power Company has been incorporated with a capital stock of $15,000.

Lightning recently struck the electric-light plant at Malvern, Ark., and it was set on fire and destroyed. The plant was owned by B. W. Turner and cost about $5,000.

The Philadelphia Suburban Electric Company has bought the Citizens' Electric Light, Heat and Power Company of Clifton Heights. This will give the company the control of all the electric lighting between Media and Philadelphia, and Chester and Philadelphia. The company will build a new power station near the center of its operating territory.

The Reed City (Mich.) Electric Company, owned by J. H. Andrews, is installing a three-wire system. New poles, wires and transformers are being placed. The new plant will be equipped with a 150-kilowatt Wood alternator and other modern improvements. It will be in operation in a few days.

A permit for the construction of the new distributing station of the Louisville (Ky.) Lighting Company, to be built on Third Avenue, between Market and Jefferson streets, has been issued. The plant will cost $14,000, and is to be constructed of brick and concrete. It will be three stories high and will occupy a site 27 by 105 feet.

The Franklin Water, Light and Power Company of Franklin, Ind., which has been controlled by Chicago people for the last five years, has been sold to the Ferris brothers, owners of lighting and water plants at Yankton, S. D., and Eldorado and Osage, Iowa. Thomas Ferris, now managing the Osage plant, will come to Franklin and assume charge. It is understood some improvements and new equipment will be put in the Franklin plant.

Bids will be received August 10th at the office of the mayor of Mobile, Ala., for furnishing the city with 450 street lights based on a contract for a period of five years; also for a period of 10 years from November 1, 1907; also on the erection on city property and operation of a 600-light plant for a period of 10 years, based on municipal ownership after the lapse of that period. Specifications can be had on application to Mayor P. J. Lyon.

Columbus (Ohio) men are largely interested in the Salt Lake Public Service Company of Salt Lake City, Utah. F. B. Wemple and James M. Butler recently returned from that city, where they took part in the final organization of the company. It will have a capital stock of $3,000,0000 with an authorized issue of $2,500,000 bonds. Of the latter $1,500,000 are to be issued for the construction of the plant and the remainder retained for future extensions. It is said that the company controls most of the water rights within 150 miles of Salt Lake City and has secured a franchise for lighting and heating the city. It will also be able to develop an immense waterpower that will be for sale.

An account of some tests of the Kuzel lamp is given in a recent issue of L'Electricien. As compared with the osmium lamp of Dr. Auer, which required 1.5 watts per candlepower, this lamp only needed one watt per candle, while the practical durability was such that, after burning for 1,000 to 1,500 hours, the brilliancy had only been diminished by 10 per cent. It would appear that the tension of the current during the tests was only 32 volts, though it is said that the lamp can be used on a current of 110 volts. The metal employed for the filament made use of in these experiments (which are set out in a tabulated form) is said to be tungsten, and the mode of manufacture is described. In one of the tests a lamp was still burning brightly after 3,537 hours, the percentage loss of brilliancy being only 10.9.

ELECTRIC RAILWAYS

J. H. Baker has asked the city of Sedalia, Mo., for an electric-railway franchise.

J. W. Mathewson and others of Mammoth Springs, Ark., contemplate a trolley line to Thayer.

The Newton and Northwestern Railway is about to start work on its new power plant in Fraser, Iowa.

The Pottstown and Reading (Pa.) Street Railway Company has passed into the hands of C. Taylor Leland and a number of other Philadelphia capitalists. It is understood that the line will be extended from Saratoga to Royersford and made part of a system which will be built to Sixty-third and Market streets, Philadelphia, by way of Valley Forge and Lower Merion.

Work on the extension of the Sharon and Wheatland electric road from South Sharon, Pa., to Wheatland has been commenced. The intention is to build the road to West Middlesex.

Eastern capitalists are said to be planning to build an electric railroad from Colorado Springs, Colo., to Denver, and also an electric line from Colorado Springs to Pueblo. Rumors of these projected lines have been current for some time.

The Milwaukee Northern Electric Railway Company, which is building a line into Milwaukee from Fond du Lac, Wis., has purchased a site for a large power house on the river front opposite the Hoffman House at Port Washington, Wis. Contracts have been made with the Allis-Chalmers Company and the Power and Mining Machinery Company for $280,000 worth of equipment for the railroad.

As a part of its investigations on the general problem of standardization, the American Street and Interurban Railway Association is asking the co-operation of managers and engineers of street and interurban railways. A data sheet on brake shoes is being sent out from the office of the secretary, 60 Wall Street, New York city. The information thus gathered is to form the basis of the committee report on this subject at the next convention.

An elevated station to be built at Forest Hills, Boston, Mass., will be the largest of its kind in the world. At the new terminal, surface cars will not, as is the case now, ascend to the level of the elevated trains, but will stop on the surface directly below the elevated structure, the unloading platform of the surface lines being directly below the loading platform of the elevated, and vice versa. For the convenience of patrons, however, esculators are to be installed in addition to numerous and roomy stairways.

W. S. Barstow of New York has just returned from Portland, Ore., after a four weeks' trip. He reports that there is in contemplation the building of several miles of railroad extensions in connection with the Oregon Electric Railway Company, for which W. S. Barstow & Co. are now building and equipping about 60 miles of road. It is expected that part of the main line between Portland and Salem will be in operation by September 1st, and that cars will be operated between the two cities by July 1, 1907.

The Strangen-Wick Railway Company, which operates a suburban line near the city of Stockholm, Sweden, has contracted with the Westinghouse Electric and Manufacturing Company of Pittsburg for the electrical equipment of the cars to operate this road with the single-phase system. This recognition of the superiority of American electric-railway apparatus is the result of an elaborate test instituted by the Swedish government about a year ago. In this test, manufacturers of electric-railway systems from America and Europe entered into competition, and the palm was finally awarded to the Westinghouse company, which was then given an order for an alternating-current single-phase locomotive. The order from the Strangen-Wick company calls for the same type of electric-railway motors.

PUBLICATIONS.

One of the latest publications from the Allis-Chalmers Company is Bulletin No. 1505, describing the heavy-duty Corliss engines. Nearly all the parts are illustrated, showing the method of construction and the points of advantage.

The July number of "Everbest" Magazine, published by the Ewing-Merkle Electric Company of St. Louis, tells of the company's products in an interesting manner. It combines electrical information with plenty of good fun.

"The Economical Lighting of Industrial Plants" is the title of a neat little booklet published by the Cooper Hewitt Lamp Company of Pittsburg. It is principally devoted to showing the efficiency and economy of mercury-vapor lamps for illuminating industrial establishments. A number of good half tones show the lamp in use.

Dixon's graphite brushes form the subject of a small pamphlet issued by the Joseph Dixon Crucible Company of Jersey City, N. J. The use of graphite brushes is recommended because of the lower contact resistance and the self-lubricating qualities of the brush. Results of tests by Prof. A. F. Ganz, of Stevens Institute, are given.

The 1906 catalogue from the Sturgess Engineering Department of the Ludlow Valve Manufacturing Company, Troy, N. Y., describes the company's new vertical type waterwheel governors. The new governor described has a number of features which are quite novel and have elicited great interest on the part of hydraulic engineers. The book is very attractive and its 62 pages contain some excellent illustrations and a large amount of information on the subject treated. Sturgess governors now

regulate plants aggregating over 150,000 horsepower where every hydraulic and load condition is represented.

A little booklet from the Steel City Electric Company, Pittsburg, Pa., contains a wealth of information about contractors' supplies, such as locknuts, bushings, floor outlets, insulator supports, beam straps, reaming devices, hand conduit benders, etc. The company says it will give its customers "the best goods, prompt delivery and the lowest prices."

Some interesting points for central-station men are contained in a booklet from the Nernst Lamp Company, Pittsburg, Pa., in which is presented an argument in favor of the Nernst series alternating vertical-glower street-lighting system. The booklet shows where Nernst lamps may be used to advantage, and there are some comparisons of street illumination. The lamp and its parts are illustrated, and diagrams are given of transformer connections.

The Stanley-G. I. Electric Manufacturing Company's bulletin No. 611 is devoted to the G. I. snap switch, one of the most reliable snap switches on the market. Stanley-G. I. circular No. 784 is devoted to the G. I. incandescent lamps, which are furnished for all circuits and conditions. The G. I. incandescent lamp, in common with the G. I. arc lamp, has a reputation for being ultra high-grade and of long life and high efficiency. Stanley-G. I. circular No. 781 describes the G. I. type J primary fuse box or transformer cut-out. Either circulars or bulletin may be had by addressing the home office at Pittsfield, Mass.

A sensible and attractive evidence of the intelligent effort now making by American manufacturers to secure and extend foreign trade, particularly in Central and South America, is a handsome pamphlet entitled "Industrias y Productos de Westinghouse." The booklet is printed in Spanish, but, as may be imagined from the title, it has to do with Westinghouse industries and Westinghouse installations. It is handsomely illustrated, and with its 64 pages and tasteful cover it demonstrates that the literature of the Westinghouse Companies' Publishing Department intended for foreign consumption is in no way inferior to that presented in the English language.

The latest catalogue, No. 18, from the Chicago Fuse Wire and Manufacturing Company, 170 South Clinton Street, is on enclosed fuse material, and is very complete. It covers old code fuses to fit cut-outs in common use, 250 and 500 volts; also National Electrical Code enclosed fuses and blocks, 250 and 600 volts. The company will be glad to send this catalogue to anyone upon application. The company is turning out very high-class goods, this department being under the direction of its engineer, Mr. C. T. McDonald, who entered the employment of the company on March 1st. Prior to that time he was with the Underwriters' Laboratories, having supervision of tests. Box bulletin No. 17, from the same company, refers to Union outlet combination switch boxes.

SOCIETIES AND SCHOOLS.

The executive committee of the Central Electric Railway Association has decided to hold the first after-vacation meeting on September 26th at Robinson Park, west of Fort Wayne, Ind., a beautiful resort on the Fort Wayne and Wabash Valley traction line. It is the purpose of the committee to give the members of the association, their wives and guests an outing. A programme is being prepared which will provide for amusements, refreshments and a general social time. No papers or technical subjects will be discussed at this meeting. Special cars from Ohio and various parts of Indiana will bring the members and visitors to the park.

The Illuminating Engineering Society has adopted a society badge designed by Waldo S. Kellogg. The design is a pleasing one in blue enamel and gold, with the lamp of knowledge, or some other lamp, and the letters I E S as prominent features. Badges will be sold to members on application to V. R. Lansingh, treasurer, 227 Fulton Street, New York city.

TRADE NEWS.

Sealed proposals are being invited until August 11th for installing electric motor, etc., at Vancouver Barracks, Wash. Lieutenant Bates Tucker, Vancouver Barracks, Wash., can give details.

The Bureau of Yards and Docks of the Navy Department is inviting sealed proposals until August 18th for installing an electric elevator in building No. 104 at the Puget Sound navy yard, Bremerton, Wash. Plans and specifications will be furnished by the commandant of the yard.

The San Francisco correspondent of the Western Electrician writes under date of July 26th that the entire plant of the Standard Underground Cable Company, located at First and Linden streets, Oakland, Cal., has been destroyed by fire. The origin of the fire is unknown, but it is believed that it originated in the pattern rooms at the rear of the plant. It is estimated that the loss was about $100,000, and it is understood that the property was insured, and that the company will rebuild. The company has the sympathy of the trade in its untimely loss.

The Union Portland Cement Company of Ogden, Utah, recently ordered two 1,200-kilowatt Westinghouse-Parsons steam turbines for its plant at Portland, Utah. The turbines will operate on 175 pounds steam pressure, 27-inch vacuum, and no superheat, driving enclosed type turbo-generators delivering 480 volts at a frequency of 30 cycles to a three-phase distribution system. The turbines will operate 24 hours a day generating power for motor-driven machinery throughout the mill, and electric locomotives operating between the quarry and the mill.

The Navy Department, through the Bureau of Supplies and Accounts, is inviting sealed proposals until August 14th for furnishing eastern navy yards with the following material: Schedule 66, thermostats, conduit and fittings, insulators, contacts and blades, miscellaneous electrical supplies. On August 21st the bureau will open bids for furnishing western navy yards with the following: Schedule 63, motors, electrical supplies. Blank proposals, etc., can be obtained at the navy pay office in New York or upon application to the bureau at Washington. On August 7th the bureau will open bids for furnishing western yards with a number of motors embraced in schedule 37. Proposal blanks and detailed information can be obtained upon application to the navy pay office in New York or to the bureau at Washington.

BUSINESS.

A 750-kilowatt Westinghouse-Parsons turbine is destined for the Pittsburg Reduction Company's plant at East St. Louis, Ill., operating non-condensing on a steam pressure of 150 pounds.

A full line of Security specialties, made by the F. Bissell Company, Toledo, Ohio, will be found with the Electric Appliance Company in San Francisco and with the same company in New Orleans. These agencies are newly appointed, and are in addition to the distributors already handling this product.

The Engineering Construction and Securities Company, Chicago, has just been employed as contractor and engineer by the Oskaloosa & Buxton Electric Railway Company to construct an electric railway in Iowa. The Engineering Construction and Securities Company has only recently been organized, and this is the first contract undertaken by the company.

The Aiton Machine Company is putting on the market a high-speed 12-spool strander, designed to operate at 1,000 revolutions per minute, and intended for use in the manufacture of hollow clothes-line and other light stranding work where high speed and large output are demanded. The first machine is going to the Malin Company of Cleveland, Ohio.

In the new Public Service Building of the Milwaukee Electric Railway and Light Company, Milwaukee, Wis., there are 40,000 of the various sizes of Blake insulated staples for the installation of telephones. This is an indication of the high esteem in which Blake insulated staples are held for interior telephone wiring. These staples are made by the Blake Signal and Manufacturing Company of Boston.

The De La Vergne Machine Company, New York city, is installing at the E. & G. Brooke Iron Company's plant, Birdsboro, Pa., refrigerating machinery of 350 tons capacity, to be used in drying the air blast for furnaces. Much interest has been aroused among blast-furnace men by this new method, in which the air is passed over coils of pipe containing cold brine or ammonia. Part of the moisture contained in the air is deposited on these pipes, the part remaining being practically constant, so that the humidity of the blast is uniform. Among other important benefits derived from using a dry air blast of uniform humidity are improvements in the quality of iron and greater economy and efficiency in the operation of the furnace. Frank C. Roberts & Co., Philadelphia, Pa., are the engineers.

The following recent sales by the Crocker-Wheeler Company of Ampere, N. J., shows the varied line of customers served: Allentown Spinning Company, one 60-kilowatt direct-current engine-type generator, 125-volt, 675 revolutions per minute; Northern Coal and Coke Company, one 80-kilowatt, direct-current generator, 250 volts; N. J. Zinc Company, four motors, ranging from 10 to 35 horsepower; Haverford College, one 125-kilovolt-ampere engine-type alternating-current generator, 2,300-volt, 60-cycle, three-phase, 257 revolutions per minute; Mohawk Valley Cap Company, one 300-kilowatt direct-current generator, 480-volt, 150 revolutions per minute, one 18-kilowatt direct-current generator, 125-volt, 170 revolutions per minute, and two motors ranging in horsepower from 10 to 75, all of 440 volts; E. I. DuPont Company, one 130-kilowatt direct-current generator, 550 volts.

The Carnegie Steel Company has purchased for its Homestead works two 2,000-kilowatt alternating-current generators driven by gas engines. These units are to be furnished by Allis-Chalmers Company of Milwaukee, and they complete an order recently given for machinery costing approximately $1,000,000 for the Homestead plant. It includes three gas-engine-driven electric units and four gas blowing engines, the aggregate capacity of these machines being nearly 30,000 horsepower. Another sale of gas-engine-driven electric generating units has just been made to the Milwaukee Northern Railway Company (electric), whose plant will represent the largest installation of this kind on the continent, it is said. The power house of this company, which will be situated at Port Washington, Wis., is to contain three horizontal twin-tandem gas engines, each having a rated capacity of 1,500 horsepower, direct connected to three 1,000-kilowatt three-phase 25-cycle alternating-current generators.

ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued (United States Patent Office) July 24, 1906.

826,529. Automatic Stop for Whip Hoists. William D. Baldwin, New York, and John D. Ihlder, Yonkers, N. Y., assignors to the Otis Elevator Company, East Orange, N. J. Application filed March 21, 1904.

A whip hoist is driven by an electric motor. A switch in the path of the rope is arranged to be opened by the latter when its end approaches the limit of its travel. The switch controls the circuit of a holding magnet, which, when broken, cuts off the electrical supply from the motor. The switch also controls the circuit of an auxiliary magnet, which, when broken, establishes a short circuit through resistance across the motor armature.

826,534. Telephone System. Charles G. Burke and Edward J. Burke, Brooklyn, N. Y., assignors of one-half to John Q. A. Whittemore, Boston, Mass. Application filed August 6, 1904. Renewed May 25, 1906.

One feature is the provision of a device for producing a counter eletromotive force connected in series with the battery and the transmitter and parallel with the main-line circuit.

826,542. Telephone Transmitter. Edward E. Clement, Washington, D. C., assignor to the Dean Electric Company, Elyria, Ohio. Application filed May 17, 1904.

A resistance cup or chamber is independently supported within a central aperture in the diaphragm, its outer face being substantially flush with the outer face of the diaphragm. There is direct connection between the diaphragm and cup and an electrode extends into the cup and is rigidly held with respect thereto.

826,551. Electric Signal. Allen B. Dungan, Allentown, Pa., assignor of one-half to George C. Williams, Reading, Pa. Application filed October 17, 1905.

An electric signaling system for electric railways has a single track and turnouts on which to operate. Circuit-closing devices are operable by a car entering from either end of the main line for energizing a pair of signals at one end and a single signal at the opposite end of the main line, thereby indicating the direction in which the car is traveling.

826,565. Trolley Stand. Boniface A. Grasberger, Richmond, Va. Application filed August 17, 190-.

A trolley support is carried by a vertically movable frame, and stops on the base and frame are provided with friction surfaces which coact to raise the frame and permit its position to be reversed when pressed together with sufficient force.

826,589. Electrical Insulator. Max Meirowsky, Cologne-Ehrenfeld, Germany. Application filed January 31, 1905.

A metal cap has an opening at its end, a metal member lying partly in the cap and partly projecting through the opening in the cap. Insulating material surrounding the metal member is partly surrounded by the metal cap.

826,615. Telegraphy. Robert J. Sheehy, New York, N. Y. Application filed October 25, 1902.

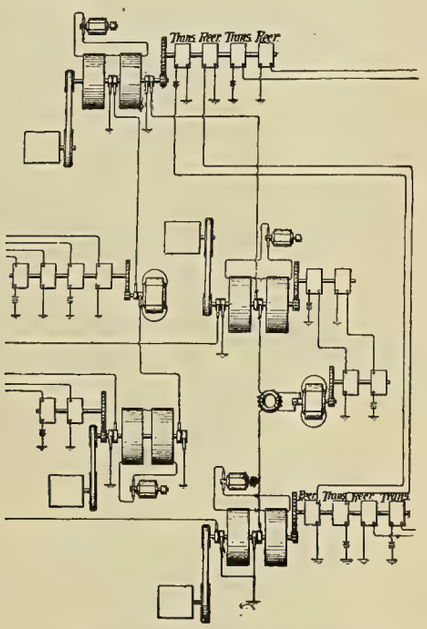
Two synchronously moving alternating-current electric machines are located at distant stations and connected by a synchronizing line. Combined in the system are a series of printing-telegraph instruments, one series at each machine, whose type wheels are mechanically driven thereby, a clutch connection between each type wheel and its driving shaft or mechanism, telegraphing lines connecting instruments at one station with instruments at another, and means whereby the type wheels may be arrested by currents transmitted over the telegraphing lines. (See cut on next page.)

826,627. Slow-release Magnet. Louis H. Thullen, Edgewood, Pa., assignor to the Union Switch and Signal Company, Swissvale, Pa. Application filed December 22, 1903.

The combination consists in a slot arm for railway signals with a suitable frame, an engaging finger and levers carried thereby, and a magnet and armature. The armature when attracted by the magnet holds the finger and levers rigid, the magnet being provided with a closed circuit which upon interruption of the current normally flowing through the winding of the magnet retards the release of the armature.

826,629. Cord-suspension Electric Dental Engine. John V. Trenaman, New York, N. Y. Application filed July 21, 1905.

A suspensory member sustains the weight of a motor. A number of conducting wires are disposed adjacent to the suspensory member and the motor mechanism is connected with the wires and driven thereby. There is a covering common to the suspensory member and the conducting wires.



NO. 826,615.—PRINTING TELEGRAPH.

826,650. Pole-piece for Electric Machines. Niels A. Christensen, Milwaukee, Wis. Application filed April 11, 1901.

An integral pole piece formed as a separate structure has its front face laminated by means of plates bunched together in contact with each other. The back is a homogeneous block or body cast upon the plates and adapted to fit a field frame.

826,668. Dynamo. Ernest C. Ketchum, Boston, Mass. Application filed July 3, 1905.

In the rotatable member of a dynamo-electrical machine are combined a shaft, two sets of metal disks thereon, insulations between the disks, tubular members connecting the disks of two sets in pairs, and other means for electrically connecting the disks of the two sets in series.

826,680. Multiple Switchboard Construction. Benjamin F. Merritt, East Orange, N. J., assignor to the New York Telephone Company, New York, N. Y. Application filed August 7, 1905.

In a multiple switchboard a horizontal fireproof partition extends from the rear of the switchboard between the multiple and answering jacks. Cables carrying conductors are supported upon the partition, and skinners or extensions of the conductors are connected to the jacks. Fireproof partitions separate the space occupied by the skinners into sections.

826,686. Telephone Support. William B. Oliver, Baltimore, Md., assignor to the Oliver Manufacturing Company, Philadelphia, Pa. Application filed October 14, 1904.

A telephone support designed to swing from an upper to a lower position is described.

826,742. Process of Reducing Metallic Compounds and Producing Carbides. Edgar F. Price, Niara Falls, N. Y., assignor to the Union Carbide Company, Niagara Falls, N. Y. Application filed October 13, 1903. Renewed January 18, 1906.

This and the following patent refer to a process of smelting a charge of divided materials which consists in preheating the charge by showering it through a hot atmosphere, collecting the showered particles into a body, and electrically heating the body to the required temperature by an electric current passing through a resistance conductor. (See cut.)

826,743. Process of Reducing Compounds and Producing Carbides. Edgar F. Price, Niagara Falls, N. Y., assignor to the Union Carbide Company, Niagara Falls, N. Y. Application filed October 16, 1903. Renewed January 18, 1906.

826,744. Apparatus for Reducing Metallic Compounds and Producing Carbides. Edgar F. Price, Niagara Falls, N. Y., assignor to the Union Carbide Company, Niagara Falls, N. Y. Application filed April 4, 1904. Renewed January 18, 1906.

826,745. Apparatus for Reducing Compounds and Producing Carbides. Edgar F. Price, Niagara Falls, N. Y., assignor to the Union Carbide Company, Niagara Falls, N. Y. Application filed April 4, 1904. Renewed January 18, 1906.

This and the patent immediately preceding refer to an apparatus for smelting divided materials, comprising means for preheating the material by showering it through a hot atmosphere, an electric resistance furnace, and means for charging a body of the preheated material into the furnace.

826,752. Signaling System for Elevators. James B. Smalley, Chicago, Ill., and Charles A. Reiners, New York, N. Y., assignors to the Elevator Supply and Repair Company of Illinois. Application filed May 24, 1905.

An electrically-controlled signal is carried by the elevator car, and electrically-controlled signals are located along the elevator shaft, one at each floor, a commutator being adapted to determine the time when the signals shall be operated, and in part comprising two series of contact plates. Each of the floors is served by one of the floor signals, a plate of one of the series being connected therewith, and a plate of the other series being connected to the source of supply through a switch controlled by hand-operated mechanism located at the floor. The commutator also comprises two brushes, one for each series of plates and relatively movable over the same, the brushes being electrically connected whereby electrical connection is made between a plate of each series, the car signal being in circuit with a third brush on one of the series and connected to the source of supply in parallel with the floor light.

826,782. Trolley. John Grundl, Pittsburg, Pa. Application filed December 11, 1905.

An improved trolley wheel and harp is described.

826,799. Trolley-pole Controller. Andrew L. Prentiss, Buffalo, N. Y. Application filed May 10, 1905.

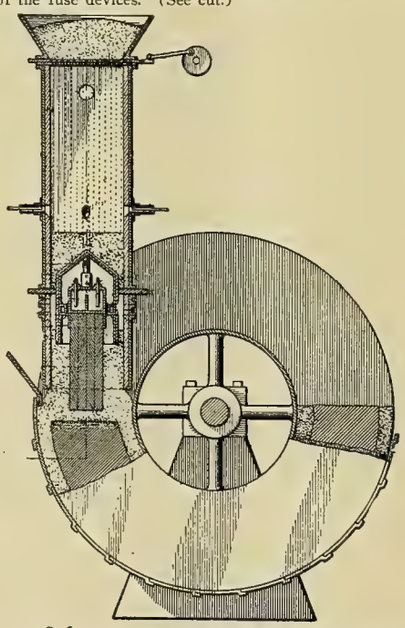
A spring is connected with the pole for normally pressing the trolley wheel against the conductor. Means for depressing the pole include a pressure cylinder containing a piston. A valve mechanism is mounted on the pole and controlled by the movements thereof and operating to admit the pressure fluid to the cylinder when the pole rises above its operative position.

826,845. Safety Device for Overhead Electric Conductors. Emile Giraud, Paris, France. Application filed April 10, 1905.

An insulating device for overhead conductors is described.

826,888. Fuse Block. Joseph Sachs, Hartford, Conn., assignor to the Johns-Pratt Company, Hartford, Conn. Application filed June 24, 1902.

Means are provided for independently securing the fuse devices to the movable part, which means are adapted to be actuated exteriorly of the movable part. Means receive the terminals of the fuse devices, at least one of which means is adapted to be electrically open-circuited when the fuse device terminals are received therein, and there are means actuated by a movement of the movable part and fuse devices for making and breaking the electric circuits through the fuse block by way of the fuse devices. (See cut.)



NO. 826,742.—PROCESS OF PRODUCING CARBIDES.

826,910. Thermostatic Magnet Protector. John Thulin, Chicago, Ill. Application filed December 12, 1904.

Included in the device are the following: A magnet coil directly connected at one end to one side of the line, a metal plate disposed in surface contact with the magnet coil and electrically connected therewith, a spring-actuated circuit-closer carried by and insulated from the plate and connected with the other side of the line, a body of low-fusible metal disposed on the plate and engaging the free end of the circuit-closer to maintain the same at one limit of its movement and normally maintain the circuit through the coil closed, an insulating block carried by the plate, and a terminal mounted on the insulating block in the path of the circuit-closer, the terminal being connected with the first-named side of the line and adapted, when the metal is fused and the circuit-closer released, to short-circuit the magnet coil.

826,916. Insulator. Samuel Bartley and William O. Bartley, Calhoun, Ill. Application filed January 2, 1904.

An insulator comprises a two-part casing, the parts being provided at one side with intergaging retaining hooks and lugs and upon the opposite sides with locking lugs. Insulating material within the casing comprises sections having an opening for the passage of a conductor wire therethrough and a locking plate.

826,938. Telephone Attachment. Frank F. Howe, Cleveland, Ohio. Application filed January 23, 1906.

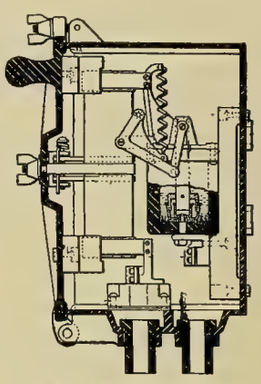
The attachment comprises a bracket for supporting the receiver.

826,962. Electric Furnace. Benvenuto Platschick, Paris, France. Application filed November 27, 1905.

An electric muffle comprises a recipient of fireproof material, a heating conductor secured in the wall of the recipient, two contact pieces projecting from the lateral face of the recipient and connected to the conductor, a bed plate, a casing on the bed plate to receive the recipient, the casing having apertures in one wall for the passage of the contact pieces, and spring contacts on the bed plate to engage the contact pieces.

826,974. Electric Cut-out. Herbert E. Trumbo, San Francisco, Cal. Application filed November 20, 1905.

Combined are a base, a fuse holder revolubly mounted thereon, a number of removable fusible sections carried by the holder, contact pieces at the ends of the holder and receiving the ends of the sections, spring contacts engaging the contacts, the holder having spaced peripheral flanges, and spring clips secured to the base and extending up along the sides of the holder between the flanges thereof.



NO. 826,888.—FUSE BLOCK.

826,999. Electrically Operated Block-signal System for Railroads. Lester Dickey, Perry, Iowa, assignor to Elza S. Stoots, Perry, Iowa. Application filed December 6, 1905.

Electromagnets on normally closed circuits sustain signals out of the danger-indicating position. A train-governed relay normally retains the magnets on a closed circuit, and is designed to break the circuit of the magnets on the entering of a train into the block, whereby the signal devices are freed for assuming the danger-indicating position.

827,054. Railway Signaling System. Charles P. Breese, Norfolk, Va., assignor to the Hall Signal Company of Maine. Application filed August 11, 1902.

The combination consists of a contact conductor, a return conductor, a feed wire, means permanently connecting the contact conductor to the feed wire, a signal, a circuit for actuating the signal and a circuit for controlling the actuating circuit, the controlling circuit being controlled by the means connecting the contact conductor with the feed wire.

REISSUE.

12,510. Electric-controlling Device for Cars. James H. K. McCollum, Toronto, Canada. Application filed June 18, 1906. Original No. 817,264, dated April 10, 1906.

In an electric-controlling device for cars is combined a compound wound motor, a suitable controller, a variable resistance therefor, automatic means used in connection therewith for reversing the relation of the armature to the fields, means for short-circuiting the motors and a regulator located in the local or short circuit and designed to throw the resistance in or out of the local or short circuit.

PATENTS THAT HAVE EXPIRED.

Following is a list of electrical patents (issued by the United States Patent Office) that expired on July 30, 1906:

407,761, 407,762 and 407,763. Calelectric Generator. E. G. Acheson, Pittsburg, Pa.
407,781. Galvanic Battery. W. P. Kookogey, Brooklyn, N. Y.
407,799. Telephone. J. Trowbridge and S. Sheldon, Cambridge, Mass.
407,844. Alternating-current Electric Motor. E. Thompson, Lynn, Mass.
407,875. Alternating-current Dynamo. G. Pfannkuche, Cleveland, O.
407,895. Electric Lighting System. F. E. Kinsman, Plainfield, N. J.
407,896. Insulating Composition. F. Marquard, New York, N. Y.
407,914. Electric Projector. J. J. Wood, Brooklyn, N. Y.
407,931. Galvanic Battery. C. J. Hirlimann, Fort Lee, N. J.
407,938. Insulating Composition. F. Marquard, New York, N. Y.
407,945. Electric Clock for Use in Exposed Places. A. Speer, Passaic, N. J.
407,973. Electric Lamp Support. A. T. Thompson, Boston, Mass.
408,016, 408,017. Electric Meter. E. R. Knowles, Brooklyn, N. Y.
408,018. Electrical Indicator. E. R. Knowles, Brooklyn, N. Y.
408,042. Electric Signal Box. D. A. Palmer, Englewood, Ill.
408,045. Protecting Case for Armatures. A. L. Riker, New York, N. Y.
408,112. Means for Measuring and Regulating the Charge and Discharge of Secondary Batteries. W. P. Kookogey, Brooklyn, N. Y.
408,151. Electric Eyeglasses. H. Welcker, Berlin, Germany.
408,157. Electric-measuring Instrument. J. A. Barrett, Brooklyn, N. Y.
408,182. Alloy for Secondary-battery Plates. E. R. Knowles, Brooklyn, N. Y.
408,194. Electric Switch. H. T. Riggs, Farmington, Me.

WESTERN ELECTRICIAN

EVERY SATURDAY

Vol. XXXIX. CHICAGO, AUGUST 11, 1906 No. 6

The Testing of Electric Meters.

By Emile Guarini.

The importance of periodically testing electricity meters is well recognized. In order to facilitate this testing operation a well-known firm of electrical manufacturers in Berlin has recently introduced an arrangement which will not fail to interest the readers of the Western Electrician.

As may be seen from the accompanying illustrations, the necessary apparatus, such as ammeters, voltmeters, wattmeters, switches and resistances, are mounted upon a wooden board, which is easy to be moved. Upon this board there are fixed three panels of 45 by 50 centimeters, which can easily be replaced. These panels in their turn support the testing devices. To prevent any damage to the panels, and in order at the same time to insulate the box of the meter, the meters may be fixed on china supports, a suitable number of which are placed at a suitable distance upon the panels. If the meters are of different sizes, it is well to have some panels in reserve for each size. Each meter can then be placed without loss of time with the corresponding panel upon the board. Instead of china supports, use may also be made of a universal regulatable means of suspension, which must be of such a size as to be applicable for various sizes of apparatus.

This having been done, the meters are inserted easily at any ends of flexible cables, in the circuits of which the conductors are placed permanently behind the switchboard.

These verifying plants adapt themselves to the kind of current and to the various types of tests. In practice, we distinguish the verification of continuous-current meters by means of the current of the distribution of electricity, by means of batteries of accumulators for the circuit of intensity and the circuit of tension, by means of the current of distribution for the circuit of tension and of a battery of accumulators for the circuit of intensity. Then there is the verification of the alternating-current meters for non-inductive charge with the current of distribution. Finally there is the verification of the alternating-current meters and of the three-phase-current meters for inductive load with the current of a three-phase service. In this latter case it is absolutely necessary to have three-phase current at disposal. If there is only alternating current at disposal, and if it be desired to verify alternating meters with inductive load or three-phase meters, recourse must be had to a converter, transforming the alternating current into three-phase current.

Fig. 1 represents the test of a continuous-current meter, with two conductors for a minimum intensity of 30 amperes and a tension of 300 volts. The measurement of the intensity and that of the tension is effected by means of an ammeter of precision, without coefficient of temperature with shunts, and also of a voltmeter of precision. To the left of the board there is the main switch of bipolar type. Below there are four hand switches of single-pole type. These latter are intended for closing the field of measurement for the ammeter; they control the various shunts arranged behind the board. To the right, above the table, there are other switches which lead to the charging resistances and permit of the gradual modification of the intensity. The charging resistances are either incandescent lamps or constant resistances with asbestos insulation; they are arranged behind the board in such a way that the troubles due to light and heat are excluded.

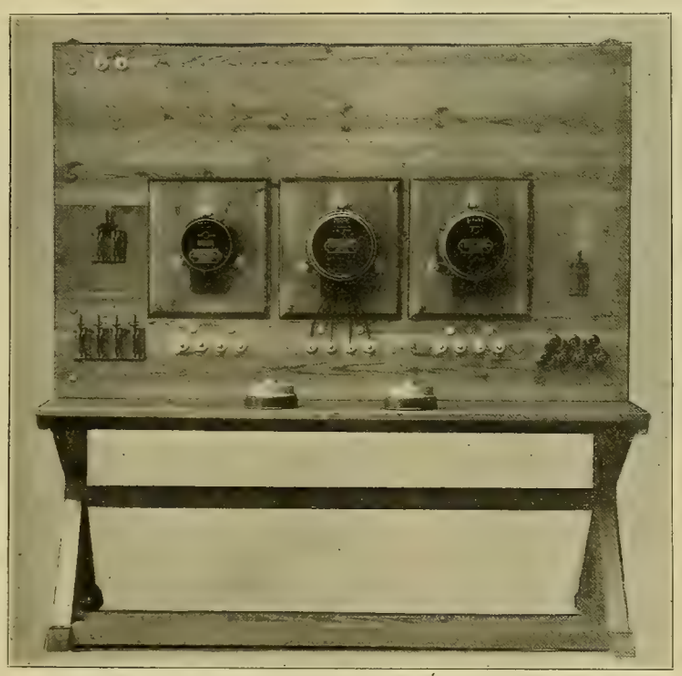


Fig. 1. Arrangement for Direct-current Meters with Two Conductors.

Fig. 2 represents a plant for continuous-current meters, with two conductors of 400 volts, 300 amperes maximum. The regulation of the main current, supplied by some large secondary elements, is effected by means of the resistance, which will be seen to the right. This resistance permits of obtaining any current intensity comprised between 0.2 and 300 amperes. The tension circuit is connected either to a tension battery or to the service direct. The switches shown to the right and left at the upper portion of the board serve for connecting up and disconnecting the tension and intensity circuits. The switches placed in the lower portion are intended for the selection of the shunts for the apparatus for measuring the intensity.

This arrangement can also serve for the verification of the three-conductor continuous-current meters, charging uniformly one after the other or simultaneously the two branches. If it be desired to verify a three-wire distribution meter, the branches of which are charged simultaneously, but unequally, recourse will be had to the arrangement for the verification of alternating meters with non-inductive charge by means of the service current.

This latter arrangement is shown in Fig. 3. It is similar to that described in connection with Fig. 1; the only difference is that the instruments of precision are replaced by technical instruments. These latter serve solely for regulation and rapid examination; the exact knowledge of these dimensions is not necessary for the measurement. A precision wattmeter suits much better for this purpose. Ammeters with a restricted field can be short-circuited by means of the switches with handles, directly the intensity of the current exceeds the extreme limit of their measuring capacity.

Fig. 4 (next page) shows the arrangement of the verification of alternating-current meters with an inductive charge, and of three-phase-current meters with equal charges on the three-wire (meters for motors) where the current windings only belong to one single phase.

The three-phase meters for unequal loads on the wires can be verified by means of this arrangement by successive measurements of alternating current.

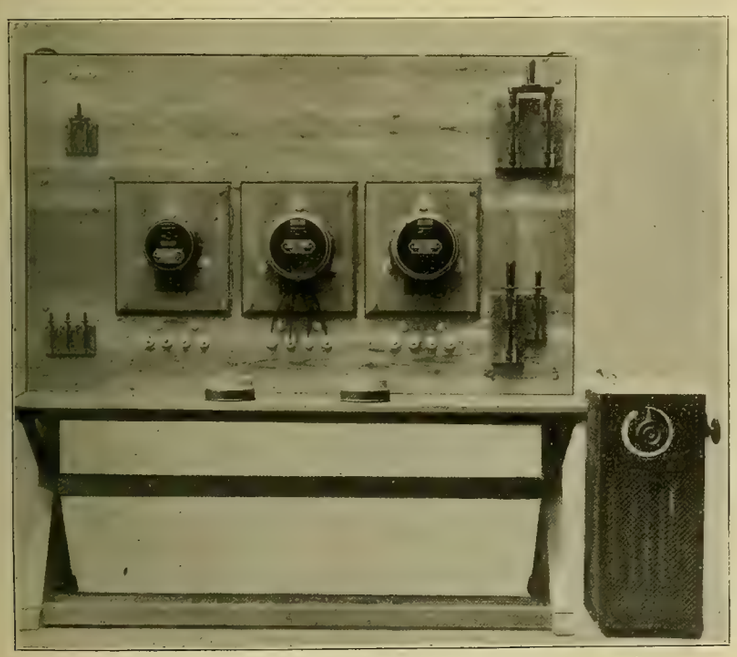


Fig. 2. Arrangement for Direct-current Meters with Auxiliary Resistance.

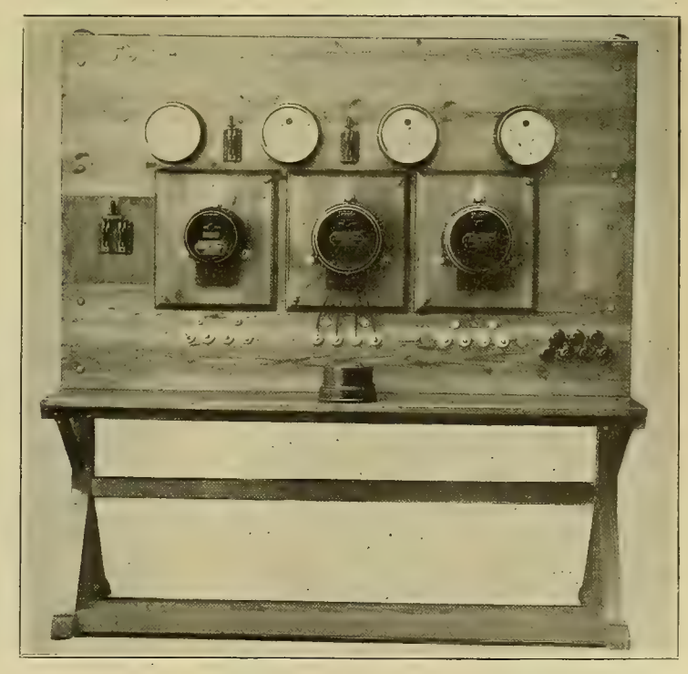


Fig. 3. Arrangement for Three-wire Distribution Meters.

The switchboard is fitted with technical apparatus for the regulation of the potential and of the intensity, which, if need be, permits of the short-circuiting the restricted capacity current indicators. The measurement of the charge is made by means of a precision wattmeter. Below the board of the table there are located the intensity and phase transformers with the regulating resistances belonging thereto. The current transformer serves for the production of low-tension currents. In order

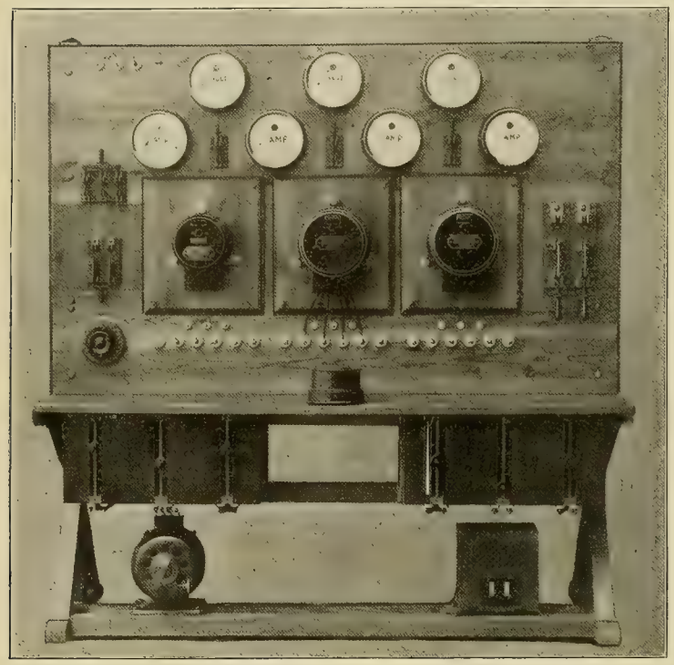
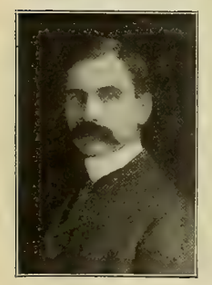


FIG. 4. ARRANGEMENT FOR TESTING ALTERNATING-CURRENT METERS.

to establish, cut off or change the circuit of tension or the circuit of intensity, the board is provided with five switches of different sizes.

Black River (Wis.) Power Transmission.

In the Western Electrician of May 12th last the organization of the La Crosse Waterpower Company to develop the power of the Black River, Wisconsin, and transmit it to Winona, Minn., and La Crosse, Wis., was noted. Since then there have been further developments in this interesting project, the most notable being the retirement of Samuel Insull of Chicago as president, owing to pressure of other duties, and the appointment of William J. Ferris, formerly of the General Electric Company's office of Chicago, and more recently assistant manager of the Illinois Traction System, Champaign, Ill., as his successor. Mr. Ferris, who is general manager as well as president, is taking hold of the project with his accustomed energy and is now making his headquarters in La Crosse, although spending much of his time at the site of the plant, in Hatfield, Wis.



WILLIAM J. FERRIS.

It is calculated that with the fall at Hatfield, and the volume of the river, there can be easily developed 15,000 horsepower. This is to be transmitted about 40 miles to La Crosse and 50 miles to Winona. The voltage of transmission will probably be 60,000, although a lower potential may be employed. Three-phase current will probably be used, and the company has purchased a private right-of-way 80 feet wide on which to erect a double-pole line, one being in reserve, to be used in case of emergency. It is likely that the impulse type of waterwheels will be used, and this will be connected to five 3,000-horsepower generators wound for 2,300 volts. Suitable sub-stations will be built at the terminals of the line, in the cities named, and the current sold for various purposes.

The conditions for building a plant at Hatfield are almost ideal, as the river is confined within banks and bed of granite, in which a steel-concrete dam of the most substantial character can readily be built. This dam will be about 400 feet wide at the top and about 175 feet at the bottom. Operations will be begun at once, and the company announces that it is in the market for the machinery and apparatus which will be needed.

The Electric Car Equipment of the Long Island Railroad.

By W. N. Smith.

When changing from steam to electric motive power on suburban lines, such as those of the Long Island Railroad, the tendency is to convert them into a rapid-transit system of the same general type as the subway and elevated systems now operating in the largest cities.

Frequency and regularity of service are essential to the profitable development of a rapid-transit system. The car service must also be of sufficiently flexible character to meet the fluctuating conditions of the traffic, which are changing from hour to hour during the day, as well as from day to day and from month to month. The now well-known multiple-unit system of train operation, which has been so satisfactorily tested in elevated and underground-railway service, is, obviously, also the best method for the convenient handling of the suburban type of train, where, as in other rapid-transit service, relatively frequent stops are necessary. The distribution of motive power through the train eliminates dead weight, and at the same time utilizes the weight of the train itself to secure the adhesion needed for train propulsion, an advantage which becomes of greater relative importance as the interval between stops is shortened and the train is accelerated from rest more frequently, which is a condition peculiar to rapid transit and suburban passenger service.

The design of the car equipment of the Long Island Railroad is based upon a careful study of the traffic conditions as they were outlined by the railroad officials at the commencement of the undertaking, calling for trains with the number of cars varying from two to six per train at different hours of the day, in regular operation, while heavy excursion travel to the beaches and racetracks would occasionally require trains of 10 or 12 cars. Some of the service is express and some local. It was deemed of the greatest importance to provide a single type of equipment that should be uniformly available for all the varying conditions of train service.

The proposed local service on the Atlantic Division involved making stops at an average of about 1.6 miles. The express service originally contemplated between Flatbush Avenue station and Jamaica provided for only one intermediate stop in the 9.63 miles between them. On the Rockaway Beach Division a local train making all stops between Flatbush Avenue and Rockaway Park would average one stop every 0.99 mile, while an express run to Rockaway Park involved a run seven miles in length at the highest practicable speed.

These runs called for a schedule speed, including stops, of about 25 miles per hour for local trains on the Atlantic Division, and about 30½ miles per hour for the express trains. Upon the Rockaway Beach Division, with relatively more frequent stops, the local run called for a schedule speed of about 20 miles per hour, while the express run, with seven stops in the 15.88 miles, called for about 25 miles per hour. The average length of stop was usually assumed at 30 seconds.

The headway of trains on the proposed schedule was, between Flatbush Avenue and Jamaica, about 20 minutes during the greater part of the day, with 10 minutes during the morning and evening rush hours, and 30 to 60 minutes during the early morning hours. During the rush hours express trains were also to be interspersed with locals.

Between Flatbush Avenue and Rockaway Park the local trains were to run on about half-hourly headway during the most of the day, this being changed to 20 minutes during the rush hours and 60 minutes during early morning hours. Express trains were also to be interspersed between locals during the rush hours. The Brooklyn Rapid Transit trains operating over parts of the Long Island lines were to be mostly express, running on about half-hourly intervals during the early part of the day, but from noon until late at night on 15-minute headway.

Upon days when there would be both a race-track movement on the Atlantic Division and heavy travel to the beaches the headway of the combined traffic on Atlantic Avenue was to be reduced to about 3⅓ minutes.

The Long Island Railroad local trains, as originally proposed, were to consist of two and three cars, except during the rush hours, when they were to be of six cars. The express trains were to consist of three cars each. The Brooklyn Rapid Transit trains, on ordinary days, were to be of four cars each, increased to six on holidays.

The maximum possible speed for express runs can be made when all the cars of a multiple-unit train are motor cars. Ordinary schedule conditions, however, usually permit a portion of each train to consist of trailers, and the most severe condition of frequent stops can be met if the proportion of trailers is not more than one trailer to two motor cars. A considerable saving in the weight of the entire train is thus possible without exceeding either the tractive power of the motors or their ability to radiate the heat developed by the frequent accelerations which are the severest tax upon their capacity. In fact, the proportion of motor cars to trailers is based upon the speed and time characteristics of the schedule and the frequency of stops.

The fact that the Atlantic Division is partly in a subway, and the need for interchangeability with the rolling stock of the Interborough Rapid Transit subway, had much to do with the design of the cars. The complete success of the first all-steel passenger cars ever built, and which were designed by Mr. George Gibbs for the New York Subway, led him, in his capacity as chief engineer of the Long Island Railroad electric conversion, to advocate their use on this road as well. To the Interborough Rapid Transit Company and the Long Island Railroad Company belong, therefore, the distinction of being the first railroads in the world to adopt this radical departure in car construction, designed to insure to the public immunity from the danger of fire in cars equipped with apparatus carrying powerful electric currents. The incidental advantages of these steel over wooden cars in superior strength and durability are, of course, likewise of importance in insuring their adoption. It should also be noted that the steel construction adopted does not materially increase the weight over what would be called durable construction in a wooden car, the increased strength and durability being secured without sacrificing operating economy.

FIG. 1. STEEL MOTOR CAR OF LONG ISLAND RAILROAD.

Steel-car Construction.

The principal dimensions of the steel-car bodies are as follows:

Length over body corner posts, 41 feet 6½ inches.
Length over buffers, 51 feet two inches.
Length over drawbars, 51 feet four inches.
Width over side sills, eight feet 6¾ inches.
Width over sheathing, eight feet seven inches.

Width over eaves, eight feet eight inches.
Width over window sills, nine feet one-half inch.
Width over platform floor, eight feet 10 inches.
Height from under side of sill to top of plate, seven feet one inch.
Height from under side of center sill to top of roof, eight feet 9¼ inches.
Height from top of rail to under side of sill at truck center (car light), three feet 3⅝ inches.
Height from top of rail to top of roof with car light, 12 feet three-fourths inch.
The principal dimensions of the steel trailer cars are the same as those for motor cars, and they

Gauge of track, four feet 8½ inches.
Distance between backs of wheel flanges, four feet 5⅜ inches.
Height of truck center plate above rail, car body loaded with 15,000 pounds, 31½ inches.
Height of truck side bearings above rail, car body loaded with 15,000 pounds, 35½ inches.
Wheel base, six feet eight inches.
Weight of truck complete with two gears, but without motors, 13,800 pounds.
Weight on center plate, with car body loaded, 30,885 pounds.

Fig. 2. Steel-car Multiple-unit Train in Service.

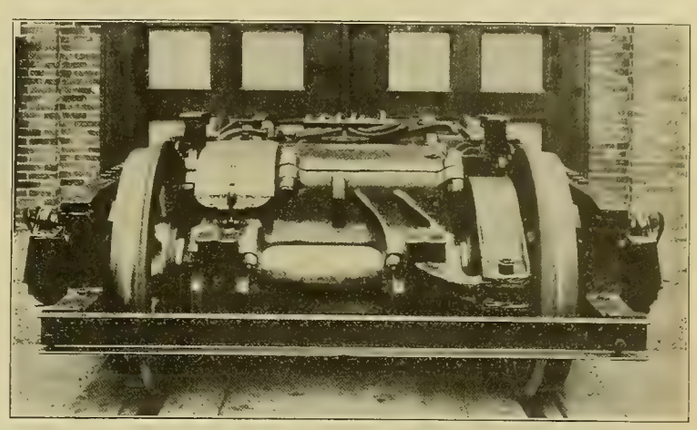


Fig. 3. Motors and Truck.

ELECTRIC CAR EQUIPMENT OF THE LONG ISLAND RAILROAD.

may, if desired, be readily converted into motor cars.

While the conformation of the car body is practically identical with the conventional type of steam-railroad coach, the adoption of steel as the constructive material is responsible for some differences in the general designs of car framing that have been hitherto followed in wooden-car construction.

The side sheathing of the car consists of steel plates one-eighth inch thick, their lower edges being flush with the bottom of the sill. The bulb angles which form the belt rail and the window sills overlap this sheathing. The post covers between the windows are of special pressed steel, flanged out at their lower ends to fit over the belt rail, which runs along the entire length of the car body outside of the posts.

There are 130 motor cars and four trailers, all of which were built at the Berwick (Pa.) shops of the American Car and Foundry Company. They

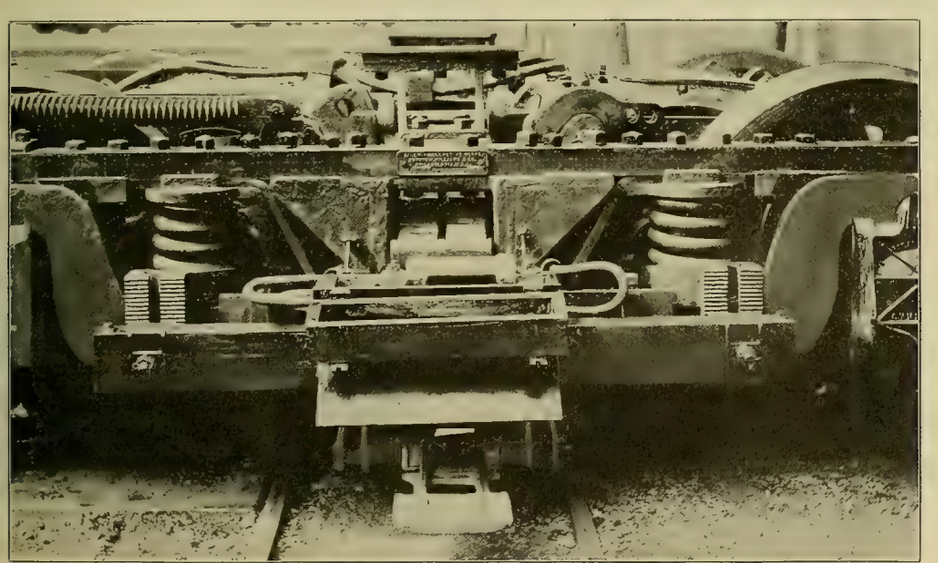


FIG. 4. THIRD-RAIL SHOE, FUSE AND CONNECTIONS USED ON LONG ISLAND RAILROAD.

were personally designed by Mr. George Gibbs, chief engineer of electric traction of the Long Island Railroad, and a number of United States and foreign patents have been issued to him covering the various features of the construction.

Fig. 1 is a view of the completely equipped steel car, showing the vestibule end door closed, as it appears when the vestibule is being used as the motorman's compartment.

Trucks.

The motor and trailer trucks are of the M. C. B. type, the wheel base of the motor trucks being six feet eight inches for 36-inch wheels, the trailer trucks having five-foot six-inch wheel base for 30-inch wheels. The distance between truck centers is 34 feet. General dimensions of the motor truck are as follows:

Weight of one motor on truck transom, 3,500 pounds.
Torque of one motor on truck transom, 3,000 foot-pounds.

Third-rail Shoes.

The standard third-rail shoes on the Long Island cars are of the hinged-slipper type, supported on the usual wooden beam, which is clamped against the notched face of the equalizer-spring seat castings, providing means for vertical adjustment. Upon the center of the beam is placed a 600-ampere enclosed-type fuse, in a wooden box, with a hinged cover, and lined with asbestos. The arrangement is shown in detail in Fig. 4.

Trains from the Brooklyn Rapid Transit Company's elevated lines operate over the Atlantic Avenue and Rockaway Beach divisions by way of Chestnut Street Junction to Rockaway Park.

The Brooklyn Elevated lines have been for some years operated by the third rail, but the location of their rail is 22¼ inches outside and six inches above the track rail, while the Long Island Railroad third rail is 26 inches out and 3½ inches up. This made it necessary to devise some form of adjustable third-rail shoe which would operate with equal facility over both third rails and be able to change from one to the other at reduced speed without requiring attention on the part of the motorman or train crew. Such an arrangement has been worked out, and patents on it have been applied for by Mr. James C. Boyd. It consists essentially of a hinged-slipper type of shoe, mounted upon a movable lug, which is held in either position by means of coil springs, and is actuated by an arm that engages with a stationary cam mounted alongside of the track in line with the third rail. The movement of the car past this cam in one direction changes the shoe from the inner to the outer low position, while a reverse movement of the car past the cam changes it from the outer to the inner raised position. These adjustable shoe equipments have been fitted to such cars of the Brooklyn Rapid Transit Company as are to operate over the lines of the Long Island Railroad.

Air Brakes.

The cars are equipped with hand brakes and with the Westinghouse "quick-service" automatic air brake. This brake is of the new design, developed from the quick-action brake. Compressed air is supplied to the system by a Westinghouse D-2 electrically driven air compressor on each motor car, controlled by a standard form J Westinghouse governor. This pump has a rated capacity of 24 cubic feet of free air per minute, and supplies both the air brake and the pneumatic-control system, but the brake and the control systems are operated from separate reservoirs.

Electrical Equipment.

The selection of the electrical equipment of the motor cars, whether operated singly or in trains, required the most careful study of the loads to be handled, the schedule conditions under which the apparatus is to be operated, and the limitations of the apparatus itself. Whether all cars of a train should be motor cars; whether all axles of the motor cars should be equipped; what the motor characteristics, the ratio of gearing, and the wheel diameter should be; the maximum speed that could be depended on to make up time, and the amount of time to be allowed for "laying over" at terminals, were, among others, considerations of the utmost importance in coming to a decision on the equipment that would most economically serve the purposes of the Long Island Railroad suburban lines.

The variable number of motor and trailer cars per train caused some variation in the load per motor on different trains. There were also various classes of express and local service to deal with, involving different schedule speeds and average lengths of run between stops, for all of which it was desirable to provide a uniform equipment, so that any car could be devoted to any desired type of service without discrimination. The motor equipment to be adopted must handle traffic efficiently under any and all of the varying conditions of train weight and schedule speed that occur in the operation of the suburban lines of the Long Island Railroad.

Careful investigation showed that the greatest flexibility would result from a two-motor-car equipment, using the most powerful motors practicable. The limitations were mainly the dimensions imposed by the largest trucks that could be operated under the conditions prescribed by the tunnel and curve clearances, which restricted the wheel base of the motor truck to six feet eight inches. This restricted the size of the motor to about 200 horsepower, and the study of the conditions was consequently reduced to an examination of the characteristics and gear ratio most suitable for this motor, and of its power of endurance to resist overheating.

The general result of the motor computations, as determining the size of the car equipment, was that a medium gear ratio (25:58 for the No. 113 Westinghouse motor) was fixed upon, and the number of motor cars and trailers per train was recommended in accordance with the following table:

Length of Train.	Local.	Express.
2-car train	2 motor cars. 1 No trailers.	1 motor car. 1 trailer.
3-car train	2 motor cars. 1 trailer.	2 motor cars. 1 trailer.
4-car train	3 motor cars. 1 trailer.	2 motor cars. 2 trailers.
5-car train	3 motor cars. 2 trailers.	3 motor cars. 2 trailers.
6-car train	4 motor cars. 2 trailers.	3 motor cars. 3 trailers.
7-car train	4 motor cars. 3 trailers.	4 motor cars. 3 trailers.
8-car train	5 motor cars. 3 trailers.	4 motor cars. 4 trailers.

Motors.

The motors are of the No. 113 Westinghouse type, both mounted on one truck. The cast-steel

frame is split at an angle of 45 degrees horizontally, the axle bearing being in the lower half. The armature can be taken out without removing the motor from the truck by lifting off the top half of the frame; or the motor can be lifted entire from the truck by removing the gear case and axle caps. Access to the brushes and brush-holders is provided through the opening in the frame over the commutator, which extends down well over the axle, making it easy to inspect the motor from the pit. The commutator cover is perforated, and openings in the bearing housings at the pinion end provide for ventilation, which is practically effected by air being drawn in at that end and thrown out through the ventilating cover over the commutator, forming a continuous draft through the motor.

There are four pole-pieces built up with soft-steel punchings and bolted to the top, bottom and sides of the motor frame. The field coils are flat and are formed of copper strap wound flatwise and insulated with treated asbestos ribbon. The coils are held on the poles by brass hangers, independent of the bolts which secure the pole-pieces. The armature is 19 inches in diameter and is built up of soft-steel punchings. Ample space is provided in the core for ventilation. The rotation of the armature draws air in from the outside through the openings in the housing at the pinion end, forces it through the interior of the armature spider and through the openings in the core, thus securing a very thorough ventilation of the entire armature. A view of the motors and truck is given in Fig. 3.

Control System.

One of the most important features in electric-railway development during the past eight years has been the gradual perfection of systems of multiple-unit control, where a number of motors distributed throughout a train can be readily controlled from either end of any one of the motor cars in the train. By the development of this system of control, electric-train operation has been simplified; locomotives and accompanying dead weight have been rendered unnecessary for suburban trains; the number of train and switching movements to accomplish a given result has been lessened, and trains of one or more cars can be made up or cut apart, incidentally affording the greatest possible flexibility in disposition of the cars, to meet the exigencies of traffic.

The Westinghouse electropneumatic multiple-control system was adopted for the cars of the Long Island Railroad. Its special features are as follows:

1. Air operation of main switches.
2. Use of storage battery current for the control of main switches.
3. Indirect system of control from a small master controller with small currents and train line conductors.
4. Automatic progression of switch operation in starting a train.
5. Protective features.

The advantage of air pressure as an actuating force for making and breaking switch contacts is that it permits an application of considerable power at the contact with relatively light and simple means, consisting simply of a piston working in an air cylinder, making contact by air pressure and breaking it by a powerful release spring when the air is exhausted. Contact is thus made certain, and welding is prevented at the contact points with the very heavy operating currents that have to be carried. On account of the great power obtained with a small amount of air the switches can be constructed with large contacts and substantial parts.

The use of storage-battery current for controlling the main switches removes the necessity for using line current at 600 volts in the control system, and, further, relieves it from any bad effects that can result from a fluctuation of the potential on the system. As the loads to be carried on the Long Island Railroad are quite heavy, with the possibility of extreme fluctuations in potential on the line in regular service, this point becomes important. The likelihood of damage to wiring is less, as 14 volts is far easier to insulate than 600. The certainty of action of the control is with this system entirely independent of the line pressure.

The indirect system of control involves the use of main switches on each car, which are actuated by the movement of a master controller by the motorman. This dispenses with the concentration of a large number of cables and contacts where arcs are likely to be frequent and heavy (as would be the case where contacts are made on a controller of the drum type), and distributes the points of contact in a manner that prevents such risks.

The automatic feature of operation is of importance in securing a regular progressive action of the switches independently of the manner in which the motorman may handle the controller, or of any accident that may happen to the train line. The switches are only moved in a certain predetermined manner through a system of interlocks, and the operating current is limited to a certain predetermined amount, ensuring a rate of acceleration that is automatically kept constant, which results in maximum comfort to the passengers and a minimum of wear and tear.

The control system is naturally divided into two general sections: (1) The main motor-control system through whose connections the current from the third rail is fed into the motors and back again into the track return, and (2) the auxiliary control system through which, by means of any one of the master controllers which are placed at each end of every motor car, the motorman actuates the switches which make and break connections in the main motor-control system.

The main motor-control switches are opened and closed by compressed air. The action of the air is in turn controlled by electromagnetic valves which are opened and closed by making and breaking the current in their exciting coils by means of the master controller. These valves are light and easily moved, and the auxiliary control system, therefore, operates with very light currents in a train line of seven small wires taking current from an independent storage battery of seven cells carried on each motor car.

The apparatus constituting the main-control system comprises the following:

(a) Group of unit switches.
(b) Resistances.
(c) Electrically operated line switch.
(d) Supply system, comprising the third-rail shoes, supply mains and bus line, connecting the main-control apparatus on all the cars, including the necessary fuses and jumpers.

The various details of the design have been carefully worked out to make the control as nearly as possible proof against the errors of the operator or against excess or failure of the main-current supply. The connection of the control system with the air-brake system lends itself readily to the introduction of features designed to automatically protect the train from accident.

Fig. 5 is a perspective view of the parts of the electric motor and control equipment, so disposed as to give a clear idea of the manner in which they are related to one another. Fig. 7 shows the control and wiring equipment underneath a steel car.

The auxiliary control system is in no way electrically connected with the main motor-control system or any of the 600-volt wiring, and is absolutely independent of the main-supply system. The apparatus in detail is as follows:

1. Master controller.
2. Line switch cut-out switch.
3. Brake cut-out switch.
4. Overload trip and reset device.
5. Train line.
6. Magnet valves and interlocks.
7. Line relay.
8. Limit switch.
9. Control cut-out switch.
10. Battery-charging outfit.

The trailer cars are fitted with bus lines and their third-rail shoe connections for the main circuit and also with the train line, including the necessary junction boxes and connector sockets for the auxiliary control circuit, these being necessary for connecting motor cars which are separated by a trailer.

There is one master controller at each end of every motor car. This is a very simple device, consisting only of a movable drum carrying contact segments, the contacts being made with stationary fingers. The circuits made and broken by these contact fingers receive their current from the 14-volt storage battery. On the face of the master controller there are nine notches or stops, one in the center and four on either side, which engage the spring catch of the handle. If the handle comes to and remains in the center position when the brake cut-out switch is closed the train-brake relay valve operates to exhaust air from the brake pipe and causes an emergency application of the train brakes. The first notch is really the "off" or coasting position of the controller, and when the handle is at this point the train brakes are not applied, but all switches, including the line switch, are open. Reversal is accomplished by moving the handle to the opposite side of the center notch.

When on the second notch or switching position the controller establishes such connections with the train line that the reverse switch is thrown to the correct position, the line switch is closed, and the switch group closes the circuit of the motors with all the resistance in, thus effecting a slow movement of the train. This, of course, can only happen with all the train-line jumpers connected up, so that the auxiliary control apparatus on each motor car is in parallel across the wires of the train line. A single series of contacts made by one master controller any where

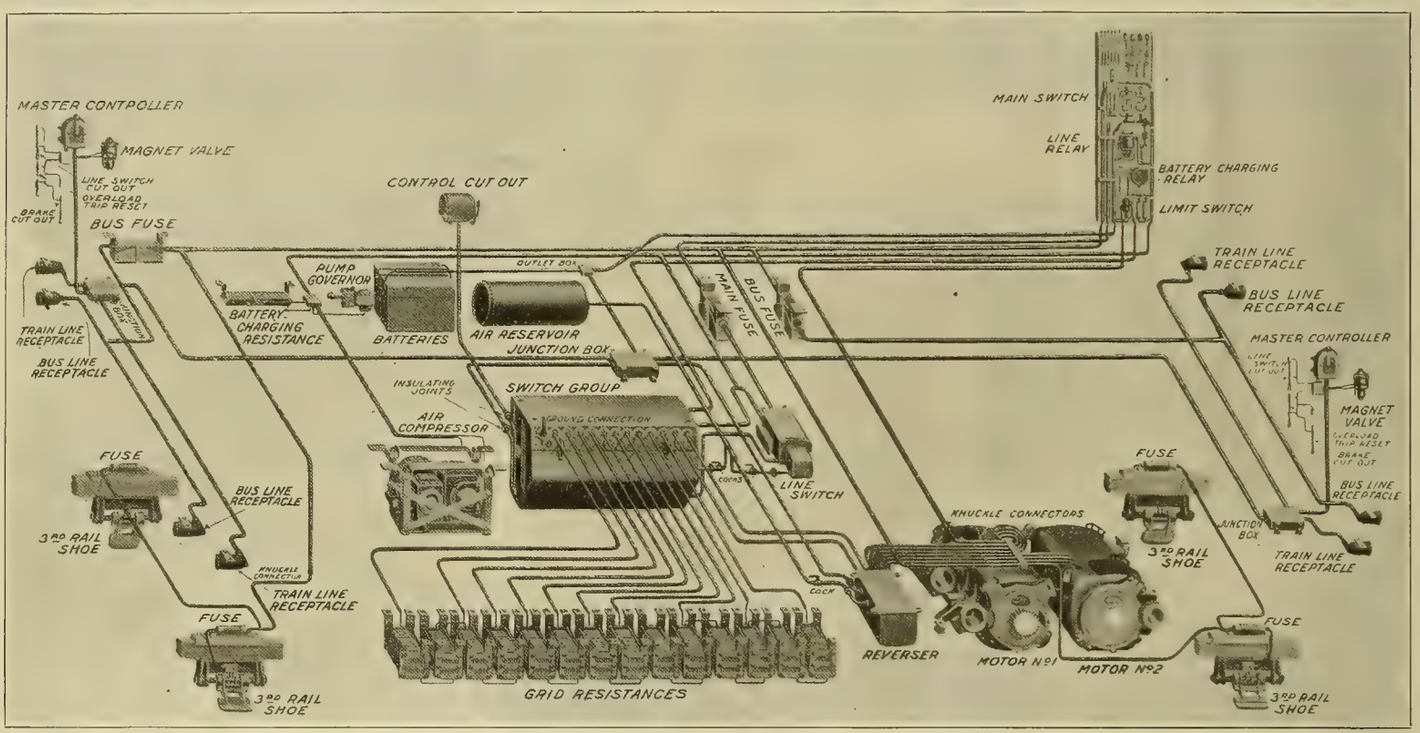


FIG. 5. PERSPECTIVE VIEW OF CAR WIRING AND EQUIPMENT, LONG ISLAND RAILROAD.

in the train-line charges in proper succession all the seven wires constituting the train line throughout the train and causes identical combinations in the auxiliary control circuit devices to be made in all the cars simultaneously.

The third notch is the series running position, and the fourth and last notch is called the multiple-running position, bringing the motors gradually to full speed.

In Fig. 2 is shown a five-car train of steel cars in regular operation on the Rockaway Beach Division.

Lighting.

The lighting of the car is divided into five independent circuits for interior illumination, besides a separate circuit at each end controlling the vestibule dome lights and the signal markers. The incandescent headlight is in series with a resistance and independent of all other circuits. The interior of each car is lighted by 26 16-candlepower incandescent lamps. Two 16-candlepower lamps are placed in each vestibule in such a manner as to effectively light the platform and the steps. One 16-candlepower lamp is located in each marker and a 50-candlepower lamp is placed in the headlights which are permanently fixed on the vestibule roof between the markers. Snap switches are placed within easy reach of the motorman for the control of the headlight, the markers and the platform lights.

Heaters.

The cars are heated throughout with electric heaters of the panel type, each having a ventilated sheet-iron back, and being placed under the seats. There are 24 heaters in the body of the car, and at each end there is one of a special type in the motorman's cab. The heaters inside of the body of the car are proportioned so that each can radiate the heat generated by 600 watts without sufficient rise of temperature to endanger passengers' clothing. The variation in the amount of heat is accomplished by having two sets of heater coils, one of twice the capacity of the other. Either or both sets may be cut in by switches, thus providing three degrees of heat, the distribution being uniform in all parts of the car on any step.

The heating element consists of double-galvanized iron wire, wound spirally, said spiral being then wound around a porcelain spindle, grooved to receive it. Two of these heating elements, one of twice the resistance of the other, are set in a cast-iron frame with a ventilated back lined with asbestos, due provision being made for the ingress and egress of the air, so that it can circulate through the heater.

The heaters in the steel motor cars were supplied by the Consolidated Car Heating Company. Those in the wooden trailer cars were manufactured by the Gold Car Heating and Lighting Company and are of the truss-plank type of construction. The internal arrangement of the Gold heater is of the usual construction, consisting of a special resistance wire wound as a helix and supported on a crimped and enameled steel rod. There are two elements, as in the case of the motor-car heaters.

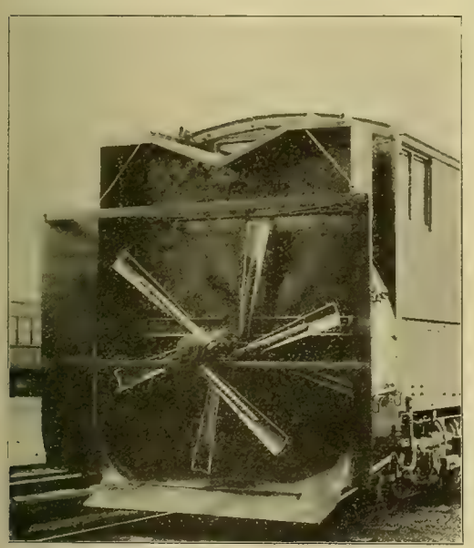


FIG. 6. ELECTRIC SNOW PLOW ON LONG ISLAND RAILROAD.

The heating circuits are controlled by quick-break knife switches mounted at the top of the switchboard panel at the end of the car. Fuses for the heater circuits are mounted directly below the switches.

Wiring.

All wires and cables, for whatever purpose, are run in iron conduit. The sizes of wire used in the car wiring were No. 12 and No. 14 for the auxiliary control, and No. 0, No. 00, 144,000 circular mils and 250,000 circular mils for the main motor-control circuit. These various sizes of conductors are all made up in stranded cables.

In the vestibule at the motor end of the car is mounted the car switchboard. A compartment is provided in the end bulkhead with a metal door lined with asbestos material, which, when opened, exposes the entire front of the switchboard panel. The panel is supported by a steel frame being held in it against a rubber cushion, and arc shields of asbestos are provided at all points where arcing from the switches is liable to reach the framework of the car. Additional insulation is provided in the form of electrobestos at the sides and the top of the switchboard compartment. The power cables are brought into the bottom of the switchboard through loricated conduit, the ends of which are capped with special bell-mouthed castings fitted with rubber rings to prevent damaging the insulation on the cables.

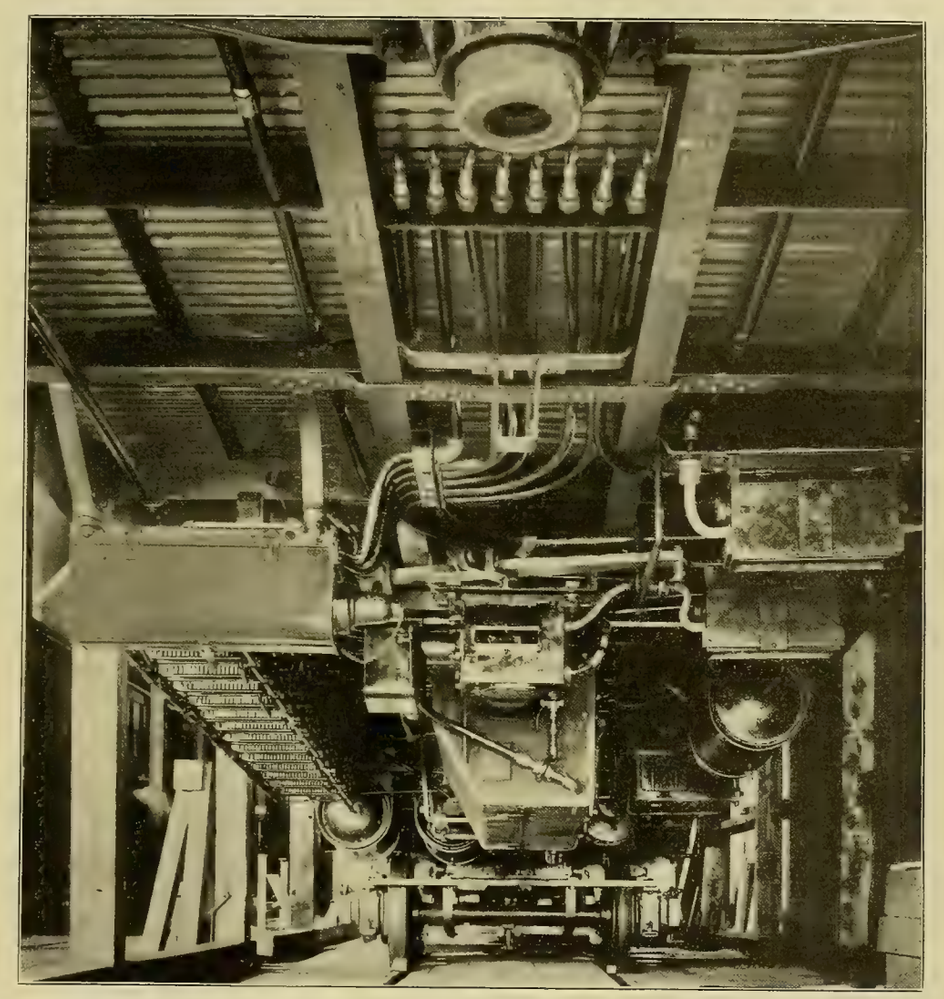


FIG. 7. CONTROL AND WIRING EQUIPMENT UNDERNEATH STEEL CAR OF LONG ISLAND RAILROAD.

Auxiliary Equipment.

The steel cars as thus constructed and equipped have now been in successful operation for over a year.

Besides the steel cars above described, 55 wooden trailer cars which had been built six or seven years previously with a view to using them in electrical trains were equipped to run in trains with the motor cars. Provision had been made in designing these car bodies for conveniently disposing the electric-lighting circuits, but the class of work then in use was not considered safe now. These trailers are 46 feet long and 8½ feet wide over all.

Five electric express cars were provided, equipped with the standard type of motor and trailer trucks, two 200-horsepower standard motors, and with the standard multiple-unit control apparatus. These cars are built of wood, 52 feet 5 inches over all in length, 9 feet 9½ inches in width, and with roof 12 feet 6¾ inches above the top of the rails. They are equipped with standard M. C. B. couplers and haul the old standard steam baggage and express cars as trailers.

A rotary snowplow has also been provided, built by the Peckham Manufacturing Company, and equipped with one motor and one trailer truck of standard type, and all of the standard motor-car electrical equipment. A set of revolving blades with fan and housing is mounted at each end of the car, operated by one line shaft running through the car and fitted with two friction clutches, one for each end section, the center section carrying two 50-horsepower railway type motors, run by a series parallel controller of the standard platform type. A view of the plow is given in Fig. 6.

Conclusion.

With the present account of the electric-car equipment the description of the newly installed system for operating the Long Island Railroad trains with electric power is brought to a close. The car equipment has proved itself in every way equal to the demands made upon it both for regular and emergency conditions of travel. The electro-pneumatic multiple-unit control system has worked perfectly from the start; and throughout the entire installation, including the power station, transmission system, sub-stations and cars, the endeavor was made not only to take advantage of the most recent progress, but, as opportunity offered, to establish new precedents in the art. In achieving the distinction of being the first one of the main steam railroad lines to initiate and make effective the change of motive power for its suburban service to meet the needs of its territory, the Long Island Railroad Company has set an example of foresight, thoroughness and sufficiency in the execution of the undertaking.

The equipment of the steel passenger cars, the auxiliary rolling stock and the building of inspection sheds were carried out by Westinghouse, Church, Kerr & Co., who, as in other portions of the complete equipment, acted as constructing engineers. The entire work of design and construction was in charge of Mr. George Gibbs, chief engineer of electric traction of the Long Island Railroad.

The respective parts taken, first, by the Atlantic Avenue Commission in formulating a concrete plan of improvement of such far-reaching importance, and, later, by the Board of the Atlantic Avenue Improvement in planning and executing the work, and by the Long Island Railroad in co-operating with all the duly constituted authorities for the advancement of a plan so conducive to the welfare of the community served by it, have not been enlarged upon in the foregoing technical description of the work, but they are now matters of history, a full knowledge of which is available for other municipalities and corporations which may be confronted by similar problems.

But the record will be incomplete without an acknowledgment of the credit due to the late Mr. William H. Baldwin, Jr., president of the Long Island Railroad from 1896 to 1905, whose foresight, public spirit and initiative played such a leading part in the solution of a difficult rapid-transit problem. Could he have lived but one year longer he would have witnessed the consummation of his labors, which have conferred a lasting benefit on the community.

Otho G. Bolitho of Penzance, England, has invented an apparatus for catching fish, in which an incandescent electric lamp is used inside a bag net or trap to lure the fish. The lamp cord is supported by the frame by which the net is raised and lowered from the fishing boat.

WESTERN ELECTRICIAN

EVERY SATURDAY.

PUBLICATION OFFICES:

507 Marquette Building, - CHICAGO.

TELEPHONE, MAIN 1746.

Eastern Office, 150 Nassau Street, New York.

Telephone, 8220 Beekman.

Trade Supplied by Western News Co.

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DATES AHEAD.

International Association of Municipal Electricians (annual convention), New Haven, Conn., August 15th to 17th.

Ohio Electric Light Association (annual convention), Put-in-Bay, Ohio, August 21st to 23d.

Colorado Electric Light, Power and Railway Association (annual convention), Denver, September 18th to 20th.

Illinois State Electric Association (annual convention), Springfield, Ill., September 19th and 20th.

Central Electric Railway Association (outing), Robinson Park, near Fort Wayne, Ind., September 26th.

Old Time Telegraphers and Historical Association, and United States Military Telegraphers (annual meeting), Arlington Hotel, Washington, D. C., October 9th, 10th and 11th.

American Street and Interurban Railway Association (annual convention), Columbus, O., October 15th to 19th.

MUCH INTEREST attaches to the report of the directors of the Westinghouse Electric and Manufacturing Company, which is given, nearly in full, in this issue. The report covers a period of six years and gives much interesting information in relation to the financial, engineering and industrial features of a great electrical manufacturing business. The company has extensive foreign relations, having allies bearing the Westinghouse name in Great Britain, France, Germany and Russia. It employs nearly 15,000 hands, exclusive of the selling organization, and has large manufacturing works at East Pittsburg, Cleveland and other places.

That portion of the report dealing with engineering matters will receive especial attention from technical men. Mr. Westinghouse himself, for instance, lays distinct claim, for the company's engineers, to the development and introduction of the single-phase alternating-current railway. Vice-president Osborne says, further, that the system was made possible by the genius of Mr. B. G. Lamme. Another interesting statement is to the effect that at least 45 per cent. of the engineering force is continuously engaged in development work—that is, work for the future. It is greatly to the credit of the great electrical companies of the United States that this enlightened policy of developing the art by research and experiment has been adopted. To this policy is largely due the important position, electrically, of the United States among the nations of the earth. In relation to arc lamps, important improvements are promised which will "revolutionize existing practice." The steam turbo-generator business has increased during the last year (ended March 31, 1906) 94 per cent. over that of any previous year. Referring to long-distance transmission, this is an important quotation from the report: "Our engineers have under consideration today an installation involving the transmission of voltages up to 150,000, and we have several commercial plants in operation and under contract involving voltages of 60,000 to 80,000."

In all, we are sure that this six-year report will be read with attention.

IF EXPERIENCE provides the lamp that lights our pathway, as some epigram-maker has said, then the thoughtful municipal-ownership advocate must see a rather gloomy outlook before him, for the record of municipal ownership in the United States shows many failures and few successes. One of the latest failures is reported from Hamilton, Ohio, where there is a municipal electric-light plant which cost over $100,000 and has been in operation 12 years in a city of from 25,000 to 30,000 inhabitants. Here the conditions should be as favorable as are apt to be found, and yet an official report to the state auditor of Ohio declares (we quote from the New York Times) that the management of the plant has been marked by "mismanagement, extravagance and unbusiness-like methods." One indictment found by the public auditor against the administration of the city lighting plant was "the employment of inexperienced men to superintend important work, where both mechanical and electrical skill were necessary." The report continues:

"In the electrical department the enormous waste of energy, owing to faulty construction, has raised the cost of production of current to an abnormal figure. The operation of the gasworks has been far from economical, and it is an established fact that the cost of production of light and power from both utilities has at times exceeded the schedule rate charged for the service."

But that was not all. In the words of the report, "officials, ex-officials, prominent citizens and others were enjoying free service; while these accounts were duly charged on the books, apparently no effort had been made toward their collection or adjustment. Several individual accounts ranged from $100 to $1,100." At the beginning of the year there was found outstanding more than $35,000 of these uncollected accounts, an amount equal to the entire yearly receipts of the municipal electric-light plant.

The report covered the period from January 1, 1903, to January 1, 1906. It shows, as other similar investigations have shown, that, in this country at least, and probably in all countries, public-utility enterprises of an industrial nature are best conducted by private concerns, suitably supervised for the protection of the community granting the franchise.

EXPORTS of electrical machinery and appliances continue to show the most gratifying increase in value. The total valuation of such exports for the fiscal year ended June 30, 1906, was $14,800,237, compared with $12,253,904 for the corresponding year ended in 1905 (showing an increase of 21 per cent.), and $10,507,013 for the year before that.

But two classifications of electrical exports are made by the Bureau of Statistics of the United States Department of Commerce and Labor (from which these figures are obtained)—"Electrical appliances, including telegraph and telephone instruments," and "Electrical machinery." A more minute classification would be desirable, and it is to be hoped that now that our electrical export trade has reached such handsome proportions the government will undertake to give more detailed information. However, it is to be noted that the exports are divided quite equally between appliances and machinery, 47 per cent. of the total belonging to the former class and 53 per cent. to the latter. Totals in each class by months are given elsewhere in this issue of the Western Electrician. These monthly reports are also interesting as showing that in only three months of the fiscal year did the total electrical exports of the country fall below a million dollars, while two months—December, 1905, and April, 1906—swelled the year's figures by over a million and a half dollar each.

In relation to electrical machinery the government return gives the country of destination, although this information is not given for the electrical appliances, unfortunately. Of the total exports of electrical machinery of $7,869,137, it is shown that British North America was the largest buyer, taking $2,138,134 worth during the 1906 fiscal year. This was also the case in 1905 and 1904, and the increase shown is satisfactory, the respective figures for the three years being $2,138,134, $1,711,981 and $1,403,080. Our second best customer for electrical machinery was the United Kingdom in 1906, with a total of $1,153,528. Mexico came third with $974,248, Japan fourth with $726,492, Cuba fifth with $528,565, Europe outside of the United Kingdom, France and Germany, sixth, with $455,213, Brazil seventh with $397,570, British Australasia eighth with $293,920, British Africa ninth with $249,829, and France tenth with $249,438.

But this order was different in the fiscal year 1905. Then Japan, taking $1,391,877 worth of electrical machinery, was our second best customer; the United Kingdom with $1,088,961 was third, Mexico with $925,065 was fourth, British Australasia with $390,146 was fifth, the Philippine Islands were sixth, South America outside of Argentina, Brazil and Colombia was seventh, Europe outside of the United Kingdom, France and Germany was eighth, Germany was ninth and France was tenth.

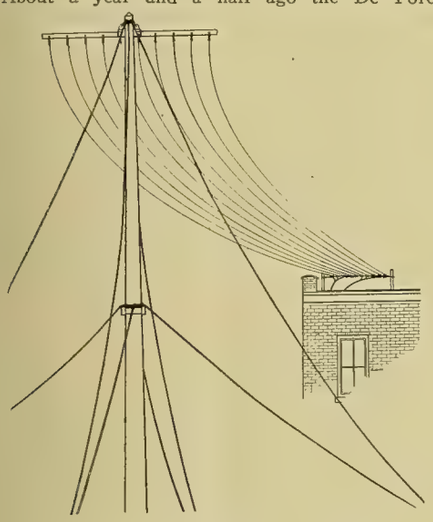
In 1904 the United Kingdom was the second largest importer of our electrical machinery, the figure being $1,323,019; Japan was third with $884,792, Mexico fourth with $564,660, Europe outside of the United Kingdom, France and Germany fifth, British Australasia sixth, British East Indies seventh, Brazil eighth, South America outside of Argentina, Brazil and Colombia ninth, and France tenth.

A study of the destination of American electrical machinery exported for the last three years reveals some interesting facts. Not only is British North America first in rank in each of these years, but with equal persistence France is tenth. An extraordinary increase is to be noted in shipments of this class of exports to Cuba, the valuation jumping from $51,269 in 1905 to $528,565 in 1906. Our four good steady customers are British North America, the United Kingdom, Mexico and Japan, but the last named is not buying from us so much as in former years, as the Western Electrician predicted would be the case in a previous editorial consideration of this extremely interesting subject. China should prove, in the years to come, a larger buyer of American electrical machinery than Japan has ever been.

New Wireless Station in South Chicago.

Space-telegraph stations are increasing in number in the United States, and Chicago is not without its examples. Mention has been made heretofore in the Western Electrician of the several stations in Chicago as they have been completed. The Marconi space-telegraph station at the foot of Oak Street on the North Side was described June 13, 1903. The station has since been purchased by the De Forest company. About a year ago the station at the foot of Oak Street was struck by lightning and has not been in operation since.

About a year and a half ago the De Forest



NEW WIRELESS STATION IN SOUTH CHICAGO.

company built a large plant on South Western Avenue. This plant was built, it was said, for long-distance transmission, especially to the Kansas City and St. Louis stations. What use is now made of this station is not clear. Shortly after the opening of its offices in the Railway Exchange Building (Michigan Avenue and Jackson Street) the De Forest company opened a station in that building. Now another station has been erected in South Chicago, from which, it is believed, racing news is transmitted by wireless to the alleged gambling boat City of Traverse while the latter is afloat on Lake Michigan and thus eluding the authorities, owing to the varying statutes and jurisdictions of the United States and the states of Illinois and Indiana. A sketch of the mast, or pole, and antennæ at South Chicago is reproduced in the accompanying cut.

The pole, 117 feet high, was erected after an injunction had been secured by the De Forest company restraining the city from interfering with it. It is not as substantially built as are the masts at other stations. It has at its top an adjustable cross-arm from which 10 aerial wires are strung. The wires are connected to the cross-arm by long rubber insulators and converge slightly down to the roof of an adjoining building. The aerial wires at their lower end are connected to large porcelain insulators, which in turn are strung upon a wire stretched between two posts. The ends of the aerial wires are then connected to two cables which enter the operating room below. The pole is of heavy construction and well guyed by large manila ropes. From all appearances the pole was put up for temporary use, and can be taken down at a moment's notice.

Niagara Current Operating Street-railway Cars in Syracuse.

The Syracuse (N. Y.) Herald of July 31st gives the news of the actual operation of street cars in that city by electric current generated at Niagara Falls and transmitted 160 miles.

"At nine o'clock this morning the Niagara power was turned into the third big rotary converter at the Rapid Transit company's power house, and every one of the 82 cars on the different lines was impelled by the force of the water at the western end of the state. Everything has been working smoothly since, and Superintendent John E. Duffy says that he expects that the Niagara power will be used continually from now on. The old power and the frequent breakdowns of the old generators are of the past and it is hoped by the company that the old machinery may never be used again. The old machinery, however, will be kept in good repair, to be used in case of emergency. Up to last night the power had been thrown into different lines of the system to make sure that everything was all right, two of the rotary transformers being used. About 3,000 horsepower is being used today, the load being rather light. The transmission line is about 160 miles long."

Alternating-current Wiring.

[From the Question Box of the National Electric Light Association.]

QUESTION.

Where a network of secondaries is tied in together, is it advisable to fuse the section covered by each transformer, and if so, what relation should the size of fuse have to the secondary?

ANSWERS.

E. C. Deal, Hackensack, N. J.: It is advisable to use section fuses, also fuse secondary lead of transformer, using a fuse slightly in excess of transformer capacity. Use section fuse half the capacity of transformer. If secondary system is properly balanced very little current will pass through the fuses under ordinary conditions, but in case of a short-circuit on any section, when all transformers are operating at full load, a momentary 50 per cent. overload on the transformers of adjoining sections will cause the sectional fuses to blow, consequently cutting out the defective section. I am supposing that all transformers are of the same size. Care should also be taken in properly fusing primary side of transformers in use on such a system.

Paul F. Williams, Chicago Edison Company, Chicago, Ill.: When a network of secondaries is tied together it is advisable to fuse the section covered by each transformer. The fuse should bear some relation to the size of the transformer, being about half the capacity of the transformer; the idea being that should the fuses on one transformer blow, the fuses in secondaries will blow, thus indicating, by lights being out, that this section's transformer fuses are blown. Otherwise, transformer fuses may be out and a long length of secondary fed by those transformers whose fuses are still holding, thus giving poor service on the end of the secondary.

W. H. Greenslit, Vicksburg, Miss.: Fusing each section is not done as a rule. However, there are cases when it may prove valuable. The neutral point, or rather the point (between transformers tied together) which carries minimum current at all times, is the place for the fuse. It should have capacity enough to carry the current flow caused by irregularities and changes in load in either section, and should be small enough to protect either transformer from excess load if the opposite transformer for any reason fails.

L. L. Elden, Boston, Mass.: After a number of years' experience under all sorts of conditions it has been found advisable to fuse only the primary side of transformers on a network. Fuses are installed ordinarily which represent a 100 per cent. overload on each transformer.

QUESTION.

Is the Y-connection with grounded neutral preferable to the Delta-connection in a high-tension transmission line, and if so, why?

ANSWERS.

William B. Jackson, Madison, Wis.: The writer is of the opinion that for all high-tension, three-phase transmission lines, of reasonable pressure, the delta connection is far more desirable than the Y-connection, for the reason that it makes it possible to remove any one of the step-up or step-down transformers without interfering with the operation of the system, thus making it so that a transformer may remove itself by opening the protective devices without interfering with the service. The delta arrangement also makes it possible to have a simpler arrangement for cutting in a reserve transformer than with the Y-connection.

Fred W. C. Bailey, Cincinnati, Ohio: The relative importance of certain advantages and disadvantages of the Y and delta connections on high-tension transmission lines is a matter of some dispute. The delta is generally used for straight three-wire three-phase work up to 20,000 volts, but for very high voltage the Y-connection with grounded neutral seems to be preferred, as the rise in pressure on open or short-circuit is not so dangerous and the grounded neutral assists unbalancing.

F. D. Sampson, Charlotte, N. C.: Some of the largest plants recently designed expect to use delta connection throughout. This company operates everything thus connected and there has been no trouble directly traceable to the delta connection. With proper breakdown tests made by manufacturers upon line insulators, transformers, oil switches and alternators the delta connection will remain the more popular connection in three-phase transmission work. The great advantage of the delta connection lies in the fact that you are able to cut a transformer in or out of service without interruption. This is a salient feature where the number of transformers is limited. Grounded neutrals are all right theoretically, but the fact still remains that with the opening of the high-tension circuits they will cause currents to flow to earth. Telephone service is very likely to be interfered with, with grounded neutrals or Y-connected systems.

H. A. Strauss, Allis-Chalmers Company, Milwaukee, Wis.: If Y is operated with grounded neutral it is safer than delta, because the difference of potential between coils and core is limited to 58 per cent. of the line voltage. Y-connected transformers are somewhat cheaper than delta-connected. If transformers are to be operated without grounded neutral the delta is more satisfactory, because operation is not impossible if one transformer of the delta is in trouble or burned out, which is the case when one transformer of a Y is out of service. In general, use delta in all cases except where it becomes necessary to limit the voltage per transformer when Y-connection may become imperative, but if you use Y, operate with grounded neutral.

Electrical Exports for the Fiscal Year 1905-1906 Were $14,800,000.

Electrical exports from the United States for the fiscal year ended June 30, 1906, reached a total value of $14,800,237, compared with $12,253,904 for the corresponding period in 1904-05, and $10,507,013 in 1903-1904. This shows an annual increase for the last two fiscal years of about $2,000,000 in these exports.

Of the total for the 12 months ended with June, 1906, $6,931,100 represents the value of electrical appliances and $7,869,137 electrical machinery.

In the item of electrical machinery only for the 12 months mentioned, British North America was the largest purchaser, having bought $2,138,134 worth, compared with $1,711,981 for the previous 12 months. The United Kingdom was second with $1,153,528, Mexico was third with $974,248, and Japan was fourth with $726,492. Japan fell off from $1,391,877 for the corresponding period ended in 1905. Next in order were: Cuba, $528,565; Brazil, $397,570; British Australasia, $293,920; British Africa, $249,829; France, $249,438; Argentine, $146,424; British East Indies, $110,714.

The following table gives the electrical exports by months for the fiscal year ended June 30, 1906:

Month.	Electrical Appliances.	Electrical Machinery.	Total.
July, 1905	$ 373,191	$ 597,483	$ 970,674
August, 1905	542,270	589,233	1,131,503
September, 1905	386,887	465,882	852,769
October, 1905	454,224	527,669	981,893
November, 1905	546,856	547,738	1,094,594
December, 1905	685,425	840,292	1,525,717
January, 1906	529,253	799,939	1,329,192
February, 1906	544,906	646,532	1,191,438
March, 1906	590,328	705,037	1,295,365
April, 1906	752,039	827,816	1,579,855
May, 1906	709,875	681,955	1,391,830
June, 1906	815,846	639,561	1,455,407
Total	$6,931,100	$7,869,137	$14,800,237

Electrical exports from the United States for the month of June, 1906, amounted to a total value of $1,455,407, compared with $1,101,410 in June, 1905. Both classes of goods—electrical appliances and electrical machinery, the former including telegraph and telephone instruments—show a gain over June, 1905, but the former had an unusually large increase. Figures in detail are as follows: Electrical appliances—June, 1905, $472,154; June, 1906, $815,846. Electrical machinery—June, 1905, $629,256; June, 1906, $639,561.

Considering only goods classified as electrical machinery the following countries were the leading purchasers from the United States in June, the value of the goods exported to each country being given: British North America, $121,202; Brazil, $109,739; United Kingdom, $93,616; Mexico, $46,681; Cuba, $42,680; British Australasia, $40,360; Japan, $37,755; France, $20,335; British Africa, $19,926; British East Indies, $19,182; Philippine Islands, $11,425; Argentina, $8,509; Germany, $8,331; Central American states and British Honduras, $3,452; Chinese Empire, $1,810; European countries not elsewhere mentioned, $39,436; other South African countries, $7,455.

Five-cent Lighting Rate Declared to Be Too Low.

Judge Thompson in the United States Court at Cincinnati has rendered a decision approving of the finding of Master Commissioner T. P. Linn against the city of Columbus in passing an ordinance requiring the Columbus Railway and Light Company to furnish light at five cents per kilowatt-hour. The master commissioner found that the ordinance was unconstitutional, as the price fixed was so low that it amounted to confiscation of property. The court allowed the master commissioner a fee of $6,000, which will have to be paid by the city unless it should win out in the higher courts. City Solicitor George S. Marshall, it is stated, will carry the case to the Supreme Court if a decision in favor of the city is not reached before.

THE SMALL CENTRAL STATION.

Practical Hints on Its Construction and Operation.

CHAPTER VI. (*Concluded*).

STEAM ENGINES.

Type, Size and Cost of Engine.—The type having been settled, then purchase the best engine built of the kind selected. In most cases the station dealt with in this series of articles will find its best service and greatest economy in the simple automatic high-speed engine. Though there is a tendency toward the use of high-pressure steam, it is mainly in large installations; for the smaller plants a pressure of 100 pounds or under is the most approved practice. For this lower pressure the compound engine could not be recommended, nor can it be operated with economy without the use of a condenser, which would raise the first cost of the power plant to a point which would not prove a profitable investment for the small power being considered.

The use of a Corliss engine means either a slow-speed generator that may be belted direct or the installation of an expensive lot of shafting which very quickly more than compensates for any saving of steam at the engine in the power necessary to drive it. The slow-speed generator is almost out of the question in small plants where it is desired to keep the first cost low. For these reasons and because the modern automatic high-speed engines give a very good efficiency the Corliss is rapidly being supplanted by its smaller, cheaper and more flexible rival in the field in which we are to operate.

After the type, the size of the engine must be determined. Upon this point hinges the saving or expenditure of considerable money in the future operation of the plant. In most instances for direct connection or belting the purchaser will select an engine sufficiently large to handle the maximum load on the generator when the latter is working at 100 per cent. load. This is, of course, correct, but the generator should be so chosen that it will be operating at all times on not less than 75 per cent. load, thus insuring to the engine an efficient working load. In other words, determine the average required electrical output and buy as small a generator as is possible, leaving sufficient reserve capacity in the machine to take care of the peak load, and leaving this peak load to be handled by the allowable overload capacity of the generator. With the size of the generator decided upon, the required engine horsepower is immediately settled.

By applying to any builder of high-grade engines and giving him the necessary data, the purchaser will receive information relating to the size of cylinder, speed, regulation, etc., of the engine. The purchase then becomes almost a matter of personal opinion, for practically any of the high-grade automatic high-speed engines on the market at the present time will give satisfactory results if properly installed and operated.

The accompanying prices given on simple engines are averages struck from figures obtained from the leading automatic high-speed engine manufacturers of the day, and are as accurate as it is possible to make such data. It must be remembered that supply and demand regulate such matters, and accordingly market values fluctuate. It may be safely stated, however, that an efficient engine and one that would be recommended by a competent engineer cannot be purchased at a price to any extent lower than that given in the table.

AVERAGE PRICE OF AUTOMATIC HIGH-SPEED ENGINES.

Horsepower	30	40	50	60	70	80	90	100	110	130	150	175	200	250
Size of cylinder (inches)	8X10	9X10	10X10	11X10	11X12	12X12	13X12	13X14	14X14	16X14	16X16	18X18	19X18	20X20
Steam pressure (pounds)	80	80	80	80	80	80	80	80	80	80	80	80	80	80
*R. P. M.	300 to 325	300 to 325	300 to 325	300 to 310	290 to 300	285 to 300	275	275	250 to 275	225 to 275	225 to 250	200 to 225	200 to 225	180 to 200
Cost of foundation	$70	$70	$70	$75	$90	$90	$90	$115	$120	$140	$165	$200	$225	$250
Cost of engine erected on foundation and including cost of same	$775	$845	$890	$945	$1,080	$1,160	$1,245	$1,450	$1,550	$1,775	$1,900	$2,690	$2,955	$3,400

For prices on direct-connected apparatus add to the above figures 20 per cent.
Increase in horsepower on 90-pound steam, 10 per cent.
*In reports received, the engine speeds recommended for any one particular size of cylinder varied between the limits given in the table.

The horsepower of a single-cylinder engine is calculated by multiplying together the area of the piston in inches, the mean effective pressure (M. E. P.) in pounds per square inch, the length of the stroke in feet, and the number of strokes per minute; then dividing by 33,000.

The area of the piston is the square of its diameter multiplied by 0.7854, and the diagram (Fig. 10) furnishes a ready and accurate method of finding the mean effective pressures in any cylinder at any initial pressure or cut-off.

Let it be desired to find the mean effective pressure in a cylinder where the initial pressure is 160 pounds by steam gauge, the cut-off 25 per cent., or one-fourth of the stroke. It will be seen that the expression on the diagram is "absolute pressure," not steam-gauge pressure. The absolute pressure of steam is measured from zero, or perfect vacuum, and consists of the pressure indicated by the steam gauge (which is known as pressure above atmosphere), and the pressure of atmosphere as indicated by the barometer. The latter is for all practical purposes a constant quantity for any given locality and may be roughly taken at 14.7 pounds, corresponding to 29.70 inches of mercury. To the steam pressure, as indicated by the gauge, add 14.7 pounds for total pressure; thus, if the pressure by the gauge is 80 pounds, the total pressure is 94.7 pounds.

Therefore, to conform to the diagram, add 14.7 pounds to the initial pressure, or 160 + 14.7 = 174.7 pounds absolute steam pressure. Now follow along the bottom side of the diagram and the percentage of cut-off will be seen to increase to 50 per cent. gradually, and at the top of the diagram from 50 per cent. to 100 per cent. Fix the eye upon the point of 25 per cent. cut-off, the condition of the problem, and follow slowly up the vertical line or space at this point until it crosses the heavy curved line. Let the eye then follow the horizontal line or space to either side, the reading at this edge will be found to be 58.25 per cent. This is the percentage of absolute initial pressure which equals the absolute mean pressure. Multiply 174.7 pounds by 0.3825, the result is 101.76, the absolute mean pressure; subtracting 14.7, the remainder, 87.06, is the mean effective pressure sought.

The length of stroke is twice the length of cylinder. The number of strokes is the revolutions per minute. Having obtained the correct result from multiplying together these factors, it remains to divide by 33,000 to have the actual horsepower of the engine.

A brief explanation of a condensing engine may interest some intending purchaser. Should it help him to adopt this type of engine, in case the cost of water permit, it will prove worth while.

In the non-condensing engine the steam, after acting on the piston, escapes through the exhaust to the open air; therefore the pressure of the outgoing steam must exceed atmospheric pressure, or 14.7 pounds to the square inch.

Now, if the engine be operated non-condensing, this 14.7 pounds on steam side of piston is balanced by a like pressure of atmosphere on exhaust side of piston, and its effect is annihilated; but if the engine be operated condensing, a large proportion of the pressure of atmosphere on exhaust side of piston is removed, and an equivalent portion of the pressure of atmosphere on steam side of piston made to do useful work. With well-proportioned condensing apparatus the pressure of atmosphere on exhaust side of piston can be reduced nearly 90 per cent., or a vacuum can be maintained in the exhaust end of the cylinder of 13 pounds, and this 13 pounds pressure per square inch of piston is clear gain. When the piston moves forward in an engine the total pressure on steam side at any point in the stroke of piston is the pressure above the atmosphere plus 14.7 pounds, and the total pressure for the whole stroke is the mean pressure above the atmosphere plus 14.7 pounds. Thus, if the mean pressure for whole stroke is 30 pounds, the total mean pressure is 44.7 pounds, and this 44.7 pounds, whether engine is operated condensing or non-condensing, is the variable factor in estimating the load on the engine.

When the resistance of the atmosphere is removed from the piston the steam may be cut off earlier and further expanded in the cylinder. This reduces the draught on the boiler and admits of a slower combustion of the fuel. In this way economy is promoted by condensation of the exhaust steam and by vacuum formed in the cylinder. A vacuum equal to 14 pounds per square inch is a 35 per cent. saving in fuel, or the same increase in power; but this saving undergoes a great reduction in consequence of the cylinder being open alternately to the lower temperature in the condenser, which varies with the degree of expansion employed, being least when the steam follows full stroke, which is very seldom the case. Deducting the power required to work the condenser, the practical gain, therefore, in the condensing engine is from 20 to 30 per cent. (See Fig. 11.)

AVERAGE PRICE OF CONDENSERS.

Horsepower, Single Cylinder.	Horsepower, Compound.	Cost Erected.
40	50	$ 310
60	100	480
100	120	600
120	150	675
150	200	775
200	250	875
250	325	975
320	425	1,200

The accompanying chart (Fig. 12), adopted in the daily report of a number of stations, shows a method of readily distinguishing the average load.

The hourly or half-hourly readings of the daily record are taken from the slip each day, and after dotting the respective points on the chart the line is drawn and the chart filed. It thus becomes a reference readily giving the load carried by any individual engine or dynamo, or combinations of each, any hour of any day.

AVERAGE PRICE OF HIGH-SPEED COMPOUND ENGINES.

Horsepower at 100 pounds steam pressure, one-quarter cut-off	60	80	100	125	150	200	250
Diameter of high-pressure cylinder in inches	8	9	10	11	12	13	15
Diameter of low-pressure cylinder in inches	13	16	18	19	20	22	25
Length of stroke in inches	12	12	12	14	16	16	16
Revolutions per minute	300	300	275	250	225	180	150
Cost of foundation	$95	$115	$140	$170	$200	$250	$300
Cost of engine erected, including foundation	$1,200	$1,450	$1,850	$2,225	$2,475	$3,650	$4,250

Increased cost for direct-connected unit, 20 per cent.

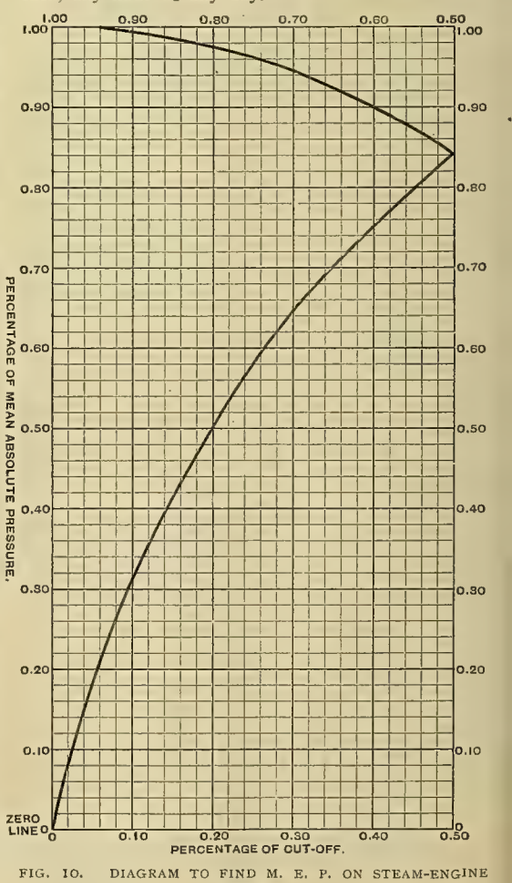


FIG. 10. DIAGRAM TO FIND M. E. P. ON STEAM-ENGINE PISTONS.

Any discrepancy between the load carried and the number of lamps paid for monthly by the customers is shown immediately in comparing the monthly statement of accounts receivable with the station output.

Leaks sufficiently large seriously to impair the

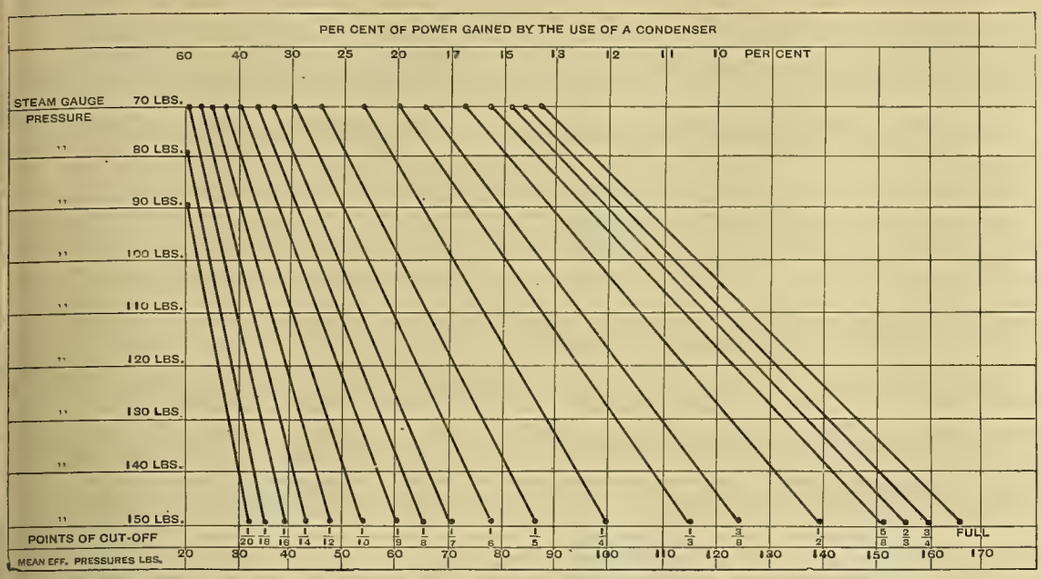
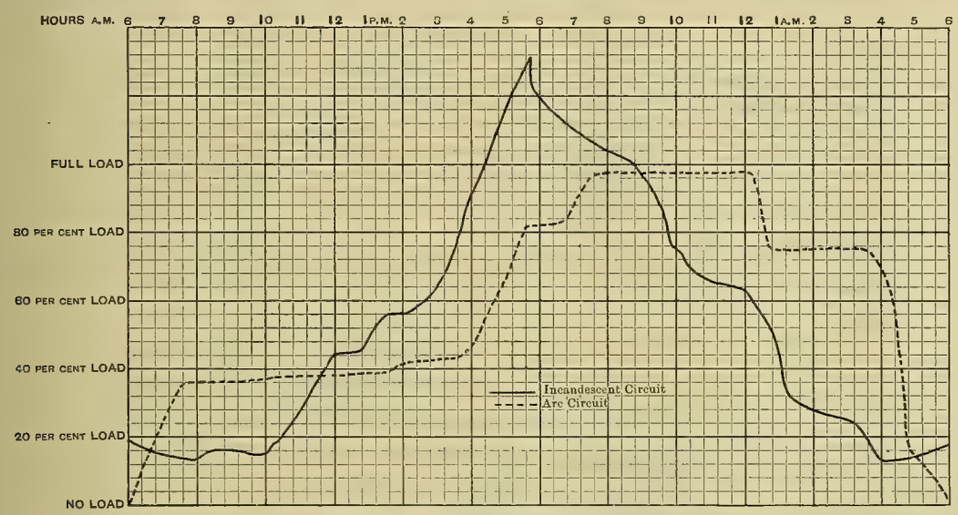


FIG. 11. STEAM CONDENSER DIAGRAM.



In this chart the full load is represented in 60 squares.
The Incandescent Circuit 30 squares or an average load of 50 per cent.
The Arc " 36 " " " " " " 60 " "

FIG. 12. CHART OF DAILY LOAD.

profits frequently exist in the boilers, engines, dynamos, defective circuits or careless employes, and which are readily observed and corrected when the daily load is compared with the receipts.

A rough estimate of the cost of engine and pump foundations may be made from the following average figures: Crushed stone and cement foundation laid, including excavation and cartage, will cost about 40 cents per cubic foot. The capstone will cost for a thickness of six inches about $1.50 per square foot set and ready to receive the engine or pump.

It will nearly always be found desirable to place a steam separator in the live-steam pipe line near the engine. Especially is it desirable to do so when dirty water, which foams readily in the boiler, is used; for then the steam contains much moisture which should be disposed of if the best economy is to be had from the engine. A water trap should be provided also at the low point of the steam line, when it is carried under to the engine, as is becoming the popular practice among good engineers. Where condensers are used and the condensed water used again for steaming an oil separator is essential.

In piping up pumps, pipe of the full diameter of the suction and discharge openings should be used for short lines, and where longer pipes are used this diameter should be increased, especially on the suction line. Also avoid as many bends and valves as practicable, as tees, elbows and returns rapidly increase the frictional resistance to the flow of water. The pump should never be without plenty of water at its suction end, and it should be as carefully looked after as any other part of the power plant, for it performs an important service in the operation of the station.

[*To be continued.*]

At a recent informal meeting of the International Waterways Commission, held in Toronto, Ont., it was decided that the next meeting of the commission be held in Chicago on September 18th, when the Drainage Canal will be discussed.

British Association Meets in York.

This year's meeting of the British Association was opened at York, England, on August 1st. It was the seventy-fifth meeting. Prof. Edwin Ray Lankester, the president, made the annual address, in which he reviewed the remarkable progress made in science in the last quarter of a century. The supreme achievement, the speaker said, was the discovery of the radio-activity of radium. He summarized the wonderful properties of radium as revealed by the late Professor Curie and others. He dwelt particularly upon the apparent fact that a small quantity of radium diffused through the earth will maintain its temperature against all loss by radiation, while if the sun consists of a fraction of one per cent. of radium, this would make good the heat annually lost by the sun.

On the programme in the Engineering Section were papers on single-phase traction, steam turbines and internal-combustion engines; also a paper on "Standardization in British Engineering Practice," by Sir John Wolfe Barry. Professor Ewing was scheduled to preside over this section.

The programme of Section A contained, among others, the following papers and discussions: "The Evolution of the Elements," by Professor Soddy; "The Nature of the Radiation from Incandescent Mantles," by J. Swinburne and Dr. H. Rubens of Charlottenburg; "The Internal Structure of the Earth as Indicated by the Phenomena of Radio-activity," by Hon. R. J. Strutt and Prof. J. Milne; "Osmotic Pressure," by the Earl of Berkeley; "Chemical and Electrical Changes Induced by Ultra-violet Light," by Sir William Ramsay and J. F. Spencer; "The Production of a Conducting Glass," by C. E. S. Phillips.

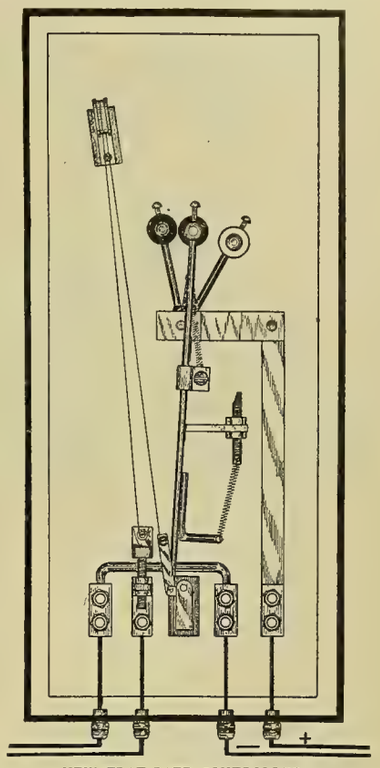
President Lankester made acknowledgment of the assistance to scientific research rendered by wealthy Americans in providing great telescopes and other gifts helpful to all branches of science. He referred to the method of Professor Pickering of Harvard University, of charting the sky rapidly, and his records of the sky as a whole. This new method, he said, is a mode of keeping a record of present movements and changes which promises much for the future of astronomy. He also gave Ernest Rutherford of McGill University, Montreal, much of the credit for the increased knowledge concerning radium.

Sir David Gill was nominated for the presidency of the association for 1907.

Universal Flat-rate Controller.

In many cases it is desirable to have some method of marketing current on a flat-rate basis, so as to save the price of a meter and still deliver to the consumer the quantity of current that he is paying for. Overload fuses and kindred devices are not exactly what is wanted, owing to the annoyance of replacing them and the fact that the central station is not afforded the desired protection with sufficient accuracy.

It is to solve this problem that the Universal flat-rate controller has been put out by the Universal Manufacturing Company of 206 Illinois Street, Chicago. This controller is a strong and simple device, 13 inches long, 6½ inches wide and 4½ inches deep, protected by a metal cover. The



NEW FLAT-RATE CONTROLLER.

supply line enters the instrument on the right (see cut), and leaves, to current consuming devices, on the left. The negative main is made continuous by the jumper between the two negative terminals. The current on the positive side of the line is carried up the copper strip on the right side of the instrument to the top. It is there conveyed by carbon contact points to the long round rod down the center of the instrument. The current passes down this long rod to the terminal at the bottom, where it is connected to a hot wire, as can be easily seen in the cut. The current then passes up, then down this hot wire to the positive terminal on the left side of the instrument. When a wire is placed in the instrument of sufficient capacity to carry, say, five amperes, and the consumer adds another lamp, the wire will then lengthen and allow the long round rod to be lowered slightly. This movement unbalances the differential balancing of the two springs shown, and the spring at the top overpowers the one at the bottom and shifts the round rod to the left, which operation breaks the connection between the two carbon contacts at the top. The circuit being broken, the wire cools off, and contracts, thus aiding the spring in the middle of the instrument. The force of this spring, together with that created by the contracting hot wire, throws the top of the long round rod to the right, which operation makes contact between the two carbon contact points.

These two operations will continue as long as the line remains overloaded. The circuit is broken when the wire is heated, and, completing itself as soon as the wire cools sufficiently, it will alternately switch on and off in periods of 20 to 30 seconds. Its control of the circuit is so specific and accurate, it is said, that it will go through this operation 50 times in one night if the circuit is overloaded that many times, or it will go through the operation once if the circuit is overloaded only once, and the greater the overload the quicker the action. The manufacturer declares that this controller will go through its on and off switching process in every instance that the consumer overloads the line to the small amount of one-fourth of an ampere of current.

The instrument when installed is adjusted, or set for so many lamps, or amperes, and when the consumer attempts to add any more lights than it is set for, it will go through its operations, thus advising the consumer that he is using more lights than his contract calls for. The capacity of the controller ranges from two to five 16-candlepower lamps in one size and from five to 25 lamps in another, according to adjustment.

Report of the Westinghouse Electric and Manufacturing Company.

At a meeting of the stockholders of the Westinghouse Electric and Manufacturing Company, held on July 25th, a report of the board of directors was submitted. Following is the report, somewhat condensed:

PRESIDENT GEORGE WESTINGHOUSE.

The general operations of your company are set forth in the reports of the first vice-president, Mr. E. M. Herr, and of the second vice-president, Mr. L. A. Osborne, while the financial conditions are shown by the balance sheet as of March 31st, and by the statement of income and profit and loss for the period of six years intervening since the report submitted at the last meeting of the stockholders held February 20, 1901. During this period the requirements for additional manufacturing facilities and working capital have demanded extraordinary efforts and care on the part of your directors and managers in order to maintain a well-earned reputation for excellence of apparatus and, above all, such a financial standing as would insure temporarily the large amounts needed to carry on the widely increasing operations of the company until a complete financial plan could be evolved and made effective. Such a financial plan was consummated and announced to the stockholders by circular letter dated January 23, 1906, and was ratified at a special meeting of the stockholders held March 26, 1906, at the offices of the company, and the stability of the company thereby fully assured.

Your president has been especially charged with the creation and development of your interests in foreign companies. As indicated by the financial statement, these large interests are in the following foreign companies:

First—British Westinghouse Electric and Manufacturing Company, Limited, London, England.

Second—Société Anonyme Westinghouse, Paris, covering France, Spain, Portugal, Italy, Belgium, Switzerland and Holland and their dependencies.

Third—Westinghouse Electricitäts Actiengesellschaft, Berlin, for Germany.

Fourth—Westinghouse Electric Company, Limited, London, of which all shares are owned by your company and has all territory not covered by the companies named.

Keen competition with manufacturers in Europe and the usual difficulty in starting new plants have thus far prevented returns upon the money invested in these foreign enterprises, but it may be stated with confidence that the business of each of these interests will, in the near future, be brought to a condition which will make these investments profitable.

The recent securing of important contracts aggregating $6,000,000 from the municipal authorities of St. Petersburg, Russia, for the construction of electric tramways in that city resulted in negotiations between important French bankers, who controlled a suitable modern electric manufacturing plant in Moscow. These negotiations have resulted in the formation of the Société Westinghouse Electrique de Russie, organized under French laws, to purchase these works and the electric business which has been developed by the electric department of the Société Anonyme Westinghouse of St. Petersburg (the Russian Brake Company) on a most favorable basis, and which will cover all expenditures in developing the electric department, besides increasing your assets by nearly $1,000,000. The immediate working capital for this new company has been supplied by the financial interests referred to, and the new company thus starts in business with large orders in hand under exceptionally favorable conditions, financially and otherwise, with a strong board of direction and experienced Russian officials who have been identified with your affairs for several years.

There are further important pending operations which may soon result as favorably for your company as has the business in Russia just referred to.

Your special attention is directed to Vice-president Osborne's report relating to the development and introduction of the single-phase alternating-current railway apparatus. Reference is made to this in order that the credit for this important development shall be given to your engineers, to whom it rightfully belongs.

FIRST VICE-PRESIDENT E. M. HERR.—MANUFACTURING DEPARTMENT.

I submit herewith report on the manufacturing department for the fiscal period from March 31, 1900, to March 31, 1906. During this period the East Pittsburg works were twice increased in size and capacity; in 1901-2 by extensions yielding 653,711 square feet of additional floor space. The six-story general office building was also erected in 1901. In 1904-5 these works were again enlarged by the building known as the East Machine Shop, with floor area of 694,943 square feet; also 45,980 square feet additional area, all commanded with powerful electric cranes in a building connecting this shop with other works buildings. These additions gave the East Pittsburg works nearly four times the original floor space.

The Cleveland (Walker) works were changed in 1904 into an iron foundry, admirably equipped, and since then used for the more important foundry work. The Newark works were completely rebuilt since 1902, and additions were made providing a total floor space of 185,000 square feet. All these additions to the works in East Pittsburg, Cleveland and Newark are now fully equipped with machinery and are prepared to care for the large business now being done, as well as for a reasonable growth.

Especial attention has been given to provide adequate facilities for taking care of the rapidly growing and important business in turbo-generators as well as the building of electric locomotives of all sizes and types, both for special and regular railroad service.

Following is the total number of employes, exclusive of the selling organization, at the close of each of the last six fiscal years: 1901, 7,971; 1902, 9,305; 1903, 11,269; 1904, 10,622; 1905, 11,894; 1906, 14,705.

During the last year a line of railway between East Pittsburg and Trafford City was completely equipped by this company with the latest type of catenary suspension trolley line for high-tension alternating-current transmission, and is being used in testing single-phase electric locomotives manufactured. This railway is also fitted with the third rail and adequate sub-stations for testing locomotives using direct current, thus affording complete facilities for thoroughly testing under service conditions this important and rapidly increasing part of the product of our works.

To provide for the rapidly increasing business of the Sawyer-Man Electric Company, demanding larger quarters, an ample plot of ground was recently purchased in Watsessing, N. J., on which entirely fireproof buildings containing 206,700 square feet of floor space are being erected. These buildings will be equipped with the most modern appliances for the manufacture of incandescent lamps.

A large addition to the main factory of the Bryant and Perkins companies in Bridgeport is rapidly nearing completion and will afford needed relief to the increasing manufacturing requirements of the business of these companies.

It is a pleasure to commend the faithful, intelligent and loyal efforts for the company's welfare of all officers and employes.

SECOND VICE-PRESIDENT L. A. OSBORNE.—ENGINEERING AND SALES DEPARTMENTS.

Engineering.—In probably no other industry is the product subject to such frequent and complete change as in our own. Apparatus is now in daily use in sizes and of dimensions which but a few years ago it would have been thought folly to attempt. The fields wherein the applications of electricity may be profitably employed are constantly increasing. The pre-eminent success of our business, a success which has been achieved by leading and not following, has been and is primarily due to the excellence of our engineering.

Following is shown the number of persons employed in the engineering department during the past six years up to the fiscal year ending March 31st: 1901, 420; 1902, 490; 1903, 535; 1904, 590; 1905, 602; 1906, 627.

Research Division.—This is designed to carry on advanced electrical work and research and to investigate to an exact degree materials and processes, so that information may be placed at the disposal of our designing engineers that will enable them to attain a maximum of efficiency in the design of commercial apparatus.

Chemical and Physical Laboratories.—These provide means for facilitating our general development work and for determining the adaptability and sufficiency of the materials entering into our finished product.

Materials Committee.—This committee, which also includes representatives from the manufacturing department, insures the careful study of our requirements, and by specifying a definite basis for the purchase of our raw materials has enabled large savings to be effected and has resulted in securing a more definite and better class of materials.

Division of Standards.—This division controls the calibration of all instruments of precision, and its work has enabled the company to maintain the first position in the instrument business and the reputation for high-grade, careful and accurate work.

Development.—It is of interest to note that at least 45 per cent. of our engineering force is continuously engaged on development work, that is, in work for the future. To be effective, this work must be carried on by highly specialized and experienced engineers. The character of this work determines the success of the company's future product. To judge the future by our past accomplishments leads us to have no misgivings. This work will in the future increase rather than diminish, due to the rapid extension of electrical applications and to the fact that the requirements of electrical design are becoming daily more exacting.

Among the multitude of problems which have been successfully solved by our engineers and which have resulted in new applications and new outlets for the company's product, one development stands out, which, by reason of the brilliancy of its accomplishment, exceeds all others. I refer to the development of the single-phase alternating-current system for railway operation.

The single-phase system, which was made possible by the genius of our chief engineer, Mr. B. G. Lamme, was developed and made a complete success in the face of the incredulity of practically the entire engineering world. The system furnishes the only means today by which existing steam roads can be economically operated by electric power, and its general adoption, which is at hand, will open an enormous field for the products of our company.

The system has for more than a year been in successful operation on a number of important interurban roads. It has been adopted, after a careful study of all existing systems, by the New York, New Haven and Hartford Railroad for the operation of trains on its main line from New York city to Stamford, Conn. This contract is now in process of execution. Two other important railroads have placed contracts with us, namely, the Grand Trunk Railway of Canada, for the electrification of the Sarnia Tunnel, and the Spokane and Inland Railway of the state of Washington, for the complete operation of its lines by this system.

The present state of the art in the long-distance transmission of power is largely due to the investigations and skill of our designers. Our company has been foremost in this field and has many important projects under consideration at the present time, involving new and radical extensions of existing practice.

Our lines of apparatus for the industrial applications of electricity are adequate and being constantly increased as the demand arises. We have been particularly successful in the application of electric power to the needs of railroad shops, cotton-mill and textile industries, and have many large and important installations.

We have under process of development important improvements in arc lamps, which have proceeded to the point where we are satisfied that their application will revolutionize existing practice and will soon form an important and valuable addition to our business.

Our measuring instruments and instruments of precision represent the most advanced state of the art, and are generally preferred to those of any other make.

Generally, the performance and efficiency of our apparatus is being steadily improved, it being the constant aim of our engineers to design for maximum quality, with a consistent minimum of cost, and the success of this policy is best evidenced by the reputation our company enjoys for the high quality of its product and the ever-increasing demand for it.

Sales Department.—The following table shows the sales of the company for the fiscal years 1900-1901 to 1905-1906, both inclusive:

April 1, 1900, to March 31, 1901	$12,516,071.86
April 1, 1901, to March 31, 1902	17,927,339.43
April 1, 1902, to March 31, 1903	19,571,294.91
April 1, 1903, to March 31, 1904	18,569,614.21
April 1, 1904, to March 31, 1905	16,570,717.13
April 1, 1905, to March 31, 1906	24,939,602.35

For the first five months of the present calendar year the sales have averaged above $2,850,000 per month. The above statement of sales does not include the sales of our subsidiary companies, the Bryant and Perkins companies, the Sawyer-Man Electric Company, and the R. D. Nuttall Company, which for the fiscal year 1905-1906 amounted to about $3,500,000. All of these subsidiary companies show large increases for the current fiscal year.

It is of interest to note the growth of the sales department in connection with the foregoing table, as regards the number of employes, as follows: April 1, 1900, 124; April 1, 1901, 150; April 1, 1902, 192; April 1, 1903, 243; April 1, 1904, 294; April 1, 1905, 391; April 1, 1906, 429.

The policy of establishing district offices, wherever conditions of trade in any particular section of the country justify the maintenance of permanent representatives, is being continued. In pursuance of this policy there have been established 20 district offices, and the creation of others is now under consideration. In addition to the district offices we have established a number of subsidiary branch offices, reporting to contiguous district offices, in locations where conditions of trade do not justify a larger permanent force.

It has been our aim to be adequately and effectively represented by skilled commercial men, well versed in the technicalities of our apparatus. The maintenance of this standard naturally predicates the payment of adequate salaries, but the economy of this policy is best indicated by the relatively low ratio of the expenses of selling to the value of the product sold.

Railway and Lighting Department.—The railway and lighting department, which directs the sale of apparatus for railways and central stations for both power and lighting, has been highly successful in extending the company's business. The sales of railway motors during the past year have increased 51 per cent. over any previous year in the company's history.

The sales of electro-pneumatic unit switch system of multiple control have continued large, showing an increase of upward of 60 per cent. over any previous year. It is now recognized as the best system for the multiple-unit operation of trains.

The central-station business, including long-

distance transmission plants, has been characterized by the more general use of steam-turbine directly driven generators. Our business in turbine-driven generators has been very large and is constantly on the increase, and the reputation of our apparatus is unexcelled. The turbo-generator business has increased during the past year 94 per cent. over that of any previous year.

In long-distance transmission work our apparatus continues to be given the preference which our reputation in this class of work justifies. Higher voltages continue to be used and specified, and we have been very successful in securing recognition of the superiority of our apparatus. Our engineers have under consideration today an installation involving the transmission of voltages up to 150,000, and we have several commercial plants in operation and under contract involving voltages of 60,000 to 80,000.

Industrial and Power Department.—The industral and power department, which directs the sales of apparatus for industrial application, including machine shops, mills, mining motors and generators for resale, has shown an increase during the year 1905-1906 of 46 per cent. over the best previous year, and for the early months of the current fiscal year the sales have been on a basis very largely in excess of last year's increase. Many of the sales of this department have involved new and novel applications of electricity to mill practice, the installations have been highly successful, and have opened fields heretofore closed.

Detail and Supply Department.—Our detail and supply department, which directs the sale of meters, transformers, fan motors, arc lamps and accessories, has during the past year largely increased its sales over any previous year. The sales in this class for the first five months of the present calendar year are over 90 per cent. greater than during the same period of any previous year.

Export Department.—The export department, which has its headquarters in New York and which handles the sales in our export territories, has during the past year greatly extended the scope of its operations and has closed many large and important contracts. Our export business for the current fiscal year has shown such increases as justify us in believing that it will exceed many times the amount obtained in any previous year, and it is our further belief that this branch of our trade will constitute an extremely important proportion of our business.

The general balance sheet as at March 31, 1906, submitted by T. W. Siemon and James C. Bennett, treasurer and general auditor, respectively, shows the following figures:

ASSETS.

Property and Plants:		
Factory plants at East Pittsburg and Allegheny, Pa., and Newark, N. J.	$10,630,177.14	
Other real estate	448,177.73	
		$11,078,354.87
Quick Assets:		
Cash	$ 6,938,899.88	
Subscriptions to 5 per cent convertible sinking fund bonds, due in April, May and June, 1906	2,031,817.00	
Accounts and bills receivable	7,414,600.58	
Interest and dividends accrued, not due	93,102.46	
Raw material and supplies at purchase prices and finished parts and completed apparatus and work in progress, at factory costs	10,836,994.06	
Completed apparatus on consignment at district sales offices and other places, for resale, at factory costs	1,046,498.82	
		28,361,912.80
Investments:		
Stocks and bonds of subsidiary American companies	$ 5,191,146.93	
Stocks and bonds of foreign companies	10,661,541.79	
Stocks and bonds of Lackawanna and Wyoming Valley Rapid Transit Company	6,300,000.00	
Miscellaneous securities	434,501.36	
		22,587,190.08
Other Assets:		
Charters, franchises, patents, office furniture and fixtures at factory plants and district sales offices, insurance and taxes paid in advance, etc.		7,034,537.22
Total assets		$69,061,994.97

LIABILITIES.

Capital Stock:		
Preferred	$ 3,998,700.00	
Assenting	20,996,350.00	
Non-assenting	3,650.00	
		$24,998,700.00
Funded Debt:		
Convertible sinking fund, 5 per cent gold bonds	$15,000,000.00	
Debenture certificates	2,500,000.00	
		17,500,000.00
Collateral notes		6,000,000.00
Current Liabilities:		
Bills payable to be retired at maturity	$ 7,157,000.00	
Debenture certificates, to be retired July 1, 1906	100,000.00	
Accounts payable	1,482,819.55	
Interest accrued, not due	282,833.34	
		9,022,652.80
*Profit and loss—surplus		11,540,642.08
Total liabilities		$69,061,994.97

Note—This company has a contingent liability, as guarantor, of $850,000 bonds of the Walker Company, due 1916, secured by mortgage on the property and plant of the Walker Foundry Company, Cleveland, Ohio.

* Subject to dividend declared March 21, 1906, payable April 10, 1906.

Following is the statement of profit and loss for the six years ended March 31, 1906. The dividends received from subsidiary manufacturing companies are included under "Other Income." The undistributed net earnings of subsidiary companies are not included. Some of these companies were recently acquired and their operations do not extend throughout the period of six years covered by the statement of income:

Gross earnings—shipments billed.		$114,618,537.35
Cost of shipments, including factory costs, losses on materials scrapped, inventory adjustments, depreciations, development expenses and all selling, administration and general expenses		97,726,008.55
Net earnings		$16,892,528.80
Other Income:		
Interest and discount	$ 1,074,717.88	
Dividends and interest on sundry stocks and bonds owned	1,679,332.96	
Miscellaneous—Royalties, etc.	910,539.63	
Total		3,664,590.47
Total income		$20,557,119.27
Deductions from Income:		
Interest on bonds and debentures	$ 911,662.28	
Interest and discount	2,955,104.59	
Tax on capital stock, commissions, premiums on debentures retired, etc.	728,257.03	
Accounts and bills receivable written off	187,469.59	
Property and plant depreciated.	1,676,635.83	
Stocks and bonds depreciated.	620,523.77	
Total		7,079,653.09
Net income—surplus		$13,477,466.18
Other Profit and Loss Credits:		
Profit and loss surplus, March 31, 1900	$ 3,570,015.58	
Premium on capital stock issued	4,415,229.81	
Total		7,985,245.39
Gross surplus		$21,462,711.57
Profit and Loss Charge:		
Dividends paid during six years ended March 31, 1906		9,922,069.49
Surplus per balance sheet, March 31, 1906		$11,540,642.08

The First Incandescent-lamp Office in San Francisco.

The Shelby Electric Company of Shelby, Ohio, maker of incandescent lamps, lays claims to the honor of being the first incandescent-lamp company

THE FIRST INCANDESCENT LAMP OFFICE IN SAN FRANCISCO.

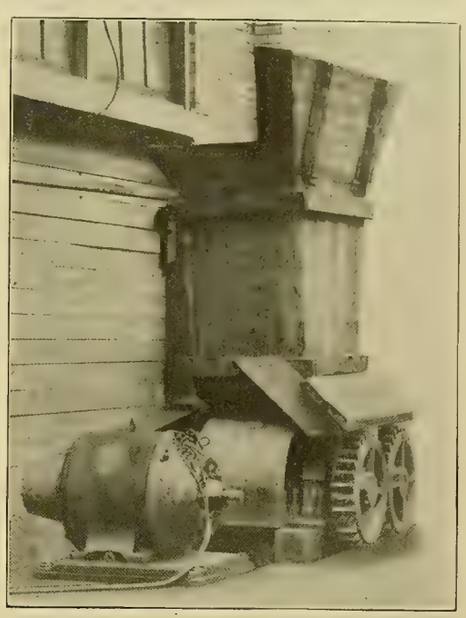
to open an office in San Francisco after the earthquake and fire. The accompanying picture shows this office, which is located at 320 Sansome Street. As seen, this office is not very pretentious, but it is large enough for the transaction of a big volume of business, and it may be surmised that many lamps will be required in the rebuilding of the city. The gentleman standing in the door is Mr. O. D. Pierce, western manager of the Shelby company. The ruins of large buildings—sad evidence of the extent of the disaster—are plainly shown in the picture.

Electric Railways to the Jamestown Exposition Grounds.

In considering the question of transportation to the Jamestown Exposition grounds it is announced that probably four different companies will build and operate electric railways from Norfolk, Va., alone. These companies are the Norfolk and Atlantic Terminal Company, the Norfolk Railway and Light Company, the Bay Shore, and the fourth, it is reported, will be the Norfolk and Southern Railway. This last named, according to exposition officials, will perfect a scheme with the Tidewater Railroad to use the latter's line from Norfolk to Sewall's Point by the electrification of the road so that trolley cars can be operated over the road during the exposition, the electric cars being operated by the same management that now runs the system to Virginia Beach. With other lines from adjacent cities, including Richmond, almost necessarily assured, the electric railway will play an important part in the handling of the visitors to the exposition grounds.

Motor Drive for Coal Crushing Rolls.

The accompanying illustration shows a set of 24 by 30-inch coal-crushing rolls, belted to an electric motor, such as are now being installed by many users of steam-driven power machinery. In



MOTOR-DRIVEN COAL CRUSHING ROLLS.

connection with furnaces at which automatic stokers are used, or where for other reasons it is desirable to have the coal crushed to a uniform size, the advantages of such an arrangement will be readily apparent. The coal, as it is unloaded from the car, is passed through these rolls and drops to the hopper which feeds the stokers. Where it is possible to secure coal in hopper cars at all times a further improvement is made by placing the crushing rolls beneath the track, allowing the coal to drop from the car into the rolls and falling from there to the stoker supply hopper.

Motor drive is the most satisfactory for an equipment of this character, as such rolls are in operation for a limited time only each day; there is therefore no waste of power and no idle belts or extra shafting to be cared for while the rolls are not in operation. These rolls are used not only for crushing coal but also rock salt, phosphate rock and other similar materials that do not require the heavy machinery furnished for mining work and the crushing of harder materials. The Allis-Chalmers Company built the complete set illustrated.

Municipal Electricians Going to New Haven.

The International Association of Municipal Electricians, which holds its convention in New Haven, Conn., on August 15th to 17th, has chosen the Tontine Hotel as headquarters, it being very convenient to the City Hall, where sessions of the convention will be held. The secretary, Frank P. Foster, Corning, N. Y., will be at headquarters Tuesday, August 14th, where all members and guests arriving early can register and secure badges. The city of New Haven is preparing a varied programme of entertainment for the delegates, and the associate members are making plans to give an exhibition of their wares, so that the members will have a chance to see the very latest developments of electrical methods and apparatus. The Tontine, Oneco, Davenport and Gard hotels have named rates ranging from $1 to $3 a day, American and European plans.

Prof. Owens on Electrical Standards.

Dr. R. B. Owens of McGill University, Montreal, has returned from England, where he attended the meeting of the International Electrotechnical Commission, composed of representatives of electrical engineering societies of nearly a dozen countries, to which allusion was made in the Western Electrician last week. He expressed the view that as a result of this work the electrical development of the whole world within the next few years will be carried out along synchronous lines, so that electrical engineers from any country will be perfectly at home engaging at work anywhere. Dr. Owens was much impressed with the work of the meeting, which he thought would do much in furthering the universal adoption of electrical power.

Advantages and Applications of the Electric Drive.[1]

By F. B. Crocker and M. Arendt.

The conditions under which machinery operates in regard to carrying speed and power required of the driving motor may be divided into four classes, and a special type of motor is usually best suited to each of these divisions.

(a) Work which requires the motor to operate automatically at a constant speed, regardless of load changes or other conditions.

(b) Work requiring frequent starting and stopping of the machine, and wide variations in speed, including sometimes rapid acceleration.

(c) An approximately steady load, or where the work varies as some function of the speed, should it change.

(d) Work in which the power varies regardless of the speed, or where speed variations with constant torque may be desired.

The first case (a) applies to line-shaft equipments, with many machines operated by the same motor; and where slight speed variations may be allowed, the alternating-current induction motor, the direct-current shunt or slightly compounded motor would answer, depending naturally upon the character of electric current available. A special refinement of this problem is encountered in the driving of textile machines, where a slight speed variation might influence the appearance of the finished product, in such instances the alternating-current motors, polyphase induction or polyphase synchronous are necessary, because the speed of the direct-current motors will vary considerably with voltage changes and variation in temperature which occurs after several hours of operation, whereas the speed of the alternating-current motors, unless the voltage varies greatly, is primarily dependent upon the frequency of the supplied current.

The second class (b) is divided into two parts, the first being applicable to electric traction and crane service, for which the motor is frequently started and stopped, and rapidly accelerated at starting; or where the speed is to be adjusted automatically to the load, slowing down when heavily loaded or climbing a steep grade. These conditions are well satisfied by the series motor, of either the direct or alternating-current types, depending upon the current supplied. Elevator service is of this class, as regards frequent starting and stopping, but after being rapidly accelerated it calls for a speed independent of the load; therefore, to obtain both requirements, elevator motors, when of the direct-current type, are heavily overcompounded to give the series characteristic at starting; then, when the motor is up to speed, the series field winding is short-circuited, and it operates as a shunt machine. If only alternating current is available the polyphase induction motor should be employed, but for powerful starting torque either slip-ring or compensator control would be necessary. In the second subdivision of this class the motor must be started and stopped frequently, and not rapidly accelerated, but on the contrary simply "inched" forward at start, as met with in the operation of printing presses and similar equipments. These conditions of service are satisfied by a direct-current compound motor, provided with double armature and series-parallel control of the machine as manufactured by the C. and C. Electric Company. They are also well satisfied by the scheme of having a double or variable potential source of current supply for the working motor, low voltage at starting and "inching" positions and higher values at running points. These features are supplied by the Bullock-Teazer system, or by the Ward Leonard motor-dynamo equipment, the latter, however, being so expensive that its use is almost entirely restricted to the operation of gun turrets, etc.

The third class (c) applies to the operation of pumps, simple fans or blower equipments and its requirements are best satisfied by the series motor, since the maximum torque is required at starting. It must be, however, either geared or direct-connected to the apparatus, because the breaking of the belt or the sudden removal of the load would cause the motor to race and become injured. The operation of pumps by electric motors is usually accomplished by gearing, since ordinary plunger pumps do not operate efficiently if driven in excess of 50 strokes per minute, and to accomplish this by direct connection would demand a very low speed and costly motor. Centrifugal pumps operating at higher speeds may be direct connected.

The fourth class (d) is found in ordinary machine-shop practice, where operation at maximum cutting or turning speed allowable requires the number of revolutions of the work or tool to vary inversely as the diameter of the piece of material being worked upon. This condition is satisfied best by the direct-current shunt or slightly compounded motors, as they are readily controlled in speed by variation of applied voltage, shunt field weakening, etc.

In the general operation of variable-speed tools, direct-current motors are used, as alternating-current induction motors are not adapted to efficient or convenient methods of speed variation, usually depending in such cases upon variable gearing or cone pullevs.

When the electric drive has been properly applied the advantages derived may be listed as follows:

1. *Saving in Power.*—This is generally the first point to be considered, but it is by no means the most important, as the cost of power in most factories is only one to three per cent. of the cost of the finished product, the cost of labor being usually many times greater. It is a fact, however, that, due to the absence of belting and shafting losses and the cutting off of electric current whenever an individually operated machine is stopped, the saving of power is a much larger quantity than might be expected. In a paper before the American Institute of Electrical Engineers by R. T. E. Lozier the following data was given:

"From the data that has been collected on power transmission in industrial shops, much of which is to be found in the transactions of the various engineering societies and in the magazines, it appears that if a certain maximum horsepower is required by all the tools of a shop, say 100 horsepower, it will require at least 100 horsepower additional to transmit this effective power by belts and shafting. This loss of 100 horsepower remains constant whether the effective horsepower is reduced or not. This means that 200 horsepower must be generated. Should these same tools be driven by individual motors instead of 100 horsepower being required for transmission, only 43 horsepower is required, even if every tool is running; but it is found that in the average industrial shop every tool is not running at the same time, some being shut down and others operating on lower than maximum speeds, thus requiring less horsepower. It has been determined practically that in the ordinary manufacturing establishment the mean effective power is but 30 per cent. of the total aggregate effective power which is required when all the tools are running at maximum load. This percentage is termed the load factor. In the case of belt drive there is, then, 100 horsepower assumed loss for 100 horsepower effective load; that is, an efficiency of 50 per cent. Applying the load factor as above, it is found that there is but 30 mean horsepower to use and that it requires 100 horsepower to transmit it, thus giving the real efficiency as only 23 per cent. With the individual motor drive the loss varies with the load. Taking the same load factor and assuming 30 per cent. as representing the loss incurred by the 30-horsepower effective load, there is but nine horsepower loss against 100 horsepower with the belt drive. Thus, with individual drive, there is generated 39 horsepower, of which 30 is effective, giving an efficiency of 77 per cent. against 23 per cent. by the shafting and belting method."

2. *Cost of Buildings.*—Heavy overhead shafting is not required for the electric drive, hence the buildings may be made lighter and cheaper in construction, as settling will not throw parts of the equipment out of alignment and cause serious friction losses, vibration, etc.

3. *Cost of Equipment.*—The relative expense of equipping a factory with electric motors or with belting and shafting is usually greater in the former case, so that the saving in operation expenses, or increased earning power, must more than offset the increased interest and depreciation. On the other hand the lower cost of the lighter building construction balances more or less the cost of the motors.

4. *Arrangement of Machinery.*—The use of electric motors enables the machinery to be placed in almost any desired position. It is not necessary that they should be parallel or arranged in rows, or placed at any particular angle with each other, whereas for belting and shafting the machinery must be arranged in a very particular manner, and very often it has to be placed where the light is poor, or accessibility and other important features must be sacrificed. A great advantage obtained, due to the flexibility of the electrically driven machines, is that portable equipments are easily made up and operated, so that the tool is frequently brought to the object to be worked on, in place of bringing the work to the tool.

5. *Clear Head Room.*—The elimination of overhead belting and shafting through the use of motors gives a clear head room, which enables overhead cranes to be freely used, a fact which results in a great saving of time and labor in the bringing of the work to the tools or removing finished pieces, the value of which is apparent when one considers the time and labor necessary to bar along heavy machinery on rollers. The clear head room also gives better illumination and ventilation. In fact the saving in cost for proper illumination may amount to as much or even more than the saving in tool-operating power; since general illumination may be largely resorted to.

6. *Cleanliness.*—The dripping of oil from overhead shafting is a constant source of annoyance, and the dirt thrown out from belting is an even worse enemy to cleanliness. The agitation of dust by belting and shafting keeps it in constant circulation, so that it penetrates everything and everywhere. This is a very important matter in printing and textile work.

7. *Health of Employes.*—On account of the better ventilation and illumination and reduction in dust and dirt, it is shown by actual experience that the general health of those who work with electrically driven machinery is improved. In the government printing office at Washington it was found that the sick list was decreased about 20 to 40 per cent. after the electric drive was introduced.

8. *Convenience for Detached Buildings.*—The electrical method enables power to be supplied easily and economically to detached buildings or sections, which is not possible with belt or steam transmission; therefore, the buildings, like the machinery within them, can be located for general convenience and not with special regard to supplying them with power. This subdivision of a plant or manufacturing establishment into a series of detached buildings is an almost absolute safeguard against total destruction by fire; and is thus a practical guarantee of continuous earning powers. If, however, electric power were not employed, it would be necessary to have long belting systems, involving great losses and extra heavy wall construction, or a series of small power plants calling for a larger force of men; and considerably less economical in operation than one central power house.

9. *Freedom for Growth.*—For similar reasons, with electric drive it is a simple matter to extend a building or add another in any direction, whereas with belting the shafting must be installed originally large enough to allow for extension; or else it must be replaced later; in which case the operation of the existing line shafts would be interfered with.

10. *Shutdowns Less Frequent and Serious.*—An accident in an electrically driven plant usually has a local effect only, simply shutting down one or a few machines, while with belting and shafting the breaking or slipping off of a belt, or the failure of a friction clutch may require the shutting down of a whole plant or a large section thereof. In a large establishment a delay of even a few minutes represents a considerable item of wages, and in addition the interruption of the work is demoralizing. It might be argued that the central station may break down; this is, however, just as likely to happen with one form of power transmission as another.

11. *Speed Control.*—The variation of speed that is possible with the electric drive and the convenience as well as the wide ranges of control are great advantages with most kinds of machine work. The operator can drive the tool to its limit of capacity and can on the other hand instantly relieve it of strain. With mechanical drive the methods of speed control are more limited and require more time to operate than with electric motors. The shifting of the belt on a cone pulley, or the throwing in and out of different sets of gears takes more effort than the simple turning of a controller handle, which can be placed right at the work, and is thus not so likely to be carried out by the operator to gain slightly in the efficiency or rapidity of his work.

If a factory or a plant manager contemplates the substitution of electric drive for the ordinary mechanical drive or other method of power distribution, it would be advisable for him to study carefully the requirements of his work so as to determine if variable speeds are necessary and what ranges, if individual or group drive would answer, and which type of motor is best suited for each tool or machine to be driven. He should then tabulate the advantages derived and give them their true monetary value; against these he should balance the interest on the additional expenditure, the maintenance and depreciation items. If then the result shows an annual saving which would amount to a sum of five per cent. or more of the cost of the new equipment, or the saving of a reasonable amount in the cost of his finished product, it would be a good policy for him to make the change.

1. Abstract of an article in the School of Mines Quarterly, being a portion of lecture notes on electric power used by the engineering department of Columbia University.

An Emphatic Protest Against Gasoline Omnibuses.

When the gasoline motor 'buses were first introduced in the streets of London the people hailed them as a beneficent agency in relieving the congestion of street traffic. But alas! the gasoline-propelled vehicle was found to have serious disadvantages, and now there is a chorus of complaints. Here is one from Sidney Colvin, printed in the London Times, which is particularly clear and vigorous:

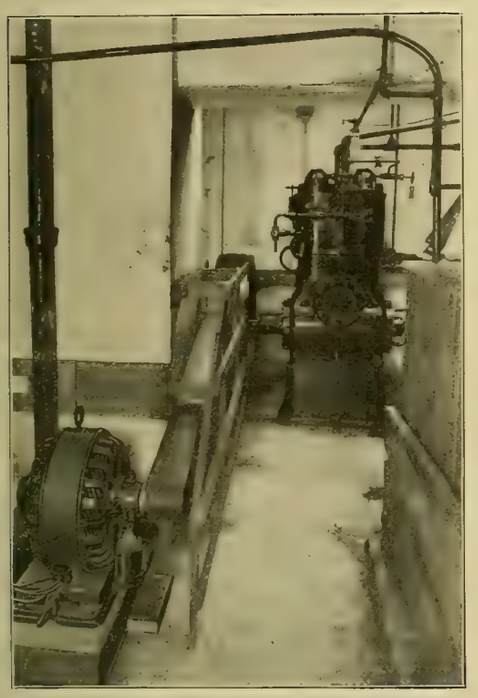
"Are not we Londoners taking too meekly the growth of a nuisance which has crept upon us by degrees, but which strikes with a shock on the senses both of visitors and of natives returning after an absence? Till lately, of all great cities London suffered perhaps least from noise and smells. Now, under the new infliction of the motor-omnibus, it is beginning to suffer most. Along their lines of route the whirr of these monsters is already deafening out of doors, and all but deafening to those who sit indoors with open windows. And their stink is even a worse plague than their din. The noisome steam discharged in the trail of these vehicles hung blue and thick and low in the streets during the close weather of last week; it penerated the parks; to draw a clean breath was impossible. If you sought refuge on the roof of one of these machines you only found yourself choked by the reek of another in front, and came

home sickened in all your senses. Surely the convenience and the excitement of quick mechanical transit are advantages that can be bought too dearly. We have already sacrificed to them all the peace and freshness of our country roads and hedgerows and wayside gardens. But the country has recesses happily beyond the reach of motor noises, motor smells and motor dust. Here in London we must needs take what air and exercise we can in the streets. Are we to be condemned for the rest of our lives to inhale these abominable petroleum fumes at every step? Have we no power of rebellion or even of remonstrance left in us? Is there no public authority which can check the multiplication of these machines until they can be made stinkless?"

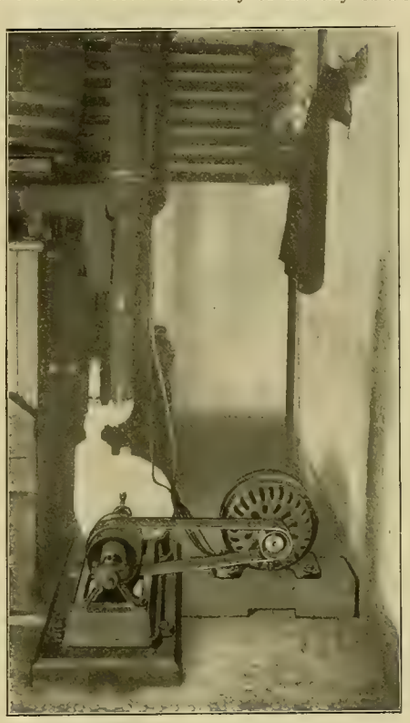
Electrically Operated Refrigerating Plant in Gallatin Hotel, Uniontown, Pa.

Mechanical refrigeration employing electric motors as its source of power is covering a broad field and has almost unlimited application in the preservation of food products and maintaining a low temperature in many industrial processes, as well as in domestic and household use.

In some cases the adoption of mechanical refrigeration depends greatly upon the question of economy, and in others cost is sacrificed for cleanliness, convenience and easily controllable temperature. Refrigeration is not confined to the cooling of various products, however, but is largely used in furnishing cooler air in private and public buildings during the heated seasons of the year.



TEN-HORSEPOWER INDUCTION MOTOR DRIVING AMMONIA PUMP IN GALLATIN HOTEL.



TWO-HORSEPOWER INDUCTION MOTOR DRIVING BRINE PUMP IN GALLATIN HOTEL.

The machines now used to produce a reduction in temperature are nearly all based on the principle of production of cold by the evaporation of liquid to the gaseous form; and of the many systems of ice-making and refrigerating in extensive use today, the ammonia compression system occupies a pre-eminent position. It consists of a complete cycle of operations, involving three successive steps—compression, condensation and expansion. These three steps are made continuous and are constantly repeated.

As an illustration of this modern development, a brief description of the refrigerating plant in the Gallatin Hotel at Uniontown, Pa., will be of interest.

The ammonia compressor, made by the Brunswick Refrigerating Company, is driven by a 10-horsepower Westinghouse type CCL motor. From the compressor the liquid ammonia is circulated in coils within the brine tank, and returns in a gaseous form. The cool brine is used for the double purpose of making ice for table purposes and for cooling the beer cellar and iceboxes. Ice cans filled with fresh water are submerged in the brine tank, and the average output of ice is six tons a day.

A circulating pump, driven by a Westinghouse two-horsepower type CCL motor, forces the brine to the beer cellar, which is nine by 16 by 7½ feet, and is maintained at an average temperature of 40° F. Besides the beer cellar there are three iceboxes, each five by six by seven feet, and one cook's box, 4½ by five by seven feet. Two of the iceboxes are used for freezing purposes, and are maintained at an average temperature of 16°F.

The entire plant is taken care of by a young boy, which clearly shows the simplicity and economical operation of refrigerating plants driven by electric motors.

Electric Railway Building in Oregon.

The Oregon Electric Railway Company is entering the Willamette Valley, south of Portland, with an electric road constructed for the handling of freight as well as passengers. This road opens up a very rich territory, in the center of which is located Salem, the capital of Oregon. The first section of the railroad will be 50 miles in length and will connect the city of Portland with Salem. It will be constructed, in accordance with the best railway practice, of 70-pound rails on rock-ballasted roadbed, with a maximum grade of 2.2 per cent. and a maximum curvature of five degrees. A portion of the 50-mile line will consist of a tangent 26 miles, with practically no grade.

The road crosses the Willamette River, over which is being constructed a steel deck span bridge on concrete piers. There are five piers in the river, and the approaches to the bridges on either side consist of fills aggregating about a thousand feet in length. The bridge proper consists of four 200-foot spans, the distance from the rail to the surface of the river being 110 feet. This is one of the largest bridges in the state, and is being constructed for the heaviest type of electric locomotive drawing trains of 100,000-pound freight cars. The road enters the south boundary of the city of Portland and continues into the center of the city, where is located the passenger station. Connection will here be made by the Southern Pacific, Northern Pacific and Great Northern railroads. The country through which the road passes is the garden spot of Oregon, and is extremely fertile, and, owing to the climate and the fact that there are no frosts or cold weather during wintertime, is rapidly building up with a farming and manufacturing population.

There will be a number of branches, aggregating some 50 miles, constructed as soon as the main line is in operation, and plans are in contemplation to extend the main line south of Salem to the city of Eugene, making an electric-railway system of some 150 miles.

All of the engineering and construction work is being done by W. S. Barstow & Co., engineers, Portland, Ore. The passenger express service will be of the best, the running time between Portland and Salem being 1½ hours, against three hours with the present railroad service.

Space Telegraphy at Sea.

The recent denial of the Marconi manager in New York city that one of his company's operators on a ship at sea refused to take a message of distress from another ship, because transmitted by another system of "wireless," directs renewed attention to the importance of space telegraphy to mariners. A recent writer notes that not long ago a large freighter became disabled in the Gulf of Mexico. It was equipped with space-telegraph apparatus; so instead of hoisting distress signals the captain began to send out wireless messages in all directions. "We are disabled and need help," he said, giving the location of the ship. Soon word was received from a distant vessel that the appeal had been heard and help was coming.

Somewhat similar was the case of the whaleback steamer City of Everett towing a barge of oil from Sabine Bar, Texas, to New York. The steel door of a forward turret was torn off by the sea, a compartment was flooded and the ship became unmanageable. She was then about 150 miles from Port Arthur, Tex. From the wireless chart showing the routes of the gulf vessels the captain saw that the ships Col. E. L. Drake and Maverick were about due at Port Arthur. He sought to locate them by wireless. The message, however, was answered by the Captain H. F. Lucas, which was 50 miles distant. The Everett communicated her position, the Lucas did likewise, and they kept in communication until sighted. The disabled ship was then towed to the shelter of Ship Shoal, where she was repaired.

By means of wireless the location of derelicts, a constant menace to navigation, becomes known. They can be avoided or destroyed. But a far more important aid to navigation is the distribution of storm warnings by wireless, particularly off Cape Hatteras, "the graveyard of ships." At this point and elsewhere on the coast the De Forest station each day sends out the weather indications from Washington. These warnings are sent into the air at random to be caught up by all ships equipped with wireless apparatus and relayed by them until there is a sort of continuous chain of warnings.

Hydro-electric Plant on the San Joaquin River.

A new hydro-electric plant recently put in operation by the San Joaquin Light and Power Company of Fresno, Cal., is of considerable interest. It is located about 50 miles northeast of Fresno, on the north fork of the San Joaquin River in the Sierra Nevada Mountains, and was put in operation in April of this year. The actual work for construction was begun in May, 1905, but has been somewhat delayed by the fact that all material, except lumber, had to be transported into the mountains on freight teams.

Water for the operation of the plant is supplied by a conduit which has a total length of 4.3 miles and comprises open canal, tunnels, flumes and pipe line. These structures are designed for a flow of 100 cubic feet per second, and with the total head of 400 feet give a total capacity of 3,600 horsepower. The canal is five feet wide on the bottom and three feet deep. It is lined throughout with concrete. The intake basin and the forebay are concrete structures and the tunnels are also lined with concrete. The flumes are of steel plate one-eighth inch thick, semi-circular in form, and six feet wide. The pipe line is 3,000 feet long and 52 inches in diameter, the thickness of steel varying from three-sixteenths to one-half inch. The waterwheels are the tangential type, two in number, and develop 83 per cent. efficiency under full load.

Two electric generators of the standard Allis-Chalmers waterwheel type, 1,000 kilowatts, 300 revolutions per minute, 550 volts, three-phase, are each provided with a base and two bearings, the shaft at each bearing being extended to carry an overhung waterwheel. The exciters are direct connected, having armatures mounted on the generator shaft between the bearings. Each exciter is of 62½ kilowatts output and easily capable of furnishing exciting current for both alternators. The revolving field type of alternator is used, with the rotor specially constructed for high peripheral speed, which in these machines reaches as high as 7,500 feet per minute.

This plant is the second one constructed by the San Joaquin Light and Power Company. The original plant is to be reconstructed and enlarged and there are plans for other new plants to be built later.

Hotel Equipment in Denver.

It is not rash to predict that Denver's large hotels will be electric from top to bottom in a very short time. The Shirley and the Albany hotels may now be classified as electric, as their equipment to furnish all electric conveniences is most complete. The Shirley recently gave up its electric plant for reasons of economy, and in accordance with its new policy of management it is now being supplied with current by the Denver Gas and Electric Company. The Shirley and the Shirley Annex are under one management. The rooms in the latter house are occupied mostly by permanent guests, who enjoy the use of most of the modern electric appliances. The electric chafing dish may be found in nearly every room, as it is frequently used for private parties. The massage vibrator is another appliance which may be found on the dresser of nearly every lady guest of the Annex. The electric flatiron is also popular among those who desire to occasionally launder some garment, and heaters for curling irons are also in evidence in every room. The Shirley's lighting scheme is as near perfect as possible. Much care and study were devoted to make it most attractive and the result makes the hotel most inviting at night.

Denver boasts of being one of the best-lighted cities in the country. It is anxious now to attain to the eminence of using electricity for all purposes to a greater extent than any other city of its size.

An Electric Day.

An interesting article appears in a recent number of Good Housekeeping, in which Mr. H. W. Hillman of Schenectady, N. Y., describes the electrical devices in his "electric house" in that city.

Attention is called first to the kitchen, in which the owner has fitted a table with the latest electrical cooking devices. The maid in the morning as she rises turns on a switch in her room which puts into operation the electrical cereal cooker in the kitchen, which is also a combination water boiler. By the time the servant is ready to go to the kitchen the water for the coffee is boiling. It is placed in the electric coffee percolator. In seven or eight minutes the coffee is ready for the table. The cereal and the coffee attended to, the switch for the frying pan is turned on. One minute is sufficient; then the bacon and eggs are started frying.

The breakfast over, dishes washed, the ironing is started, and it requires but a short time to do the ironing with the electric flatiron, which keeps a constant even heat.

The writer goes on to tell how easily dinner is prepared with a large four-quart electric kettle together with a potato steamer and other utensils, which give the electric outfit the appearance of a full-fledged cooking equipment commonly used with coal and gas ranges.

An electric oven is provided which has proved to be very good in the preparing of large roasts. The temperature of the oven being easily regulated, Mr. Hillman says that as large as 14-pound turkeys have been roasted in the oven.

In winter, when the weather is severely cold, electric heaters aid the furnace, or in the fall and spring, when the furnace is not in commission, the heaters furnish sufficient heat in the cool mornings. Particular attention is called to the electric dining-room table. It is a small table fitted with electric wiring receptacles and switches suitable for operating two or three devices such as coffee percolators, chafing dishes, or water boilers for serving tea.

Among other electrical devices is the motor-driven sewing machine, an electric shaving mug and a small electric flatiron, the latter to be carried when traveling, which is attachable to any Edison socket.

Mr. Hillman says in relation to cost that he used a coal stove for about 10 years and a gas range for six. With coal at an average price of $6.50 per ton and gas at about $1.30 per thousand, his monthly bills averaged about $6 in a family of five. The monthly cost of current for the same character of work averaged to $6.69 for 24 consecutive months, or slightly higher than the coal and gas bills. This is figured on the basis of 15 cents per kilowatt for lighting and five cents per kilowatt for power.

A Carload of Guy Anchors.

The accompanying picture of Big Four freight car No. 4273 tells its own story. It shows that the Stombaugh guy anchor is well regarded in Texas in spite of the heavy freight rates, and also that the Hobson Electric Company is a progressive and up-to-date electrical supply house which believes in keeping a good stock of the best of everything pertaining to the street-railway, electric-light and telephone field. Over three-fourths of the contents of this car is to be used by one telephone company. When one stops to consider that this car contained over $3,800 worth of five and six-inch anchors he will realize the importance of the Stombaugh guy anchor in the construction field.

The Stombaugh guy anchor patents were purchased by W. N. Matthews & Bro. of St. Louis in 1899. At that time the "dead-man" was the only known means of anchoring poles to the ground. Since then the sale of these anchors has increased enormously. When asked to what they attributed their success in the sale of the Stombaugh guy anchor, Mr. C. L. Matthews said: "To our absolute confidence in the anchor, backed up by the severest engineering tests; to good, truthful printed matter, and advertising in the best trade journals."

W. N. Matthews & Bro. are owners of patents on several other specialties, which they manufacture.

A CARLOAD OF GUY ANCHORS.

Canadian Telephone News.

The Central Telephone Company of New Brunswick is arranging to install an automatic telephone exchange in the city of Moncton, N. B., if it can get the necessary permission from the City Council.

The Eastern Telephone Company, which controls telephones on the Island of Cape Breton, N. S., has decided to sell out to the Nova Scotia Telephone Company, Halifax.

The directors of the New Brunswick Telephone Company at a meeting held at Fredericton, N. B., on July 27th, decided to apply to the local government for power to increase its capital stock from $650,000 to $1,000,000. For some years past this company has been paying a dividend of eight per cent. per annum.

The City Council of Ottawa, Ont., has accepted the offer of the Bell Telephone Company for a five-year exclusive franchise, with the privilege of cancellation by the city at the end of two years, provided that three months' notice is given before the expiration of 18 months from date. The company will pay the city $5,000 a year and supply the city with 20 free telephones and furnish house telephones at $27 and business telephones at $45 per year.

The Bell Telephone Company has been given a five-year franchise in Berlin, Ont.

The British Columbia Telephone Company has laid a submarine cable under the First Narrows, Vancouver, containing 15 pairs of wires. The cable is laid for the purpose of taking care of the North Vancouver service. W.

Indiana Telephone Items.

The Richmond Home Telephone Company has secured a site on North Ninth Street, upon which it proposes to erect a new fireproof building and make it one of the best-equipped exchanges in the state. President Lindemuth says that in all probability the company will install the automatic system.

The property appraisement of telephone companies in Indiana for 1906, as made by the state tax board, shows a considerable increase over the valuation for 1905. The increase of Independent telephone companies during the year was 75 companies, or 380 companies against 305 companies for 1905. The Central Union Telephone Company reported nearly 40,000 miles less in 1906 than in 1905.

An important suit is being tried at Washington, Ind., to test the liability of the telephone company to one of its workmen for damages and injuries resulting from his attempt to ascend a rotten pole which was filled with moisture, thus making it a conductor of electricity, so that when he took hold of an iron spike he was paralyzed by a current which passed through his body. S.

Southeastern Telephone Developments.

The Richmond (Va.) Structural Iron Works has been awarded the contract for the structural steel for the new five-story building for the Bell Telephone Company on East Grace Street.

The Warrensburg (Mo.) Home Telephone Company, capital $20,000, and the Johnson County Home Telephone Company of Warrensburg, capital, $150,000, have been chartered in Missouri.

An official of the Chesapeake and Potomac Telephone Company has recently made a statement concerning the reduction in rates. Some of the people have claimed that the reduced rates amount to little, but the official of the company says that the giving of a single telephone service in place of the party line at the same rate is one of the strong points that will soon be recognized.

The Southern Bell Telephone Company will soon build a new standard toll line from Richmond to Gordonsville, Charlottesville and other points, taking the place of the lines bought from the old Louis company last year.

In a statement filed by the general auditor of earnings and expenses of the Southern Bell in North Carolina for the year ended March 31, 1906, it is shown that Charlotte leads, with over $60,000 revenue, expenses $37,000. The gross earnings for the year in the state were $182,159, and the toll gross earnings, $67,987, total $250,146. The general expenses were $36,599; operating, $61,982; maintenance, $97,990. L.

Ohio Telephone Notes.

W. H. Kemp of Buenos Ayres, Argentina, was in Columbus a few days ago inspecting the automatic telephone system used by the Columbus Citizens' Telephone Company, with the idea of installing such a system in his home town. Mr. Kemp says the city has a system with 26,000 subscribers, but that it is such as were discarded in most of the cities of the United States years ago. The city has a population of 1,000,000 people, or about one-fifth that of the entire country. Plenty of money can be secured there to finance the new company. Mr. Kemp was accompanied by H. W. Harris of Chicago.

Many of the Independent companies that were taken under control of the Brailey syndicate a few months ago are showing decided gains in earnings under the new systems being put into practice by C. Y. McVey, general manager.

The Central Union Telephone Company has installed a dispatching system for the Toledo Urban and Interurban Railway Company, 25 telephone sets being in use between Toledo and Findlay. A system was installed a short time ago for the Canton-Akron, 16 stationary and 25 portable sets being used. The line is between Canton and New Philadelphia.

The Cleveland Telephone Company has started a monthly publication known as the Cleveland Telephone News. All matter will be contributed by persons connected with the Bell companies. C.

Telephone News from the Northwest.

The reports filed with the South Dakota state auditor for the purpose of telephone assessments show that there has been an increase of 65 such companies since the reports were made a year ago, there being 208 separate companies now doing business in the state. The report in 1895 showed only four companies.

The Mesaba Telephone Company, which recently bought the Grand Rapids (Minn.) telephone exchange, will entirely reconstruct the plant.

The Park Rapids and Eastern Telephone Company has been granted a 30-year franchise at Park Rapids, Minn.

John Steffenson and others have incorporated the Freedom Rural Telephone Company of Wekota, S. D., with a capitalization of $5,000.

The Union Grove (Wis.) Telephone Company has reorganized and incorporated with a capital stock of $5,000. The entire system will be rebuilt. W. J. Callendar is manager.

The Plover Mutual Telephone Company of Plover, Iowa, has been incorporated.

The Mississippi Valley Telephone Company of Burlington, Iowa, has completed the construction of a line across the Mississippi River, there for connection with the towns in Illinois in that vicinity. The crossing is accomplished by means of two iron poles, carrying the wires at a height of 100 feet, enough to clear the steamboats. R.

Independent Telephone Lines May Enter Chicago.

Writing under date of August 4th the Indianapolis correspondent of the Western Electrician says that an important telephone deal involving $500,000 was closed at Fort Wayne on the day before at a meeting of the stockholders of the South Bend Home Telephone Company, when 1,600 shares of the stock of the company were sold at $25 a share to Joseph Harris, vice-president of the Automatic Electric Company of Chicago. An immediate outlay of $50,000 is required, and Mr. Harris is said to have agreed to spend $100,000 on the plant and on toll connections with Chicago within the next 20 months. He has furnished bond in the sum of $75,000 to insure the performance of his undertaking. This will give Chicago Independent toll service with South Bend.

GENERAL TELEPHONE NEWS.

Among the recently incorporated telephone companies are the Ranch Telephone Company, Alliance, Neb.; the Appleton City and Rockville Telephone Company, Appleton City, Mo.; the College Telephone Company, College Station, Tex., and the Agnes Union Telephone Company, Agnes, Tex.

The Michigan State Telephone Company has purchased the Menominee Range Telephone Company in the Upper Peninsula of Michigan. A condition of the sale is that subscribers of the Range company shall be protected in the matter of rates for a period of 25 years. The lines of the company which has been absorbed extend to Iron Mountain, Quinnesec, Norway, Loretto and Waucedah on the east, Sagola and Channing on the north, Niagara on the south and Florence and Homestead, Wis., on the west.

CORRESPONDENCE.

Great Britain.

London, July 25.—The annual meetings of our leading manufacturing companies can usually be depended upon to provide interesting reading, and this year is no exception. Statements of more than ordinary importance have been made, for instance, at the meetings of the General Electric Company and the Electric Construction Company, and they give a very good impression of the state of the electrical industry in Great Britain. I will endeavor to convey what this means. To begin with, the industry is, so to speak, overstocked with electrical manufacturing firms, and it is a stern fact that it will be a question of the survival of the fittest. Consequently, although the better class firms have been working full time, and there has been an increased output, profits have decreased. There seems to be a want of sympathy between the railway companies and the manufacturers; for there is a considerable inconsistency in the matter of freight rates. In fact, foreign goods are carried cheaper than British, a point that has disturbed the General Electric Company considerably. Then, again, raw materials of almost every description have increased in rather a large proportion, but for the reason stated above, all efforts to keep selling prices up, if not proportionately, to some extent, have lamentably failed. Foreign trade, too, has been restricted by an increase in the import tariffs of several Continental countries, and upon this point Mr. Byng, the managing director of the General Electric, has had some outspoken things to say. The anticipations of a few years ago that there would be a large expansion of electrical work have been pretty well fulfilled, but the preparations for meeting the demand would appear to have been too ample; there are too many to do the work. Such is the opinion of the general body of traders, and the outlook would not appear to be too promising for some of them. The fact, however, that the demand for electrical plant is increasing is an encouraging one for the industry generally, and, after all, one need hardly feel disheartened at prices ruling low.

The last has probably been heard of electric power bills for London—for a short while. The present position is, that, seeing the utter hopelessness of the struggle, all the other bills presented with that of the London County Council have been withdrawn for this session, and the London County Council, having received what practically amounts to a mandate from the government, has already recorded its determination to bring forward next session a more comprehensive bill. Meanwhile, the promoters of the Adminstrative company's bill have transferred their energies to the Tyneside district again, where a large consolidation of interests is now taking place. Practically three huge power companies, each under parliamentary restrictions, have joined forces, and the result of cheap power is to be seen in the enormous industrial development taking place there. If London is ever served with such a cheap supply, it may be found that all the manufacturers have fled to other parts in despair. The signs point that way.

The chambers of commerce of the British empire have been holding their annual conference in London this week, and among the resolutions passed was one making a strong plea for a further extension of the British cable system by the government.

"Commercial development" of electricity supply undertakings appears to have taken a firm hold upon electric supply companies and committees of municipalities all over the country. In all directions one hears of the setting up of permanent showrooms, the appointment of commercial assistants, and the publication of periodical bulletins pointing out the advantages of electric supply. There is no doubt that the public hitherto has been kept too much in ignorance in this connection, and the exhibition at Olympia last autumn amply demonstrated this. Some few undertakings have done this all along.

The report of the electrical inspector of factories again shows the need for such supervision. The inspector points out that there is a tendency to cut down capital expenditure in connection with factory equipments to a point almost involving personal danger, and a warning is uttered against such a procedure. Among the recommendations made, as a result of the various fatal and non-fatal accidents that have occurred in factories during the last twelvemonth, is that the working floor in front of a switchboard should not be constructed of metal plates, even though normally covered with rubber mats. A number of accidents were due to the employment of unskilled persons. No less than 18 fatal accidents were reported during the year in connection with electrical apparatus upon premises working under the factory acts. The report in question contains a quantity of most useful suggestions.

The result of the sale to the postmaster-general by the Glasgow Corporation of its telephone system seems to have engendered a feeling of insecurity on the part of several other municipalities owning telephone systems. There are quite a number of applications to the postmaster-general to give more favorable terms than the standard which he has set—six per cent. of the capital expenditure. G.

Dominion of Canada.

Ottawa, August 4.—The Toronto Street Railway Company is looking for an expert engineer, and the labor men are angry at a suggestion that an American will get the preference.

The Electrical Development Company has applied to the United States government for permission to sell 62,500 horsepower in New York state. The Ontario Power Company wants to send in 90,000 horsepower and the Canadian Niagara Power Company 110,000 horsepower. It was some time ago recommended that only 160,000 horsepower in all be admitted.

The Hydro-electric Power Commission of Ontario has invited the power companies at Niagara Falls and the Cataract Power Company of Hamilton, Ont., to quote prices at which they will deliver power to the commission at Toronto to the minimum of 10,000 horsepower, ready for transmission. Should the price be deemed too high by the municipalities the commission may either develop power or expropriate some existing plant.

The Toronto Street Railway Company has decided not to bring any more steel rails from England, but to have them made in the United States. The reason for this is that the company frequently has to wait several months before procuring rails from British manufacturers, who turn out a different type of rail for home use, and delay getting out the orders for Toronto.

The announcement is made that the management of the Montreal Light, Heat and Power Company will expend several million dollars in extensions and improvements, including a new dam and power house in Soulanges, a new dam at Chambly, a new generating station in the city of Montreal, the erection of new office buildings, the laying of conduits, the renewing of cables and wires and the installation of much new machinery.

A deal has been completed whereby the Detroit United Railway Company will acquire the Windsor and Tecumseh Electric Railway of Ontario. Surveyors in the employ of the Detroit company are now engaged in looking over the line. The franchise will probably be purchased outright. Manager Anderson, representing the Windsor interests of the Detroit company, says cars may be running in three months. W.

Winnipeg, Man., August 4.—The contracts for the construction of the Brantford and Hamilton Electric Railway have been awarded. Electrical supplies will be furnished by the Canadian Westinghouse Company of Hamilton. The railway company has opened offices in the Chancery Chambers and the following officers have been appointed: I. K. Pierson, chief engineer; Elmer T. Haines, secretary; J. W. Nesbit, solicitor, and Miss Agnes Geddes, treasurer.

The Winnipeg Electric Street Railway is preparing to extend its lines in the north end of the city and has started to put down a line on Bannerman Avenue as far west as McGregor Street. It will then run south as far as the Canadian Pacific shops.

The matters outstanding between the British Columbia Electric Railway and the city have been amicably adjusted. The council has indorsed the proposed Harris Street and Ninth Avenue extensions besides approving of the schedule of an improved car service. Work on the new car line will be started immediately.

In charge of Engineer Davis, work was commenced on the survey of the nine miles which separate the city of Guelph from Puslinch Lake. In so doing the Guelph Radial Railway Company is seeking to ascertain the cost of providing rapid transit with the cities of the south, including the towns of Hespeler, Galt, Paris, Brantford, Berlin and Waterloo.

Regina, Sask., is determined to have a street railway. Mr. W. A. Hill, who is a strong supporter of the applicants for a charter to build a street-railway plant, was at one time in favor of a municipal-owned plant, but he now strongly favors a company to build and operate a road.

Mr. J. Buntzen, managing director of the British Columbia Electric Railway, some time ago submitted a pension scheme, selected by him from a large number which he investigated while in England. The proposition which has been submitted to the men is an annual payment of $3 by each man, taken from the profit-sharing payments of the profit of the company to its employes. To this the company will add dollar for dollar. The pensions are to be paid to employes reaching the age of 60 who have been in the employment of the company 15 years. The amount of the pension shall consist of one-half or one-quarter of the salary last received, as recommended by the committee of the union; all attaining a salary of $100 per month are placed outside of the provisions of the scheme. According to this scheme it will be seen that the employes will not be asked to pay anything out of the wages earned by them. H.

New England.

Boston, August 4.—The New England Telephone and Telegraph Company has declared a dividend of $1.50 a share, payable August 15th to stockholders on record July 31st.

An order looking toward the establishment of a municipal lighting plant has been passed to a second reading by the Woburn (Mass.) City Council. In 1892 and 1893 the Council voted in favor of the plan, but the people have not voted on the question.

The route selected for the projected Boston and Eastern electric railway between Boston and Beverly, Mass., crosses the Boston and Northern Street Railway Company's tracks 12 times between Boston and Salem. Through Lynn the road will pass almost entirely over private land, and the land damages will be enormous.

The Amherst (Mass.) Gas Company will obtain its electric power from the Turners Falls Company, whose plant is situated 18 miles from Amherst. The current will be delivered at the gas company's plant, where it will be transformed and distributed in Amherst, Sunderland, Hatfield and Pelham.

The New England Telephone and Telegraph Company has moved its exchange in the Brighton district of Boston to its own new building at the corner of Henshaw and Wirt streets, changing the system from magneto to common battery. The company will build a brick exchange building on Church Street, Dedham, Mass., to cost $10,000.

The Norwich and Westerly Railway Company has completed its electric railway between Norwich and Hallville, Conn.

The Beta Corporation, a society of the Massachusetts Institute of Technology, has bought the property at 44 The Fenway, in the Back Bay District of Boston. The property includes a brick house of 12 rooms and 3,000 square feet of land.

In response to a petition from the New Bedford (Mass.) Board of Trade, the Massachusetts gas and electric-light commissioners have recommended that the New Bedford Gas and Electric Light Company reduce its price for electricity from 18 cents per kilowatt-hour to 14¼ cents.

Edgar Van Etten, vice-president of the Boston and Albany Railroad Company, states that electricity will not be used as a motive power on that company's Boston suburban trains until there is some radical improvement in the application of electric power to heavy traffic. He says that under present conditions in Boston electricity cannot be successfully used as a motive power on these suburban trains.

The Boston Elevated Railway Company has filed a bond with the Cambridge (Mass.) superintendent of streets, and it now can make borings in the streets of that city. This is a preliminary step toward the construction of a subway. B.

New York.

New York city, August 4.—Plans are being carried out for the opening of electric-train service between the Grand Central Station and Stamford, Conn., on September 3d. Fifteen hundred men are working day and night on the main line of the New York, New Haven and Hartford Railroad, to complete its electrification between Stamford, Conn., and Woodlawn, N. Y. From Stamford to Woodlawn the New Haven and Hartford tracks will be used. From Woodlawn to the Grand Cental Station the trains will be operated over the Central tracks. On the former section alternating current will be used. Between Woodlawn and New York the third rail and direct current, for which the motors will also be available, will be operated.

The New Haven road is asking its steam-locomotive engineers to file bids for running the motor trains, and firemen may bid for positions as assistant motormen. It is planned to have two men in each cab. The assistant will keep a general lookout and be ready to take the motorman's place. Work in schooling the engineers and firemen as motormen and assistant motormen is about to be begun. These men will be paid about the same as the engineers and firemen are now paid.

The Westinghouse company of Pittsburg is installing the electric apparatus between Stamford and Woodlawn, a distance of 28 miles. The overhead trolley system is being put in. It is very similar to the system in operation on the Union Railway's lines in The Bronx, except that it is more substantial in construction. The motor cars, 50 of which have been ordered and are practically ready for delivery now, are 50 feet long. They are designed for pampagraph trolleys, and the motors will be fitted for a voltage of 11,000. These motors, if they come up to expectations, will be able to haul as many cars as the steam locomotives, and, if necessary, at higher speed. If very long trains have to be hauled, it will be easy to double the motor cars. Power will be furnished from a power house now in course of construction at Coscob, Conn., by the Westinghouse-Church-Kerr Company. The plant is near completion, and will supply all power between Stamford and Woodlawn.

In the construction of that part of the Pennsylvania and Long Island Railroad tunnel underlying Manhattan Island, the United Engineering and Contracting Company has adopted electricity as the motive power best adapted to all construction work. Electric current is used for the operation of the air compressors, which supply air to the drills used in the headings and the mechanical shovels, hoists, pumps, the telepherage system, and the electric locomotives. In the compressor plant are three

Laidlaw-Dunn-Gordon compressors, directly connected to motors of 480 horsepower each. When operating at their full capacity each compressor can deliver 2,800 cubic feet of air per minute at 100 pounds pressure. The switchboard in the tunnel plant is larger than the boards of many central stations located in small towns. It contains all the recording and indicating instruments, in addition to the switches and circuit-breakers. An interesting instrument is the recording pressure gauge, which is piped from the receiver, and at the end of each 24 hours, when the chart is removed, a clear and lasting record of every fluctuation in air pressure is obtained.

Controller Metz presided at a conference to consider inter-bridge communication on Wednesday. Those present were President Winter of the Brooklyn Rapid Transit Company, De Lancey Nicoll, representing the Interborough Rapid Transit Company, and George S. Rice, chief engineer of the Rapid Transit Commission. It was decided that the engineers of the two transit corporations should be instructed to investigate and report on the feasibility of either an elevated loop running through Delancey Street and the Bowery from the Williamsburg to the Brooklyn Bridge, or a subway along the same route. The representatives of the railroads agreed that an elevated loop is the most feasible proposition, and they seem willing to go ahead with it. They estimate that the change in equipment necessitated by the loop will cost some $13,000,000. The city will have to pay for the part of the loop running through Delancey Street, but the companies will pay for the structure to be built over the elevated road in the Bowery and Park Row.

The Brooklyn Rapid Transit Company has opened for traffic its new elevated extension to Canarsie Landing, on the shore of Jamaica Bay. A through service between the Williamsburg Bridge and Canarsie by way of Broadway, the East New York Loop, and the Kings County Elevated was established. C. I. C.

Ohio.

Cleveland, August 4.—In the contempt proceedings brought against Mayor Tom L. Johnson and W. J. Springborn, director of public safety, on account of ignoring the order to cease tearing up the tracks of the Cleveland Electric Railway Company on Fulton Road, the mayor was acquitted and Mr. Springborn was found guilty and fined $100. Mr. Springborn will probably carry the case to the higher courts and test the matter. The Cleveland Electric Railway Company is making a vigorous newspaper campaign, through which it says that the 3½-cent fare will apply to all points where it has lines and to such extensions as it may build, as well as to the rapid-transit lines that it has proposed to construct. Councilman Hitchins, who introduced the ordinance for the Cleveland Electric, now desires a number of changes, principally a provision that the city may purchase the property at the expiration of the franchises, and another that the maximum time of the franchise shall be 20 years instead of 25. The desire of the railroad company and of Mr. Hitchins is that the matter shall be left to a vote of the people after an ordinance has been properly drafted and put into their hands in printed form for consideration. The Forest City Railway Company has done nothing further in the way of preparing an ordinance for a franchise.

The Lorain Street Railroad Company of Lorain has been incorporated with a capital stock of $2,500,000 for the purpose, it is said, of merging the Lorain Street Railway Company and the Avon Beach and Southern, the value of the two being placed at $1,750,000.

The Scioto Valley Traction Company is making a fight for the passenger business to the camp-meeting grounds at Lancaster. From the nearest point to the grounds the company has built a good road and will run carriages to transfer passengers to the grounds. The Hocking Valley Railroad has always had this business, which amounts to quite a little. The Scioto Valley people have lighted the road between the grounds and the station and made everything attractive.

The City Council of Fostoria has let the contract for furnishing 90 arc lights for the streets to the City Heat and Light Company at $69.25 each. Formerly these lights had been costing $90 each, and 125 of them were used. A number of gas lamps have been put in place of arc lights.

A company is being incorporated to build an electric railway from Lima to Marion by way of Canton. The initial capital stock will be $100,000. W. H. Ogan of Indianapolis is promoting the road and George S. Ross of Cleveland is the chief engineer.

The Springfield and Lima Railway Company of Springfield has been incorporated by H. B. McGraw, E. A. Williams, W. S. Hayden and others for the purpose of building a line from Springfield to Xenia. The capital stock is fixed at $600,000.

An excursion was run from Columbus to Chicago Saturday by the Indiana, Columbus and Eastern electric road, the tickets being good on any of the cars leaving up to three o'clock. From Richmond, Ind., the passengers were taken over the C., C. and L. steam line, arriving in Chicago Sunday morning.

The Mann Street Car Indicator and Advertising Company has purchased 57 acres of land near Alliance, where a large plant will be built. P. J. Mann of Pittsburg is president of the company, which is capitalized at $5,000,000.

The Springfield Light and Power Company of Springfield has reduced its capital stock from $200,000 to $700.

General Manager J. L. Adams of the Schoepf roads has announced that the City Council of Columbus will be asked to allow the roads to use T rails on all its lines in the city. The large cars on these lines require that kind of rails for proper operation.

Officials of the Northern Ohio Traction and Light Company have been making an inspection of the Canton-Akron and other Tucker-Anthony lines that are to be merged with it on September 1st with a view to ascertaining what improvements will be needed.

The East Fork Light, Heat and Power Company of Cincinnati has been incorporated with a capital stock of $10,000 by practically the same men who incorporated the Little Miami Light, Heat and Power Company some days ago.

A syndicate has been formed in this city to build the Chicago, Lake Shore and South Bend line, which has been under the guidance of J. B. Hanna and several other men here in the past. The project is rather a large one, but, owing to the desirability of the territory through which it will pass, it is believed to be a splendid proposition. O. M. C.

Michigan.

Grand Rapids, August 4.—The new franchise submitted to the Detroit City Council for the Detroit United Railway is the joint production of Mayor Codd and Jere Hutchins, president of the road. It will be submitted to the people for a vote in November. It makes a number of important concessions to the city, including 10 tickets for a quarter during workingmen's hours, from 5 to 8 a. m., and from 4:30 to 6:30 p. m.; universal transfers; the street-car company to pay all paving between the tracks; the company to pay a two per cent. tax on its gross earnings, and gives the city the right to purchase at the expiration of the franchise in 1924.

Saginaw is trying to force the Saginaw Valley Lighting and Traction Company, which controls gas and electric interests in that city, to a 90-cent gas rate. The company retaliates with an application for injunction. The city charges that the Saginaw-Bay City Railway and Light Company is a holding concern for the stock of the Saginaw Traction Company, the interurban line to Bay City, the Bay City Consolidated Railway Company, the Wenona Beach electric line, the Bartlett Illuminating Company, the Saginaw City Gas Company and the Bay City Gas and Electric Company, and that it was formed to maintain a monopoly on the output of the varied interests.

Grand Rapids is having a controversy with the Grand Rapids Railway Company over a request of the city that the railway company remove its tracks from the city market.

The Benton Harbor-St. Joe Railway and Light Company held its annual meeting at Benton Harbor. The new board of directors elected the following officers: President, C. K. Minary; vice-president, J. G. McMichael; secretary, L. W. Botts; treasurer and general manager, H. C. Mason.

Construction work will begin in about three weeks on the Detroit, Grand Rapids and Saginaw road at St. Johns. Cars with individual motors may be used, each car generating its own power.

A new limited car placed on the Detroit, Monroe and Toledo Short Line failed to reach Detroit on its first trip because it was too wide to pass other interurban cars on the streets of Toledo. The car came to a standstill just as it was about to crash into another car. It has been returned to the manufacturers. L. W. B.

Indiana.

Indianapolis, August 4.—The Lafayette and Chicago Electric Railway Company, organized to build an electric railway from Lafayette to Chicago, has filed articles of incorporation, capitalized at $25,000. The directors are George Winfield, W. A. Hennegar, James M. Leatherman and others.

The promoters of the Lafayette and Hoopston Interurban Railway Company have organized by electing Henry A. Miller, Isaac E. Switzer, David E. Harrington, Elmer Hawkins, William Randall, J. H. Banks, Ward E. Smith and Lawrence Burns as directors. The proposed line will parallel the Lake Erie and Western Railroad from Lafayette to Hoopston, Ill. The length of the road will be 45 miles and will give direct communication ultimately to Bloomington, Ill.

The City Council of Noblesville has granted the Noblesville Hydraulic Company a 25-year franchise to furnish electricity in that city. The rate fixed in the franchise is eight cents a kilowatt for domestic lighting and six cents for heat and power purposes. The company will soon begin work on the completion of its dam in White River, near the city. This project was started three years ago, but was held up by an injunction secured by land owners, who claimed damages because of backwater. All of this land has since been acquired by the company and eastern capitalists have financed the scheme. Two thousand horsepower can be generated by the river water, and it is claimed the plant will be able to furnish sufficient electricity for many towns in the vicinity in addition to Noblesville. The plant represents an investment of $125,000.

Through trolley service between Indianapolis and Toledo and between Indianapolis and Lima is to be offered by the allied traction interests in a short time. The work of building a line connecting Portland, Ind., and Celina, Ohio, and one other short link connecting Fostoria and Tremont, Ohio, will permit service and join Indiana and Ohio at four different points.

A movement is on foot at Brazil, Ind., for the organization of a new interurban company to build a road from Brazil to Clay City, 20 miles. Housey Johnson is president of the committee which has charge of the preliminary work, and M. J. Murphy is secretary.

A new railroad cross-tie has been invented by George E. Blaine and Edward Hill, and the B. H. & B. Combination Tie Company of Indianapolis has been formed to establish a factory for its manufacture near Chicago. Experiments with the tie, which is constructed of steel and wood, have been made with success by the Union Railway Company of Indianapolis.

The government Geological Survey announces that gauging stations for measuring the flow of water in Indiana streams with a view of utilizing the waterpower for the generation of electricity are now being maintained in Eel River at Logansport, Kankakee River at Davis, St. Joseph River at Fort Wayne, St. Marys River at Fort Wayne, Tippecanoe River at Springboro, Wabash River at Logansport and Terre Haute, White River at Indianapolis and at Shoals, and Yellow River at Knox.

Hugh J. McGowan, president of the Indiana Terminal Traction Company, and the head of the Indiana merger traction companies, has placed an order with the Haynes Automobile Company of Kokomo for a $7,500 touring car. It is to be finished with an extra heavy body of aluminum and have a seating capacity for eight passengers. S. S.

Illinois.

Peoria, August 4.—The Danville and Eastern Illinois Railway Company has been incorporated with a capital of $5,000, to build an electric railway from Danville to a point in Vermillion County. This is another McKinley road, and is building toward Indiana to connect with the elaborate system of electric railways in that state.

William Ross, president of the Milwaukee Engineering Company, in a lengthy report to the mayor of Springfield, says that the arc lights only give 1,330 candlepower, instead of 2,000, as the contract calls for, and that it will cost $1,450 to put the plant in good working order.

The Western Electric Company has installed a new exchange for the Central Union Telephone Company at Springfield.

A local telephone company, with a capital stock of $10,000, has been formed at Heyworth. The stock has all been taken by local people.

The Peoria Gas and Electric Company will make several improvements in both the gas and electric plants. New boilers, with coal-handling and stoking apparatus, and a new concrete stack are some of the improvements planned for the electric plant. The new 1,000-kilowatt turbine is about ready to be put in service.

The Philo Fairland Telephone Company of Philo has been incorporated by George A. Lovingfers, Martin Kearns and C. V. Cotterell.

The New York, Boston and Chicago Electric Railway Company has been incorporated, with principal office in Chicago, capital $10,000, to build an electric railway. The incorporators are W. H. Case, V. H. Officer and Edward B. Kelley.

The McKinley syndicate, which has secured control of the Bloomington and Normal street railway, is asking an extension of the franchise in Bloomington for 20 years. The Council has agreed to give it if the company will furnish arc lights free for the 20 years. If the company accepts, it will mean a saving of about $10,000 per year to the city. V.

Northwestern States.

Minneapolis, August 4.—W. A. Curtis is talking of putting in an electric-lighting system at Cambridge, Iowa.

The council of Rhinelander, Wis., is considering an application for a street-railway franchise from E. A. Edmunds.

The Wisconsin River Power Company has started work for the construction of a new power dam at the Dells of the Wisconsin River near Portage, Wis.

The Cedar Rapids and Marion Street Railway Company has let contracts for the erection of a brick car barn in Marion, Iowa.

Grading work has been started for the construction of the proposed interurban line of the Fox

River Valley Electric Railway Company, out from Sheboygan, Wis.

J. A. Cummings, manager of the Chisholm (Minn.) Light and Power Company, is about to develop the rapids of the Sturgeon River and transmit electric power to Chisholm, Hibbing and other towns in that vicinity as well as the numerous iron mines. The mines there could use electric power to good advantage.

Hixon Bros. of La Crosse, Wis., are considering the construction of an electric interurban line between Mankato, Minn., and St. Peter.

The Minneapolis City Council has passed an ordinance providing for inspecting and testing electrical meters. R.

Pacific Slope.

San Francisco, August 2.—The Century Electric Construction Company, which is located at 623 Sansome Street, is now managed by W. W. Hanscom, who has become general superintendent. Mr. Hanscom was for several years in charge of the electrical construction department of the Union Iron Works, and acquired something of a reputation on motors and generators for marine use.

The Dendell Electrical and Manufacturing Company has been incorporated and capitalized at $25,000, with San Francisco as the place of business. The directors are A. E. Dendell, Ernest M. Schlessinger and E. J. Dendell.

C. E. Loss, the contractor who agreed to reconstruct the cable roadway of the Geary Street Railroad Company as an underground conduit electric railway for the city of San Francisco, at an estimated cost of $340,000, has asked the street committee of the Board of Supervisors to release him from the performance of his contract. He had filed a bond of $34,000, but he now asserts that the roadbed is no longer in the same condition that it was in before the fire of April 18th. Strong influences have been brought to bear since the fire to prevent the carrying out of the plans for a municipal street railway, it being alleged that the expansion of the rails and distortion of the roadbed would be fatal to the operation of a cable road in the event of future earthquakes. The Union Street cable line, operated by the Presidio and Ferries Railroad Company, was very badly wrecked by earthquake and fire, the power house and all of the cars being destroyed and portions of the roadbed on made ground thrown several feet out of line sideways. The Geary Street road, however, was damaged comparatively little. The plant was operated for two hours after the earthquake on April 18th and was again opened for business a few weeks after the fire. The original owners are running the Geary Street road under a monthly permit from the city and doing a fair business, although it has no transfer privileges. It is reported that the United Railroads wishes to obtain permission from the city to take the road over and operate it after converting it into an overhead trolley.

Officials of the city railway system of Bellingham, Wash., are planning the construction of an interurban electric-railway line to connect that city with Skagit County. C. D. Wyman, president, and H. F. Grant, manager of the Whatcom County Railway and Light Company, have made a tour of Whatcom County in the interests of the new project.

The United Railroads of San Francisco, which has made an enviable record for enterprise and accomplishment ever since the great fire, has accomplished wonders and is handling the street-railway traffic remarkably well, considering that it has been hampered for lack of sufficient electric cars, the hundreds of cable cars being useless since the roads have been electrified. A great deal of work has been done on the reconstruction of the Polk and Larkin Street line, but the strike of the track laborers has caused an interruption of that part of the programme. The McAllister Street cable line, however, has reached completion as an electric road, and will be started up within a few days, greatly relieving the strain on other parts of the system. The linemen's strike shows no signs of settlement, but on the arrival of Patrick Calhoun something may be accomplished. The power-house firemen and oilers have struck for eight hours, after having had their hours reduced from 10 to nine.

It is given out that the Pacific Electric Company will commence work at once on the Terminal Island-Long Beach line. Two million dollars will be spent during the coming year to improve the Pacific Electric lines, among which will be the West Long Beach line and the four-track system between Long Beach and Los Angeles.

In order that all patrolmen in Seattle, Wash., may be quickly notified at night in case of trouble and report in to police headquarters without any unnecessary delays, Chief Wappenstrin will be allowed to install a system of signal lights on patrol boxes all over the city.

A party of Philadelphia capitalists interested in the Willamette Valley company, which owns several electric and water plants throughout the valley, accompanied by I. W. Anderson of Spokane and E. W. Hall of Portland, Ore., connected with the company, left on a trip up the McKenzie, after inspecting the company's electric, gas and water plants in Eugene, Ore., and at Springfield. It is said the party will seek a suitable site on the McKenzie for a power plant with which to operate its proposed electric-railway system in Eugene and vicinity.

A. J. Burrows, a practical electrician from Aberdeen, Wash., is in Bandon, Ore., to investigate the prospect for installing an electric-light plant. It is expected that the plant will be in operation within eight months.

It is reported that the St. Helens Mill and Power Company of Castle Rock, Wash., will build an electric line to connect with the Milwaukee Railroad system, when they build through Cowlitz Pass, which is only a short distance from the power plant. A. H. Trego is president of the company.

Within a short time a wireless station will be established in Portland, Ore., probably on the East Side, and offices will be opened on both sides of the river to receive commercial messages for transmission to all Sound points.

A contract for the erection of the new telephone central building on Fifth Street, near Franklin, Olympia, Wash., has been let by Robert Doragh to the Olympia Manufacturing and Building Company, and excavation for the structure will be under way soon.

Articles of incorporation have been filed at Vancouver, Wash., for the Independent Light and Water Company, with a capital stock of $500,000, by E. W. Hall of Portland, Frank W. Waters of Salem, A. Welch of Portland, John H. McNary of Salem and J. A. Webber of Vancouver.

The Truckee River General Electric Company of Yerington, Nev., is preparing to build a generating plant on the upper Carson River, to supply Carson City and Douglas County farmers with power and light.

Construction will soon be started on improvements at the plant of the Tacoma Gas and Electric Company of Tacoma, Wash., at a cost of $50,000. A new water-gas plant will be installed, and by October 1st the present equipment will be increased by a thoroughly modern gas set with a capacity of 350,000 cubic feet daily. A.

PERSONAL.

Robert S. Jones has been appointed manager of the Bell Telephone Company in Montreal, Canada, to fill the position made vacant by the death recently of Mr. D. C. Dewar. Mr. Dewar had been manager in Montreal for many years.

The Illinois Traction Company announces the following changes: E. L. Davis is to be freight solicitor at St. Louis, and Robert Scott is to succeed Mr. Davis as freight agent at Springfield. S. K. Holland is to be in charge of the express business, with H. S. Weidman of Peoria to handle the accounts.

Warren S. Bicknell, formerly president of the Lake Shore Electric Railway Company of Cleveland, has been elected president of the Citizens Railway and Light Company of Fort Worth, Texas, formed to take over the Arlington Heights Traction Company, the Rosen Heights Street Railway Company and the Citizens' Light and Power Company. W. W. Christy, H. H. Johnson and S. M. Kelsey of Cleveland and C. B. Close of Toledo are interested in the merger.

F. J. Reynolds, manager of the Canadian Pacific Railroad commercial telegraph office in Winnipeg, Man., and for 21 years continuously in the employment of the company as an operator and chief dispatcher at various territorial points, has resigned from the service of the company owing to ill health. After taking a month's vacation in the East Mr. Reynolds will start business on his own account in Regina. He was one of the most popular officials of the company in the West.

John Finley, who for years has been the manager of the Central Railway Company, now the Peoria Railway Company, and controlled by the McKinley syndicate, has resigned, to take effect November 1st. In the years that Mr. Finley has been the head of the Peoria company the system has been changed from a horse railway to one of the best electric lines in Illinois. For some time Mr. Finley has not been in the best of health, but he was prevailed upon to remain until the interurban line was built into the city.

Mr. William J. Ferris and Mrs. Reca Mason Murphy were married on July 16th at Chattanooga, Tenn. Mr. Ferris, who is one of the most highly esteemed members of the electrical fraternity in the West, was long connected with the General Electric Company in Chicago and more recently was assistant manager of the Illinois Traction System, with office at Champaign, Ill. He is now president of the La Crosse Waterpower Company, as noted elsewhere, and is making his headquarters at La Crosse, Wis. He is therefore entitled to double congratulations, which his friends will extend to him with great sincerity.

According to an announcement from Washington, Captain I. N. Lewis, Artillery Corps, will call upon the Crocker-Wheeler Company, Ampere, N. J., during August "on official business pertaining to the installation and operation of electrical machines, tools and power-transmission machinery, and for the purpose of securing special information concerning electrical and laboratory apparatus and power-plant equipment." This unsolicited call upon the Crocker-Wheeler Company indicates the United States government's high opinion of Crocker-Wheeler electrical engineers, whose skill in laying out for the government systems for generating and applying electrical power is constantly in demand.

The London Electrician of July 20th says: "We regret to record the death, by his own hand, at the age of 43, of Professor Drude. A native of Brunswick, he early showed promise as a physicist when a student at Göttingen. A series of papers from his pen appeared in Wiedemann's Annalen in 1896-9, in which he applied the electromagnetic theory of Maxwell as developed by Hertz to the problems of light. These researches were afterward embodied in his work on 'Physics of the Ether,' and his textbook on optics deservedly ranks as a standard work on the subject. In 1900 he succeeded Wiedemann in the editorship of the Annalen der Physik, and last year he was appointed professor of physics in Berlin on the occasion of Professor Warburg becoming president of the Reichsanstalt. His decease is a serious loss to the University of Berlin and to physical science in general."

ELECTRIC LIGHTING.

Staples, Minn., has voted $70,000 bonds for an electric-light plant.

C. F. Luce has purchased the business of the Logan Electric Light Company at Logan, Iowa.

G. A. Pfedl of Giddings, Texas, has sold his electric-light plant to the Giddings Electric Light Works.

Capitalists, represented by John L. Garrett, of Chester, Pa., desire to erect a $100,000 electric-light plant in Chester, and in a proposition to the light committee of councils, they offer to turn the plant over to the city at the expiration of 10 years. The Beacon Light Company, a private corporation, now has the contract for lighting the city.

Sealed proposals will be received at the office of the president of the Miami University, Oxford, Ohio, August 16th, for engines, single-phase alternating-current generators, switchboard, transformers and inside and outside wiring for an electric-light plant to be erected on the campus of the Miami University at Oxford. Bids will be received for the different branches of the work separately or as an entirety.

In addition to the station at Franklin, Ind., recently purchased by the Ferris brothers, that enterprising aggregation of electrical men has also bought the Union City Electric Light Company of Union City, Ind. With this purchase the Ferris brothers are the proud possessors of a string of six central-station plants, located in Monmouth, Ill., Eldora and Osage, Iowa, Yankton, S. D., and Franklin and Union City, Ind.

The first annual meeting of the Rio de Janeiro Tramway, Light and Power Company was recently held in Toronto. Owing to the fact that the company's electrical plant is only in course of construction, no complete statement was submitted. Frederic Nicholls, the vice-president, reported the condition of the franchises and properties as satisfactory. Many important negotiations were under way which could not be made public at this juncture. He said that over 583,000 feet of the underground conduits was being laid, two-thirds of which was completed. All of the members of the old board of directors were re-elected.

Sealed proposals will be received at the office of the city clerk of Clay Center, Kan., until 9 a. m., August 15th, for the furnishing of all labor, equipment, material and supplies necessary for equipping and installing a complete electric-lighting plant and lighting system for Clay Center, Kan., and for making certain improvements in the waterworks plant in that city, all in accordance with the plans, specifications and instructions to bidders on file at the office of the city clerk, Clay Center, Kan., and at the office of the city's consulting engineers, the W. K. Palmer Company, 718 Dwight Building, Kansas City, Mo. The proposals are to cover the following items: Waterworks pumps, steel stack and breeching, three 66-inch by 18-foot tubular boilers, two steam engines 120 and 200 horsepower, steam piping, valves and covering, steam specialties and heater, two alternating-current generators with exciters and switchboard, pole-line material and arc apparatus, etc., installing machinery and erecting pole-line, gas-producer plant.

ELECTRIC RAILWAYS.

The Kansas City Western Railway Company will double the capacity of its power plant in Leavenworth, Kan. Two large new boilers will be installed at the engine house at Wolcott.

To lessen the number of street-railway accidents in Chicago Mayor Dunne proposes to have a bureau of street-railway "experts" drafted from the ex-motormen on the police force. According to the plan, if a car is involved in an accident the police

will accompany it to the barns and keep it in custody until one of new "experts" can examine it.

The Charleston-Paris Traction Company has secured funds for building a road between Charleston, Ill., and Paris. W. R. Patton of Charleston is interested.

The St. Louis, Webster and Valley Traction Railway has issued $1,500,000 in bonds for building a double-track railway from West End Heights, St. Louis, Mo., to Valley Park. Paul D. Caple is president.

The West Construction Company of Chattanooga, Tenn., has been awarded the contract for the construction of the new car shops of the Chattanooga Railways Company. The bid of the company was $38,073. There were three other bids.

At a special meeting of the City Council of Galva, Ill., a franchise was granted to the Galesburg and Kewanee Electric Railway Company to construct and operate a system of electric railways on certain streets in Galva for a period of 20 years.

The Red River Valley Power and Traction Company of Ardmore, I. T., proposes to build an electric interurban line parallel to the Red River from Waurika, Okla., to a point on the Santa Fe Railway, near Ardmore. T. O. Perry of Ardmore is interested.

Work on the street railway in Hutchinson, Kan., is progressing rapidly. The poles for the line are in place and wires are being strung. The laying of track is going on, and the generating machinery for the electric plant is getting in shape to supply current for the cars and for lighting.

The Undercurrent Traction Company has been incorporated in New York city, to equip railroads with electric current devices. The capital stock is $100,000. The incorporators are J. W. O'Brien, Lockport, N. Y.; F. J. Brown, George H. Findlay, Frank A. Flynn, Martin Carrick, Niagara Falls.

Thomas P. McDonough, projector of the Kansas City, Nevada and Springfield Railroad, for whose enterprise Nevada, Mo., a year or so ago, raised a bonus of $10,000, announces that the money is on hand to build the road, and that it will be built as originally planned, except that it will be an electric instead of a steam railroad.

Governor Pennypacker of Pennsylvania granted a charter to the Chambersburg and Southern Railroad Company, to build a railway from Chambersburg, Pa., to Greencastle. The company has a capital stock of $50,000. While the charter calls for a steam railroad, the promoters state that their intention is to build an electric road.

Data sheet No. 10, relating to "flange and tread of wheels," is being sent out by the secretary of the American Street and Interurban Railway Association. In this way it is hoped to gather information upon which the committee having in charge the general subject of standardization can base its report at the next convention.

Surveyors have started from Springfield, Ill., for a trip over the proposed route of the Springfield and Southeastern electric interurban line. The intention of the promoters is to first build a line from Springfield, Ill., through Taylorville to Pana, Ill., and intermediate points, and eventually to reach into Fayette County on the south and Decatur on the east.

The construction work on the double-track system of the Chicago and Milwaukee Electric road has progressed as far as the southern limits of Racine, Wis. E. H. Vivian, claim agent of the company, states that the road is nearly ready for operation from its southern terminus through Kenosha to Racine. Right-of-way was not secured through Racine, so that the road will pass its western borders. By this time next year, Mr. Vivian says, the company will be running its cars into Milwaukee.

On the completion of traction projects now being pushed in several of the northern counties of Indiana, Indianapolis will be connected by electric railway with Chicago. By January 1st the gap between South Bend and Laporte and the one between Warsaw and Peru will be completed. The gap between Michigan City and Chicago will be the last to be closed. Traction men are said to be preparing a schedule with a view of carrying people by trolley from Indianapolis to Chicago, or from Indianapolis to Michigan City, with a choice of steamboat service into Chicago.

The Aurora (Ill.) News says that the Aurora, Elgin and Chicago Railroad Company is making arrangements to develop a large car-lot freight business. It is already doing considerable business in this line, but until the recent bond sale it has been handicapped for money to put in the necessary switches, etc. It is believed that a large trade in car lots will be developed soon. General Manager Faber is also working for the early establishment of facilities for the handling of package freight in and out of Chicago. A line of automobile trucks will be established between the downtown district and the end of the Aurora-Elgin lines at Fifty-second Avenue. The interurban line carries passengers to the heart of Chicago over the Metropolitan elevated tracks, but the city recently rejected an ordinance giving the Metropolitan the right to carry freight.

According to the Vienna Neue Freie Presse of July 17th it was stated in the Bavarian chamber on the previous day by the representative of the Vienna government that the entire cost of the electrification of the railways from Munich to Garmisch and from Munich to Lindau will be approximately $10,000,000. The expenses of working these lines by electricity, if traffic is increased by 50 per cent., will be reduced from $1,500,000 to $1,000,000 per annum, and the time needed for the journey will be greatly diminished—as much as 45 minutes on the Munich-Murnau-Garmisch Railway, and from one to two hours on the line from Munich to Lindau.

Work has been begun on the lines of the Baltimore Terminal Company, which is the Baltimore end of the Washington, Baltimore and Annapolis Electric Railway Company. The Fidelity Construction Company of Cleveland is doing the general work on the main portion of the road, while the Interstate Engineering Company of Bedford, Ohio, is putting in the bridges. The company owns the old Annapolis, Washington and Baltimore, with a line from Odenton to Annapolis. From Odenton to Washington is about 16 miles. From Washington to Baltimore the distance is about 40 miles. The steam road will be electrified and the other two portions will be built.

E. V. Morgan, United States minister at Havana, in comparing British and American trade interests in Cuba, has this to say of the electric railways: "The Habana Electric and Habana Central are under aggressive American management, but their capitalization, including the investments represented by the Insular Railroad Company and the Cuba Electric Company, totaling $16,000,000, is to a considerable extent English and Canadian. The Habana Electric is the older company, while the Habana Central, having been organized for little over a year, is as yet in course of construction. It is hoped that when the latter is completed it will be able successfully to compete with the established roads which now handle the tobacco and sugar in Habana Province. A large proportion of the year's pineapple shipments have been made over the company's newly laid tracks, and the fruit farmers in the vicinity of Habana have been well satisfied with their treatment."

PUBLICATIONS.

James Leffel & Co., Springfield, Ohio, have issued a handsome and complete new 52-page catalogue, illustrating and describing their line of steam engines and boilers. The details of construction are plainly shown and fully explained, and the catalogue is one that will be valuable in the hands of any prospective purchaser of work in the steam power line. A copy will be furnished free to prospective buyers who address the company and request the catalogue.

Bulletin No. 131, from the Atlas Engine Works, Indianapolis, Ind., is about ready for general distribution. It gives a complete description of the several classes of Atlas single-valve engines, both throttling and automatic. The more important parts of these engines are fully illustrated and described. Atlas single-valve engines have been built continuously by this company for over 30 years. They are the finished result of the demand for a satisfactory steam power producer, and that it has been successful the company refers to nearly 30,000 Atlas engines in service, many of which have been in successful operation for over 20 years.

The publication bureau of the General Electric Company is distributing several new bulletins. No. 4447 pertains to low-voltage three-phase generator and feeder panels. No. 4450 takes up parts of GE-80-A railway motor. No. 4449 relates to potential and synchronizing plug switches and gives wiring diagrams. No. 4446 deals with starting compensators for alternating-current motors, giving sizes and dimensions. No. 4443 is on the Sprague-General Electric multiple-unit control for alternating and direct-current operation. Other circulars treat of motor-starting rheostats with no-voltage release, and incandescent lamp bases.

Books on the boiler, the steam engine, the dynamo, the lamp, etc., have all been presented to the public, but when one finds a neat little volume devoted entirely to a scientific yet eminently practical dissertation on the carbon brush alone, and by an authority on the subject, the electrical engineer's interest is at once attracted. John S. Speer's neat little volume, entitled "Carbon Brushes," is well worth the reading of every electrical engineer, dynamo and motor designer, and dynamo tender; in fact, anyone with the slightest interest in dynamo-electric machinery will find the 30 pages of the book (which is published by the Speer Carbon Company of St. Marys, Pa.), with the illustrations and diagrams, a valuable addition to his library. Among other things, Mr. Speer points out that no single grade of brush can be used as a "cure-all;" but that brushes of special composition must be made to meet the requirements of the various machines. This would be startling to the purchasing agent were it not a fact that three or four qualities of carbon brushes have been found to cover all difficulties that arise in practice. The author emphasizes another fact not generally understood—that a successful carbon brush must have three important qualities—resistance, lubricating and cutting qualities, each in due proportion. "Carbon Brushes," issued in the main as an advertisement for the Speer Carbon Company, contains also records and curves of an elaborate series of tests on the Speer carbon brushes that are corroborated by tests at Columbia and Purdue universities and the Case School of Applied Science, and at other colleges. A perusal of the very practical chapter on "The Misuse of Carbon Brushes" will likely save money for many a practical man. To appreciate the practical value, however, of "Carbon Brushes" one must send for it and read it for himself. The book is embellished with a handsome half-tone frontispiece portrait of the author.

TRADE NEWS.

The foreign commerce of the United States has grown much more rapidly during the last decade than its population. Completed figures for the fiscal year 1906, just presented by the Bureau of Statistics of the Department of Commerce and Labor, show that while the population has grown since 1896 but 20 per cent., imports have grown 57 per cent. and exports 109 per cent.

The Ferris brothers, now the owners of the Franklin Water and Light Company of Franklin, Ind., will soon install at that place a 150-kilowatt alternating-current generator and switchboard and a 200-horsepower engine. They also expect to start a day circuit, for which they will require a number of small motors, fans, etc. They will be glad to hear from manufacturers making the machinery mentioned.

Owing to the growth of business, with consequent demands for a closer base of operations, the Gould Storage Battery Company has found it necessary to establish a Canadian branch, with offices at 62-64 Wellington Street, West, Toronto, Ontario. Mr. P. B. Yates has been placed in charge of this office. Besides the regular line of storage batteries for load regulation, in connection with a Gould counter electromotive-force booster, on street-railway, lighting and power-plant systems, and floating or line batteries, the Gould storage batteries are being manufactured for use in train lighting and also for telephone and telegraph work.

BUSINESS.

The Stromberg-Carlson Telephone Manufacturing Company of Rochester, N. Y., reports having closed contracts for switchboards at the following places: Palouse, Wash.; Georgetown, S. C.; Cumberland, Md.; Goldfield, Iowa; Provo, Utah; Morton, N. Y.; Parma, Idaho; North Adams, Mich.; Indianapolis, Ind.; Moultrie, Ga.; Oakman, Ala.; Newtonville, Mass.; Clyde, Ohio; Logan, Utah; Rochester, N. Y.; New Castle, Ky.

The De La Vergne Machine Company, New York city, reports recent orders for Hornsby-Akroyd oil engines from the following-named: Wheaton Seminary, Norton, Mass.; P. R. Manufacturing Company, Detroit, Mich.; Rahr Brewing Company, Oshkosh, Wis.; Vitagraph Company, Brooklyn, N. Y.; Regal Oil and Gas Company, Chicago, Ill.; L. R. Wright, Pecos, Texas; James H. Holden, Fall River, Mass.; Borough of Souderton, Souderton, Pa.; James L. Breeze, Southampton, L. I.

Large cities of the Pacific Coast are rapidly adopting the automatic telephone system of the Automatic Electric Company, Chicago, the contract for the last large city, Spokane, Wash., having been closed a few days ago with the Home Telephone Company of Spokane. It calls for the building and installation of a 3,500-line automatic exchange of the most modern type, together with power appliances, telephones, etc. San Diego, Los Angeles, San Francisco, Oakland, Portland, Walla Walla, Tacoma, Bellingham and Spokane, all having automatic installations, will be important factors in an extensive long-distance system being worked out on the Coast by local capital.

The American Electric Telephone Company, Englewood, Chicago, has just closed a contract with the Topeka Independent Telephone Company of Topeka, Kan., for building the new Topeka 10,000-line, multiple, lamp-signal, central-energy switchboard. The Topeka company intends to operate a great many party lines, and for that reason the number of lines per operator's position is reduced to 100. Each position is also equipped with 15 sets of cord circuits, each including the American company's four-party selective key for permitting the operation of the American company's well-known high and low-frequency selective system of telephones. The contract also includes a two-position chief operator's desk, a two-position information and trouble clerk's desk, and one two-position toll recording desk, which is required to operate in conjunction with the four-section toll-line switchboard already installed by the American company in the Topeka company's exchange. There is also terminal room and power plant equipment. The present Topeka central-energy switchboard, which is still in operation and giving good service,

was built by the American company in 1900. The circuits adopted for the new switchboard are substantially the same as those contained in the old switchboard, and the fact that the telephone company's engineers adopted the same circuit which they have operated for years is considered by the American company as justifying its contention that its common-battery switchboard system requires the least amount of current for its operation, contains the fewest number of parts of any system, and therefore calls for the least expense in maintenance and operation. The system referred to is the American company's type, in which there are only two relays in the entire cord circuit and one relay in the line circuit.

ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued (United States Patent Office) July 31, 1906.

827,077. Electric Bell. Edward J. Burke, Brooklyn, N. Y., assignor of one-half to John Q. A. Whittemore, Boston, Mass. Application filed March 14, 1905.

This patent covers an electric alarm or call-bell which employs an electromagnet, an armature, a spring contact and a stationary contact.

827,080. Automatic Bucket. Frank O. Clukies and Arthur M. Hazell, New York, N. Y. Application filed September 14, 1905.

An electromagnet mounted on an automatic bucket is adapted to act as a grapple and trip to close and open the bucket.

827,087. Harmonic Signaling for Party Lines. William W. Dean, Elyria, Ohio, assignor to the Dean Electric Company, Elyria, Ohio. Application filed August 9, 1905.

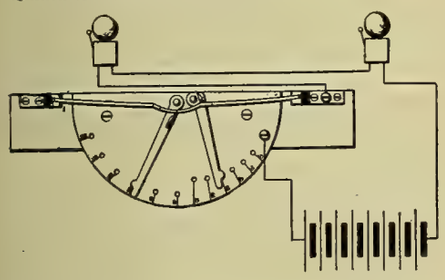
A number of signal-receiving devices are tuned to respond to periodic impulses at different frequencies, and means are also provided to supply current impulses to any desired frequency at a voltage approximately proportionate to the frequency.

827,090. Trolley-pole Head. John M. Fleming, Ottawa, Canada. Application filed July 13, 1905.

A frame supports the harp at substantially right angles to the trolley wire and comprises an upper guarding member extending around the harp in substantially the same plane as the top thereof. A lower harp-supporting member is connected to the upper member by two dependent members and a swiveling connection between the frame and harp.

827,108. Sparking Device. William W. Morse, West Orange, N. J. Application filed June 7, 1902.

An improved electric sparking plug for gas-engine ignition is described.



NO. 827,120.—ELECTRIC ALARM.

827,115. Method of Electrostatic Separation. Greenleaf W. Pickard, Amesbury, Mass., assignor to the Huff Electrostatic Separator Company of Maine. Application filed September 27, 1905.

The mixture to be separated is first heated and then subjected to electrostatic separative influence in a heated atmosphere.

827,116. Apparatus for Electrostatic Separation. Greenleaf W. Pickard, Amesbury, Mass., assignor to the Huff Electrostatic Separator Company of Maine. Application filed September 27, 1905.

In the separator described are a source of electrical energy, electrodes, means to supply material thereto, means to heat the material before it reaches the electrode, and means to heat the electrode to which the material is delivered.

827,120. Electric Alarm. William O. Rehn, Dunkirk, N. Y. Application filed October 11, 1904.

A metal strip capable of expansion and contraction through changes in temperature and having a bowed portion has a number of indicating-hands. An electric bell is electrically connected to the metal strip and the indicating hands, whereby contact of the bowed portion of the metal strip with the lug of either indicating-hand will complete a circuit and ring the bell when the indicated temperature is reached. (See cut.)

827,122. Railway Signal System. William E. Schieble, Miamisburg, Ohio, assignor to D. P. Clark & Co., Dayton, Ohio. Application filed March 24, 1905.

An electric signaling system for railroads comprises a commutator rotatably mounted on a support, contact-arms pivotally suspended from the support on opposite sides of the commutator, and a weight suspended from the arms and acting to draw them together toward the commutator.

827,142. Switch and Signal Apparatus. Clarence W. Coleman, Westfield, N. J., assignor to the Hall Signal Company of Maine. Application filed November 2, 1903.

One claim covers the combination of an admission valve, an electromagnet, means whereby the energization of the magnet moves the valve in one direction, means for moving the valve in the opposite direction, and independent means for closing the valve.

827,154. Electric Signaling Device. Patrick Kennedy, New York, N. Y. Application filed April 26, 1906.

An auxiliary electromagnet sets the mechanism in operation. A shunt about the auxiliary magnet shunts it normally out of the line circuit. A main electromagnet has circuit-breaking means for breaking the shunt about the auxiliary magnet. A shunt about the main magnet shunts it normally out of the line circuit. There are manually-operatable means for breaking the shunt about the main magnet when a signal is to be sent, and means for holding the last-named shunt open until the transmitting mechanism is set in operation.

827,179. Process of Electrolytically Dissolving Iron-oxide Scale. Charles J. Reed, Philadelphia, Pa. Application filed June 26, 1905.

The process of electrolytically dissolving iron-oxide scale from the surface of metal consists primarily in subjecting the metal as a cathode to the action of an electric current while in contact with an electrolyte containing sulphuric acid of a specific gravity above 1.06 degrees.

827,180. Process of Electrolytically Removing Scale and Producing Iron Sulphate. Charles J. Reed, Philadelphia, Pa. Application filed January 2, 1906.

This process consists in passing an electric current to the metal, as cathode, in an electrolyte containing sulphuric acid and sulphuric dioxide, withdrawing and cooling the resulting solution, thereby precipitating the iron sulphate and returning the residual solution to the electrolytic cell.

827,181. Electric Switch. George W. Richardson, Wissahickon, Pa. Application filed May 16, 1905.

In an electric switch are combined a terminal having a contact member, a flexible lever having a contact arm, and a toggle for operating the lever.

827,182. Device for Indicating at a Distance the Height of a Water Level. Franz Rittmeyer, Appenzell, Switzerland. Application filed March 8, 1905.

This device is based on the principle of variation in electrical resistances and current flow.

827,189. Electric Railway. Bartholomew M. Stack and James F. Burns, Chicago, Ill. Application filed September 1, 1905.

Combined with a motor car is a runner movably mounted on the car and beneath the same and extending longitudinally therewith. A series of contact-stud holders are located in the roadbed at distances apart less than the length of the runner, each of the holders consisting of a hollow base portion, a slotted head or cover portion and insulation located in the cover portion. A contact stud is located in the insulation and extends into the cavity of the base, electric conductors uniting the contact studs. A main electric conductor and feed conductors lead from the main conductor to some of the contact studs.

827,199. Support for Electric Lights. Otis C. White, Worcester, Mass. Application filed April 14, 1905.

A base for a supporting fixture comprises a sheet-metal shell with a filling of plastic material molded therein and held in place by inwardly bent tongues or fingers embedded in the filling.

827,218. Electrically Wound Clock. Arie De Vos, Des Moines, Iowa, assignor of one-half to S. S. Still, Des Moines, Iowa. Application filed June 30, 1904.

A clock which is wound by electrical means within the clock is described.

827,269. Electric Signaling. Jacob B. Struble, Wilkinsburg, Pa., assignor to the Union Switch and Signal Company, Swissvale, Pa. Application filed March 12, 1902. Renewed June 4, 1904.

A signaling apparatus combines a source of alternating currents, a track circuit in circuit with the source of alternating currents, a motor in circuit with the track circuit, the movable member of the motor being adapted to control a signal, and means for neutralizing a portion of the magnetic circuit of the motor.

827,270. Electric Signaling. Jacob B. Struble, Wilkinsburg, Pa., assignor to the Union Switch and Signal Company, Swissvale, Pa. Application filed March 12, 1902. Renewed June 4, 1904.

In combination with the track rails of a block section are a source of alternating current for supplying alternating current to the track rails and a relay having field and armature coils, the field coil being energized from the alternating current in the track rails. (See cut.)

827,293. Method of Treating Cotton. George D. Burton, Boston, Mass. Application filed November 20, 1905.

This process of treating cotton and other similar materials consists in immersing the material in a bath in which wool has been degreased and cleansed, adding to the bath a quantity of sodium carbonate, heating the solution, and then passing through the bath a current of electricity.

827,297. Alkaline Battery. Thomas A. Edison, Llewellyn Park, N. J., assignor to the Edison Storage Battery Company, West Orange, N. J. Application filed July 21, 1904.

Combined with the electrodes and an alkaline electrolyte is an insulator or support exposed to the action of the electrolyte, the insulator being composed of rubber substantially free of active or uncombined sulphur, whereby the formation of sulphides is avoided. (See cut on next page.)

827,310. Swiveling Current Tap and Lamp Socket. Charles F. Howes, Cambridge, Mass., assignor to the Electric Gas Lighting Company, Boston, Mass. Application filed March 29, 1905.

A swivel block is composed of two centrally perforated members, the upper having a projection for the fixture screw shell and a recess underneath, the lower supporting the lamp-socket shell and having a projection entering the recess of the upper member. A conducting rod passes through the swivel block, forming part of the electric circuit and holding the members in swiveling relationship.

827,312. Mail Carrier. Frank S. Jolly, McFall, Mo. Application filed February 5, 1906.

The device is carried on grooved wheels which run on a track, the grooved wheels being geared to a motor wheel which has connection to a conductor wire through a trolley. To the frame of the mechanism is attached a receptacle for carrying mail.

827,314. Current Collector. Arthur Linden and Paul Hiersemann, Vesterås, Sweden, assignors to Allmänna Svenska Elektriska Aktiebolaget, Vesterås, Sweden. Application filed October 18, 1905.

An overhead supply conductor is described which takes the form of a bow contact.

827,315. Coil Former. Julius W. Lundskog, Lynn, Mass., assignor to the General Electric Company, Schenectady, N. Y. Application filed December 29, 1903.

A coil former comprises, among other features, two relatively revoluble sections for supporting the longer and shorter portions of the coil, and means for supporting the offset bends of the coil independent of the positions of the sections.

827,319. Alternating-current Motor. Maurice Milch, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed January 3, 1905.

There are connections for supplying current to the armature winding on a line at an angle to the field magnetization to start the motor, and means for short-circuiting the armature on the line when the motor is up to speed. Connections are provided for short-circuiting the armature on a second line at an angle to the first.

827,320. Motor Control. Jakob E. Noeggerath, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed November 17, 1905.

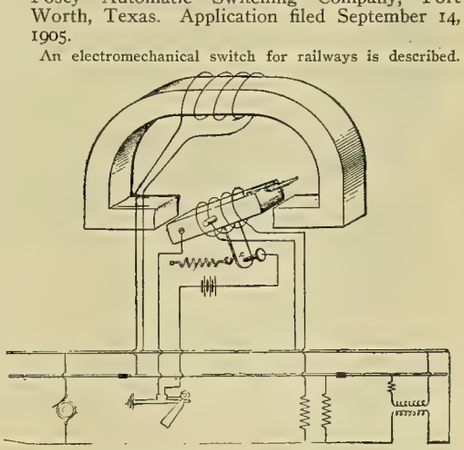
The patent covers a number of motors permanently connected in series, a unipolar dynamo-electric machine connected in shunt to the motors, connections from intermediate points on the winding of the unipolar machine to points of connection between the motors, and means for varying the voltage impressed on the terminals of the several motors. (See cut on next page.)

827,322. Distant Control of Electric Motors. Horace F. Parshall, London, England, assignor to the General Electric Company, Schenectady, N. Y. Application filed April 26, 1904.

A motor has one of its members connected to the supply mains and subjected to the same changes in direction of current as occur in the mains. A motor generator is fed from the mains and operated to maintain the direction of current in the other member of the motor unchanged during changes in direction of current in the mains.

827,323. Electromechanical Switch Thrower. James A. Posey, Midlothian, Texas, assignor to the Posey Automatic Switching Company, Fort Worth, Texas. Application filed September 14, 1905.

An electromechanical switch for railways is described.



NO. 827,270.—RAILWAY SIGNAL.

827,325. Non-reversing Two-way-running Trolley Pole. Hilary, Quertier, Dunedin, New Zealand. Application filed October 9, 1905.

The pole stands vertical in the center of the car and has spring horns extending in opposite directions from the bracket. The device is intended to operate in either direction without reversing.

827,331. Dynamo-electric Machine. Leonard A. Tirrill, Lynn, Mass., assignor to the General Electric Company, Schenectady, N. Y. Application filed February 17, 1905.

A pair of field rings are vertically disposed and one placed directly on top of and secured to the other. A shaft carries two revolving elements, one co-operating with one of the field rings and the other element co-operating with the other field ring.

827,344. Trolley Retriever. Terry Blixt, Pittsburg, Pa., assignor to Walter Foster, Pittsburg, Pa. Application filed July 3, 1905.

A winding drum is attached to the car, one end of the trolley cord being wound upon the drum, and the

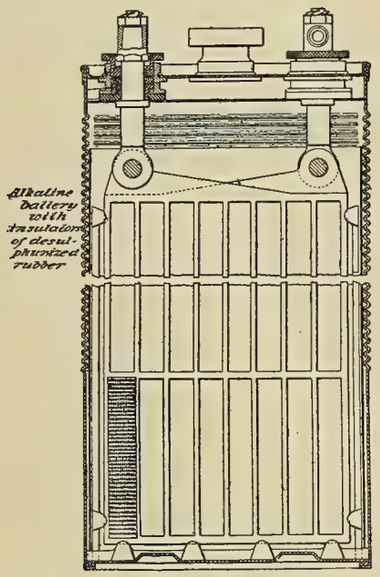
other end attached to the trolley pole. Should the trolley wheel leave the wire the drum performs its function of retrieving it.

827,353. Controlling Electric Switches. Charles E. Eveleth, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed October 3, 1903.

A polyphase alternating-current transmission system is provided with a switch, a trip circuit and connections for bringing the phases closer together in the trip circuit to develop an abnormal flux in the trip circuit under all conditions of excessive current in the lines.

827,360. Collector Ring. Henry Geisenhöner, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed February 10, 1905.

In a dynamo-electric machine are a collector ring and means for securing it to its support, the means being flexible to permit a limited movement of the collector ring relative to the support in a direction parallel to the axis of the ring. (See cut.)



NO. 827,297.—ALKALINE STORAGE BATTERY.

827,361. Insulating Support for Electrical Conductors. William K. Gibboney, Buffalo, N. Y. Application filed July 28, 1905.

A number of supporting insulators are so arranged, in connection with a flexible suspension device, that their axes are substantially in the direction of the resultants of the forces acting thereon, whereby the insulators are subject only to compression stresses in the directions of their axes.

827,380. Intense-light Lamp. Paul Lucas, Schöneberg, near Berlin, Germany. Application filed January 23, 1905.

A gas-light incandescent lamp for intense light and a battery of thermo-electric elements located above the flame to be heated by the products of combustion are combined with an electric motor adapted to be supplied by the electric current produced by the battery. Other features are a ventilator operated by the motor, a burner, and pipes receiving the air supplied by the ventilator and commingling it with the gas and delivering it toward the burner.

827,411. Railway Traffic-controlling Apparatus and System. Henry Bezer, Westfield, N. J. Application filed January 23, 1905.

The first of 76 claims reads: "A railway-signaling circuit, a source of signal-controlling current therefor, means for changing the direction of the signal-controlling current, and normal danger home and distant dual indication railway block-signaling apparatus controllable by the signaling circuit and located at a common signaling point on the railway line and responsive to directional changes in its signal-controlling current."

827,416. Apparatus for Drawing Patterns from Molds. John H. B. Bryan, Buffalo, N. Y. Application filed December 11, 1900.

Patterns are lifted from their molds by means of a vertically movable lifting rod provided with an electro-magnet. Guide devices cause the lifting rod to move in a vertical line, and there is a switch whereby the electric circuit containing the magnet may be opened and closed.

827,449. Telephony. Isidor Kitsee, Philadelphia, Pa. Application filed March 1, 1901. Renewed January 5, 1906.

Interposed in the main-line wires in series are the primary part or parts of one or more induction condensers, each condenser consisting of four series of conducting leaves, insulated from each other, two series designed to form the primary and two designed to form the secondary part of the condenser.

827,455. Resistance Device. Harry W. Leonard, Bronxville, N. Y. Application filed May 13, 1905.

In general the patent covers the combination of a resistive conductor, a support for the same, a protective and insulating material embedding the conductor, and a casing inclosing, protecting and hermetically sealing the parts.

827,469. Automatic Magnetic Circuit-breaker. William M. Scott, Philadelphia, Pa. Application filed October 14, 1904.

In a tripping mechanism a winding produces a magnetizing force dephased with respect to the impressed electromotive force. A winding produces a magnetizing force having a different phase relation with respect to the impressed electromotive force, and there are means for bringing the magnetizing forces more nearly into the same phase relation.

827,478. Apparatus for Electroplating Cylindrical Articles. Robert C. Totten, Pittsburg, Pa., assignor of one-half to Evan J. Francis, New Kensington, Pa. Application filed January 31, 1905. Renewed January 15, 1906.

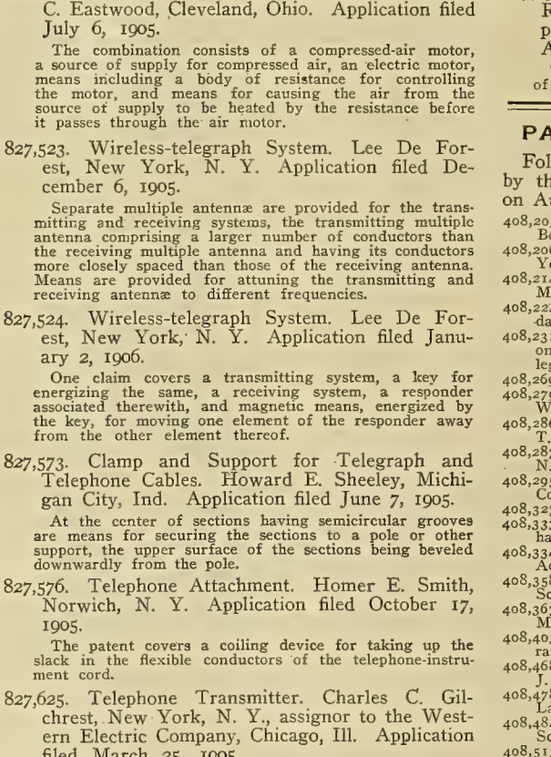
The method of constructing the tank is described.

827,497. Static Electric Machine. Otto Baysdorfer, Omaha, Neb. Application filed November 9, 1905.

One claim refers to brush-bearing arms and collector arms horizontally disposed and mounted adjacent to the inner sides of the case and extended substantially parallel in a manner to traverse the opposite peripheries of the rotatable disks. Vertically disposed storage plates are electrically connected with the collector arms and mounted interposedly between the rotatable disks and the supporting leaf, and upwardly extending insulated conducting rods are contactingly mounted upon the collector arms.

827,499. Apparatus for Magnetic Separation. Gustaf G. Bring, Petersfors, Sweden. Application filed February 10, 1905.

A substantially upright solenoid has a funnel placed therein adapted to contain a body of water and perforated at its lower end. A mantle surrounding the perforated part has a tube within the funnel having its lower end perforated, the mantle and tube communicating with means for supplying water under pressure. A channel at the top of the funnel is adapted to receive the non-magnetic particles and remove them from the apparatus.



NO. 827,320.—MOTOR CONTROL.

827,515. Compressed-air Power Apparatus. Arthur C. Eastwood, Cleveland, Ohio. Application filed July 6, 1905.

The combination consists of a compressed-air motor, a source of supply for compressed air, an electric motor, means including a body of resistance for controlling the motor, and means for causing the air from the source of supply to be heated by the resistance before it passes through the air motor.

827,523. Wireless-telegraph System. Lee De Forest, New York, N. Y. Application filed December 6, 1905.

Separate multiple antennæ are provided for the transmitting and receiving systems, the transmitting multiple antenna comprising a larger number of conductors than the receiving multiple antenna and having its conductors more closely spaced than those of the receiving antenna. Means are provided for attuning the transmitting and receiving antennæ to different frequencies.

827,524. Wireless-telegraph System. Lee De Forest, New York, N. Y. Application filed January 2, 1906.

One claim covers a transmitting system, a key for energizing the same, a receiving system, a responder associated therewith, and magnetic means, energized by the key, for moving one element of the responder away from the other element thereof.

827,573. Clamp and Support for Telegraph and Telephone Cables. Howard E. Sheeley, Michigan City, Ind. Application filed June 7, 1905.

At the center of sections having semicircular grooves are means for securing the sections to a pole or other support, the upper surface of the sections being beveled downwardly from the pole.

827,576. Telephone Attachment. Homer E. Smith, Norwich, N. Y. Application filed October 17, 1905.

The patent covers a coiling device for taking up the slack in the flexible conductors of the telephone-instrument cord.

827,625. Telephone Transmitter. Charles C. Gilchrest, New York, N. Y., assignor to the Western Electric Company, Chicago, Ill. Application filed March 25, 1905.

Details of an improved telephone transmitter are set forth.

827,663. Combined Controller and Dimmer Switch. James W. Pierce, Minneapolis, Minn. Application filed December 5, 1904.

A combined dimmer and switch device includes an operating handle connected to the dimmer and switch. There are means whereby the initial movement of the handle will actuate the dimmer without affecting the switch, and the final movement of the handle will operate the switch without affecting the dimmer.

827,681. Electric Railroad. George W. Browne, New York, N. Y., assignor of one-half to George Washington Adams, Brooklyn, N. Y., and one-half to Milton Mendel, New York, N. Y. Application filed February 23, 1905.

In an electric railroad having a sectional third rail are a live conductor having branches adapted for connection with the respective third-rail sections, a combined circuit closer and opener located at each end of the third-rail section and having vertically movable heads at opposite sides of the rail, and operating devices located upon the cars and adapted to actuate the combined circuit closer and opener.

827,683. Signal Apparatus. Clyde J. Coleman, New York, N. Y., assignor to the Hall Signal Company. Original application filed July 8, 1901. Divided and this application filed May 7, 1902.

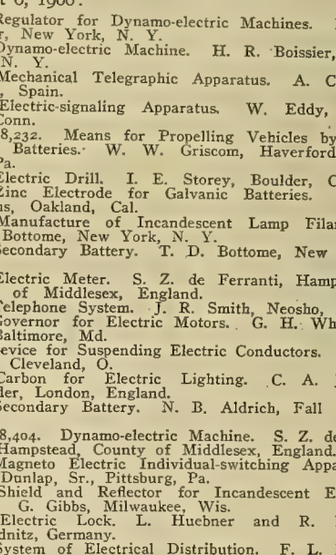
One claim provides that where gas pressure is used to operate a signal, electric means may be used to release the retained gas.

827,685. Electric Signaling Apparatus. John W. Darrah, New York, N. Y. Application filed May 9, 1905.

The device comprises a megneto and a motor normally without potential for operation. Manually actuated means are provided for tensioning the motor and moving it from its normal potentially inoperative position into its operative potential position, the motor being free to return to its potentially inoperative position at all times except during the manual control of the tensioning means.

827,687. Electrically Operated Vehicle. Henry Ducasse, Paris, France, assignor to the Société Anonyme l'Electrique, Paris, France. Original application filed December 31, 1904. Divided and this application filed February 15, 1906.

In an electric vehicle are included the combination of a cross bar, a steering wheel, a commutator, starting mechanism and a lever for operating the mechanism, the last-named members all being mounted upon a cross bar and grouped together as a unit.



NO. 827,360.—COLLECTOR RING.

827,692. Desk Telephone. Stephen C. Houghton, Rome, N. Y., assignor to the Wire and Telephone Company of America, Rome, N. Y. Application filed October 23, 1905.

This invention relates to the support and connections of a desk telephone.

PATENTS THAT HAVE EXPIRED.

Following is a list of electrical patents (issued by the United States Patent Office) that expired on August 6, 1906:

408,205. Regulator for Dynamo-electric Machines. H. R. Boissier, New York, N. Y.
408,206. Dynamo-electric Machine. H. R. Boissier, New York, N. Y.
408,214. Mechanical Telegraphic Apparatus. A. Cazana, Madrid, Spain.
408,224. Electric-signaling Apparatus. W. Eddy, Haddam, Conn.
408,231, 408,232. Means for Propelling Vehicles by Secondary Batteries. W. W. Griscom, Haverford College, Pa.
408,269. Electric Drill. I. E. Storey, Boulder, Colo.
408,279. Zinc Electrode for Galvanic Batteries. J. B. Williams, Oakland, Cal.
408,286. Manufacture of Incandescent Lamp Filaments. T. D. Bottome, New York, N. Y.
408,287. Secondary Battery. T. D. Bottome, New York, N. Y.
408,295. Electric Meter. S. Z. de Ferranti, Hampstead, County of Middlesex, England.
408,327. Telephone System. J. R. Smith, Neosho, Mo.
408,333. Governor for Electric Motors. G. H. Whittingham, Baltimore, Md.
408,334. Device for Suspending Electric Conductors. T. E. Adams, Cleveland, O.
408,358. Carbon for Electric Lighting. C. A. J. H. Schroeder, London, England.
408,367. Secondary Battery. N. B. Aldrich, Fall River, Mass.
408,403, 408,404. Dynamo-electric Machine. S. Z. de Ferranti, Hampstead, County of Middlesex, England.
408,468. Magneto Electric Individual-switching Apparatus. J. W. Dunlap, Sr., Pittsburg, Pa.
408,478. Shield and Reflector for Incandescent Electric Lamps. G. Gibbs, Milwaukee, Wis.
408,484. Electric Lock. L. Huebner and R. Busse, Schweidnitz, Germany.
408,513. System of Electrical Distribution. F. L. Perry, Chicago, Ill.
408,544. Electric Railway System. F. J. Sprague, New York, N. Y.
408,590. Electric Motor. S. C. C. Currie, Philadelphia, Pa.
408,607. Electric Drinking Vessel. F. W. Flint, Mount Airy, Ga.
408,629. Method of Producing Battery Solutions. William P. Kookogey, Brooklyn, N. Y.
408,638. Contact Arm for Electric Railway Motor Cars. C. J. Van Depoele, Lynn, Mass.
408,639. Underground Conduit for Electric Railways. C. J. Van Depoele, Lynn, Mass.
408,640. Multiple Motor Electric Locomotive. C. J. Van Depoele, Lynn, Mass.
408,641. Alternating-current Motor. C. J. Van Depoele, Lynn, Mass.
408,642. Inductional Electric Motor. C. J. Van Depoele, Lynn, Mass.
408,647. Electrical Resistance. F. O. Blackwell, New York, N. Y.
408,666. Secondary Battery. J. F. McLaughlin, Philadelphia, Pa.
408,671. Railway Signal. J. W. Riggs, St. Paul, Minn.
408,676. Electric Call Bell. T. J. Smith, Brooklyn, N. Y.
408,678. Electric Switch. W. Thompson, Orange, N. J.

WESTERN ELECTRICIAN

EVERY SATURDAY

Vol. XXXIX. CHICAGO, AUGUST 18, 1906 No. 7

Electrical Operation of Cloth Printing, Finishing and Dyeing Machines.

By Dr. Alfred Gradenwitz.

A typical instance of the use of electric power in connection with the operation of cloth-printing, finishing and dyeing machines is afforded by the illustrations herewith given and which represent the electric drive in the workshops of the Ghent (Belgium) cloth-printing shop, being a branch of the well-known firm of Parmentier & Co. of the same city. This branch deals especially with cloth printing, dyeing and finishing, all the workshops being designed for electric operation. The electric lighting and power plant was installed by the Brussels branch of the Siemens-Schuckert Company.

The current required to operate the whole plant is produced in a special power station, comprising a tandem engine of 300-horsepower output, driving a polyphase generator at 300 revolutions per minute, having a periodicity of 46.7 and wound for 200 volts. The same engine also drives a direct-current dynamo of 350 amperes and 115 volts. The direct-current dynamo supplies the current required for the lighting plant and for the driving of three motors in the printing shop in addition to the exciting current. The polyphase generator furnishes the current required for about 40 polyphase motors. The total capacity of the motors connected is about 600 horsepower.

Direct current was chosen for the printing machines on account of the extensive regulation of speed, with highly variable torques, required by these machines. If now, as in the case of standard polyphase motors, the regulation of speed be effected by inserting resistances in the armature circuit, the number of revolutions will vary along with the torque, the more so as the speed is reduced more considerably. In the case of direct-current machines, on the other hand, there is the possibility of altering the number of revolutions of the motor by regulating the shunt, when no appreciable alteration will be observed in the case of variable torques.

In Fig. 1 is shown part of the cloth-printing shop containing three cloth-printing machines—two single and one three-color machine. The single machines are operated by five-horsepower polyphase motors with 300 to 900 revolutions per minute, and the three-color machine by a 10-horsepower direct-current motor with a speed of eight to 60 revolutions per minute. The mansards of the three-color printing machine, in which the cloth is dried, are installed in the upper story.

In the raising shop, which is lighted both by arc lamps and incandescent lamps, there are 18 raising gigs, being operated through belt transmission from two 50-horsepower polyphase motors, which, in order to be protected against the dust, are installed in the adjoining room. Part of the latter, with the two motors driving the raising machines, and a luster calender operated by a direct-coupled 25-horsepower polyphase motor, is represented in Fig. 2. In the raising shop will be found further two substantial centrifugal fans, each of which is coupled to a 28-horsepower polyphase motor, and which are intended for drawing in the dust raised during operation, which dust still retains a certain commercial value.

In the finishing and drying shop, parts of which are represented in Figs. 3, 5 and 6, there are installed the drying machines represented in Fig. 3, the fans of which are operated by 15-horsepower polyphase motors, four roller-drying machines (Fig. 5), which are operated through belt transmission from four polyphase motors of four horsepower each, and two centrifugal machines (Fig. 6), each of which is operated by a five-horsepower polyphase motor. In Fig. 4 is shown a fulling machine, mainly serving to impart what is called moiré shine to the fabrics intended for lining. This is operated by a 15-horsepower polyphase motor direct-coupled to the shaft.

A number of jiggers for cold and warm washing, rubbing boards and other machines in the dyeing shops are operated through belt transmission by a 50-horsepower polyphase motor.

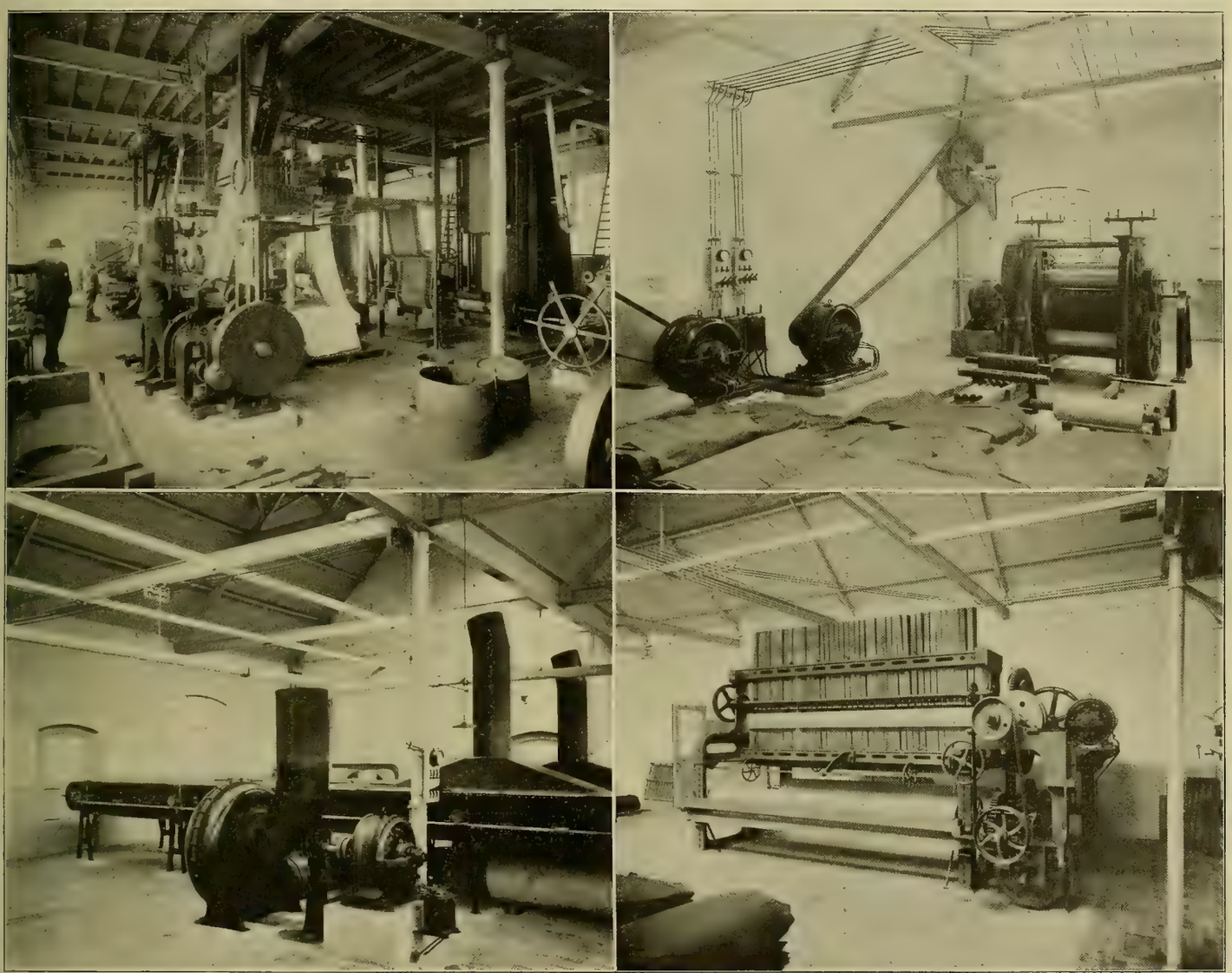


Fig. 1. Cloth-printing Machine Operated by Direct-current Motor.
Fig. 3. Drying Machines with Electrically Driven Fans.
Fig. 2. Polyphase Motors for the Operation of Raising Machines; also Luster Calender Driven by Direct-coupled Polyphase Motor.
Fig. 4. Fulling Machine Operated by Polyphase Motor.

ELECTRICAL OPERATION OF CLOTH PRINTING, FINISHING AND DYEING MACHINES.

Improved Lightning Protection Wanted.

Traction companies in Indiana and Ohio are interesting themselves in the matter of protecting their properties against lightning, a source of considerable damage and some danger. All interurban cars are equipped with lightning arresters for each car, but these are not always effective in times of storm. Sometimes a storm will tie up a line and put the cars out of business just when they are needed most by the traveling public. Charles L. Henry, general manager of the Indianapolis and Cincinnati Traction Company, has issued instructions to all employes within his jurisdiction to make specific report upon every case of lightning damage on the cars and power houses. The purpose is to secure data from which it is hoped that an improved arrester may be designed. The employes will be provided with a standard form for making reports.

A Method of Estimating Underground Construction Costs.

By Charles H. Coar.

Underground conduit systems for the conveyance of wires in electrical distribution systems are rapidly increasing in number and extent, partly because of the restrictions most cities have adopted in relation to stringing aerial wires in the center or congested portions of their confines and partly because past experience has proved to electrical engineers that in a great many instances the extra first cost of underground construction, if any exists, is allowable when compared with the cost of aerial construction, for several reasons, principally that of maintaining the wires. It is well known that it costs considerably more to maintain an aerial plant than an underground plant of distribution. The increase in underground construction has brought about new methods of accomplishing certain tasks connected with the work in a more ready manner than has heretofore been the practice, and because of this fact it may be safely said that the cost of any work coming under this classification should be cheaper in a few years hence than is the case now.

Often when one is confronted with a problem in distribution which does not readily commend itself to either the aerial or underground class he may find himself at a loss which to choose when the costs of each are considered. This may be due to a certain extent to the fact that no very large amount of cost data can be collected at any one locality which will apply equally well in another, and also because of the fluctuations in both the labor and material markets. Because of these reasons mentioned and others which usually assert themselves in the various localities, it is well for persons having to do with this class of work for the first time to collect all the cost data of any similar underground construction, which will be found very useful, as it can be utilized to great advantage in estimating the cost of this kind of work.

It must be borne in mind, however, that many factors enter into the construction of underground systems which do not manifest themselves until actual contact is made with them, very often much to the detriment of any previous cost estimate. Unrecorded obstacles in city streets are some of the greatest evils of this kind. Barring factors of this kind, cost curves can be compiled, which will aid greatly in estimating any future work. To accomplish this end, daily work cards, filled in by the construction foreman, form the most ready and inexpensive means, and have the one great advantage that a very accurate daily check can be obtained on the work as it progresses. This means that valuable data may be obtained regarding the progress and cost under the several conditions met with.

The use of a daily work report, such as is outlined in Form 1, will, if conscientiously filled out, cover most of the ordinary items met with during underground construction. This form provides space for noting the cost of laying the conduit, constructing the necessary manholes and interior arrangements with the laterals, but does not have space provided for any cable costs. The form is self-explanatory and can be printed on stiff cardboard of convenient pocket size.

There are several factors which may appear during this class of work in various localities which are not classified under this form, such, for instance, as would be the city inspection fee, if any existed, but any such conditions could be noted under "Remarks."

If a curve is not desired for estimating this class of work a series of cards as outlined in Form 2 can be filled out and utilized to calculate the cost per 100 feet of conduit construction of the various forms and sizes. Space is assigned for noting the principal factors entering into the construction, and the cards could be filled out from data collected from the daily work report or by means of trail or test calculations made under the various conditions met with in usual practice. A separate card would be used for giving the cost of the different duct installations, so that the cost of conduit construction under different excavating conditions would be recorded on different cards.

The cost of a complete manhole could be estimated in a similar manner by means of Form 3. In this form the various component parts of a manhole are noted, and the cost of the several sizes, if such are used, can be plotted out or arranged in this manner as a standard form by means of the cost data collected from test trials under the several conditions contended with. The several sizes of manholes made under different conditions would of necessity be compiled on different cards. On this form, under the classification of "Racking," any material used in making arrangements for placing the cables about on the walls of the manholes will be noted. Under the classifications of "Sewer Connection," the cost of the necessary apparatus, such as traps, would be noted, as well as the cost of making such connections if any were charged, but the excavating cost would be accounted for under the regular space assigned for this.

When the conduit is laid it is necessary to pull in the cables used in the system, and the data outlined in Form 4 on the cost of pulling in cables will aid in obtaining data which can be used in estimating this class of work. The various notations cover in general most of the factors entering into consideration, and any such as are not can be noted under "Remarks" as before. There are many circumstances entering into this class of work which will vary the cost considerably, especially so in large cities, where it is often necessary to do this class of work at nights or on Sundays, when the street traffic is at minimum. The kind of duct material and the method using in pulling in the cable will be found to be great factors in determining the cost.

The familiar "crab" arrangement is much in use as yet, although it is gradually being supplanted by the more modern apparatus, such as an engine or motor arranged to propel a winch adapted to this class of work. In pulling in cables a great deal of time is often spent in rodding the ducts prior to pulling in the tow rope and also in moving from one manhole to the next adjacent one, where, of course, the apparatus has to be set up. For this reason space is left on this form for noting the time consumed in this manner, in view of so arranging the work that the same can be accomplished and calculated with as little time as possible. This form will also adapt itself readily for use in estimating the cost of pulling out cables—a disagreeable but often necessary task.

The data outlined on a card to be filled out by the cable splicer is shown in Form 5, and it will be seen that the various notations have reference to the ordinary telephone cable. The form could, however, be altered to meet the requirements made necessary by any particular form of cable work. The various kinds of cable splices are noted in a general manner, and should furnish means, if properly filled out, of closely estimating work of this description. It should be remembered that many conditions will crop up while working on "live" cables which often make the costs of "cut overs" very expensive, and due allowance should always be made for fluctuations in this class of work. The space assigned under the heading of "Remarks" should be of general utility, if briefly used to describe any abnormal condition which tends to increase the cost above that allowed in usual practice.

It is believed that a form of this kind should be useful in obtaining information concering this necessary task in every cable plant. The costs of the various forms of cable splicing are not fairly well known, and any reliable data collected concerning the various splicing costs should prove to be of much benefit to persons having to do with this class of work.

Form 6 is intended to provide space for noting

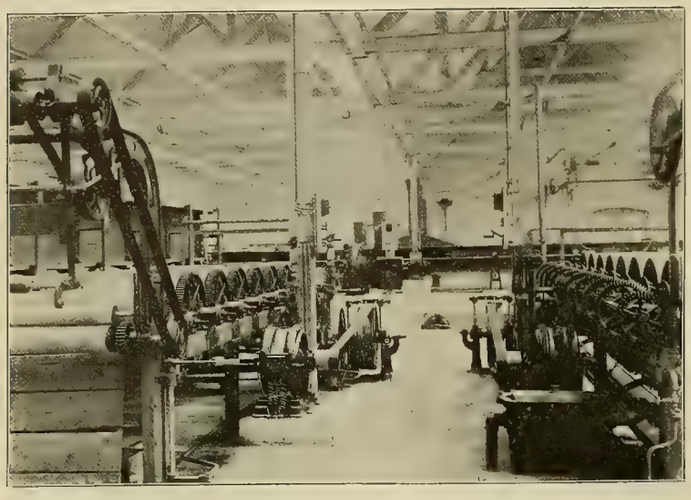


Fig. 5. Roller-drying Machines Operated by Polyphase Motors.

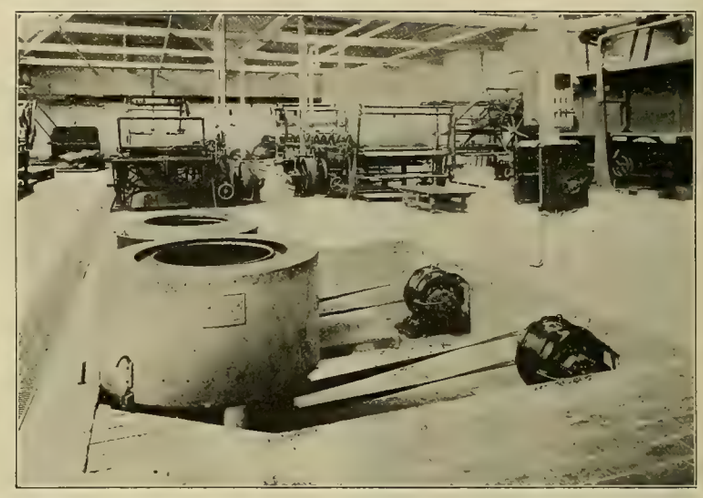
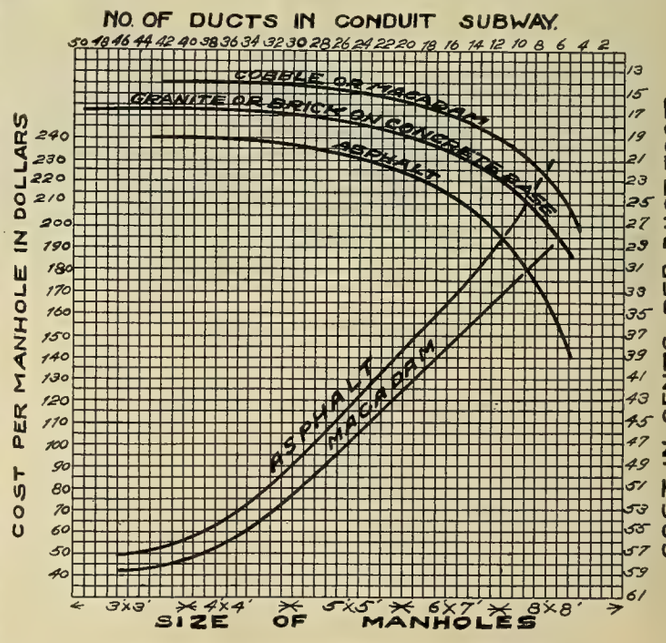


Fig. 6. Finishing Shop with Electrically Operated Centrifugal Machines.

ELECTRICAL OPERATION OF CLOTH PRINTING, FINISHING AND DYEING MACHINES. (SEE PAGE 117.)



CURVES TO SHOW COST OF UNDERGROUND CONSTRUCTION.

any cost incurred in making electrolysis surveys such as is very necessary in every well regulated underground system installed in vicinities subject to stray earth currents. The cost incidental to preventing injury from this cause to the system can be noted on this form, so that a fair average can be obtained as to the cost per manhole for making such a survey. In this work, more perhaps than any other, a large portion of the time is consumed while making the necessary moves from one point to another. For this reason, space is provided for noting the time of actual work, also the time taken up while making the necessary moves. Both of these factors warrant much consideration in large systems, where the matter of transportation often becomes a very important one.

In compiling the data collected on the daily work sheets, as already noted on the several forms, all such data as can be obtained from work done under similar conditions can be added together and an average obtained from the whole, which should be a fair cost estimate of this particular work.

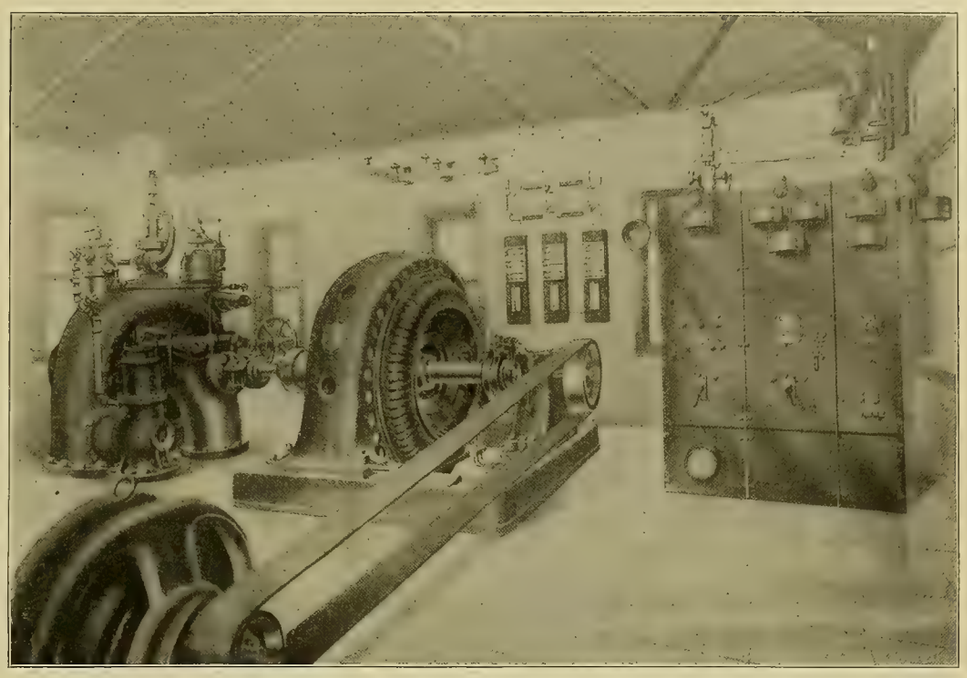
Curves can then be plotted from these average costs which will at a glance furnish a very close approximate cost of any work outlined. It should be borne in mind, however, that local conditions may crop out in work of this character which may alter greatly any previous cost estimate, but, taken as a whole, similar cost curves have proven to be very useful. A set of these curves is shown in the diagram, the conduit cost curves being estimated by Mr. C. J. Field, while the manhole costs were obtained from other sources. In connection with the conduit cost curves, as outlined by Mr. Field, it may be mentioned that the addition of from 20 to 25 per cent. of the curve cost will be sufficient to cover the costs of the necessary manholes.

The several manhole sizes noted at the bottom of the ordinates have their cost under varying conditions noted by means of the amounts at the abscissas on the left. It is the intention of the writer to utilize these forms as outlined in compiling information for cost curves during the construction of a large amount of cable work.

The Electric Generating Equipment of a Gold Mine.

Like the development of every industry from crude methods and rough machines toward efficient systems and high-class equipment, gold mining, especially in the low-grade ores, has reached a position practically parallel to that of any other producing industry, with a certain supply and an assured market. Modern methods and improved machinery have brought about an increased production of yellow metal from low-grade ores far greater than anything in the records of bonanza days, when rich surface deposits only were worked.

The application of electricity to the operation of gold mines has added, in no small degree, to the efficient production of the present day. The electric generating plant recently completed by the Palmer Mountain Tunnel and Power Company may be considered as a typical modern hydro-electric power installation for a gold mine. The power station is located on the Toats Coulee Creek, in the Palmer Mountains, near the town of Loomis, Wash., about 12 miles south of the international boundary line between the United States and British Columbia.



HYDRO-ELECTRIC GENERATING PLANT FOR GOLD MINING IN THE PALMER MOUNTAINS, WASHINGTON.

The intake of the flume, which, with the gate, is constructed of heavy material, is located a little over one mile from the power station, and consists of a heavy concrete pier abutting solid granite bedrock and anchored thereto, running out into the bed of the creek about 14 feet. The mud sills are all five-inch by six-inch material, six feet long, laid crosswise of the grade, four feet apart from center to center. On these sills three stringers of three-inch by four-inch material, two feet apart, are placed for the entire length of the flume, and over these ties the flume bottom is laid, consisting of four two-inch planks 12 inches in width, making the bottom four feet wide. For the support of the sides, uprights of three-inch by four-inch material are set into the four-inch by four-inch ties, which are allowed to project outside of the bottom. The sides of the flume, 1½-inch planks, two feet high, are spiked to the uprights. On the top of the uprights across the flume is spiked a three-inch by four-inch cap, which binds this structure together.

On the tangent every other tie has been allowed to project two feet beyond the bottom of the flume. From this projection to the upright a brace is fitted in at an angle of 45 degrees. On the curves this bracing is on every tie, thus making it impossible to rack the flume at any point. On the top of the caps a cover has been laid, which also answers the purpose of a floor, over which all the materials for the construction were run as the building progressed. About one-half of the sills are on bedrock, the balance being on earth. Those on the earth are the only part of the work subject to decay, and can be removed at any time without disturbing the remaining portions.

Very little trestling was necessary, and what has been constructed was built very substantially. Culverts have been put in at all points where the least possible chance of damage from snow and water might occur. Overflow and safety gates are at convenient points, and three large sand boxes have been constructed to trap any grit that the water may carry during high water, thus insuring the turbine wheel against wear by sand cutting. The construction is so well made throughout that there is no leakage whatever, which is very remarkable for a flume of this length.

The penstock, which runs down the mountain side, connecting the flume with the turbine wheel, is 676.8 feet in length. Beginning at the top it is 34 inches in diameter and is gradually reduced to 27 inches. From 27 inches it is gradually reduced

FORM 1.—CONDUIT CONSTRUCTION DAILY REPORT.

City .....Date .....Weather .....
City Permit No.....Estimate No.....
On .....between .....and .....
Which side of street.....Distance from curb.....
Kind of pavement.....Nature of soil.....
Depth of trench...Width of trench...No. of trench ft. dug..
No. of manholes built..No. of ducts..No. of conduit ft. laid..
Iron pipe used.....Size.....Iron bends used.....Size.....
Am't cement used....Kind....Am't water used.....
Am't sand used.....Kind....Am't brick used....Kind....
Am't planking used....Kind....Am't rock used....Kind....
Am't racking used.....Kind.....
No. ft. trench filled.....No. ft. pavement relaid.....
No. loads dirt hauled.....Distance hauled.....
No. of trench ft. partly dug..No of trench ft. partly filled..
No. of manholes dug or partly so, but not built up.....
No. of manholes partly built.....
No. of laborers employed.....Total hours worked.....
No. of cement men employed....Total hours worked.....
No. of masons employed.....Total hours worked.....
No. of teams employed.....Total hours worked.....
Remarks .....
.....
.....
.....
Foreman.

FORM 2.—COST PER 100 FEET OF CONDUIT CONSTRUCTION.

City .....Date .....Weather .....
City Permit No.....Estimate No.....
On .....between .....and .....

Excavation	Kind	Am't	Cost
Kind of paving	Nature of soil		
Conduit	Kind	Am't	Cost
Rock	Kind	Am't	Cost
Sand	Kind	Am't	Cost
Cement	Kind	Am't	Cost
Water		Am't	Cost
Dowel pins	Kind	Am't	Cost
Burlap	Kind	Am't	Cost
Repaving	Kind	Am't	Cost
Mason	Hours	Rate	Cost
Cement men	Hours	Rate	Cost
Laborers	Hours	Rate	Cost
Team	Hours	Rate	Cost
Foreman	Hours	Rate	Cost
City inspection			Cost
	Total		

Remarks .....
.....
.....
.....
Foreman.

FORM 3.—COST OF COMPLETE MANHOLE.

City .....Date .....Weather .....
City Permit No.....Estimate No.....
On .....between .....and .....

Excavation	Kind	Am't	Cost
Kind of paving	Nature of soil		
M. H. No.	Size	Depth	
Brick	Kind	Am't	Cost
Sand	Kind	Am't	Cost
Water		Am't	Cost
Racking	Kind	Am't	Cost
Frame and cover	Kind	Am't	Cost
Sewer connection	Kind	Am't	Cost
Repaving	Kind	Am't	Cost
Mason	Hours	Rate	Cost
Cement men	Hours	Rate	Cost
Laborers	Hours	Rate	Cost
Team	Hours	Rate	Cost
City inspection			Cost
	Total		

Remarks .....
.....
.....
.....
Head Mason or Foreman.

FORM 4.—COST OF PULLING IN UNDERGROUND CABLE.

City .....Date .....Weather .....
Estimate No.....Cable.....Section No.....
On.....From M. H. No.....To M. H. No.....
No. men rodding duct...Time rodding...Distance rodded...
Size of cable.....Kind.....
Total length.....No. of reels.....No. of pulls.....
No. of moves.....Average time of moves.....Total time.....
Cartage full reels.....Distance.....Time.....
Cartage empty reels.....Distance.....Time.....
Laborers employed.....Hours.....Rate.....
Team .....Hours.....Rate.....
Remarks .....
.....
.....
Foreman.

(Reverse Side.)

Location.	From M. H.	To M. H.	Reel No.	Feet.	Size.
"	"	"	"	"	"
"	"	"	"	"	"
"	"	"	"	"	"
"	"	"	"	"	"
Total					

FORM 5.—COST OF SPLICING UNDERGROUND CABLE.

City .....Date .....Weather .....
Estimate No.....Cable No.....Section No.....
Kind of cable.....Size.....
Straight splices.....Size.....
Tap splices.....Size.....
"Y" splices.....Size.....
Cut overs.....From.....to.....Size.....

Lead sleeves	Kind		Am't
Solder	Kind		Am't
Muslin	Kind		Am't
Paraffin	Kind		Am't
Paper sleeves	Kind		Am't
Candles	Kind		Am't
Splicer	Time		Rate
Helper	Time		Rate
Cartage	Time		Cost

Car fare.....from.....to.....Am't.....
Miscellaneous .....Am't.....
Remarks .....
.....
.....
.....
Foreman or Splicer.

FORM 6.—COST OF ELECTROLYSIS WORK.

City .....Date .....Weather .....
Manhole Nos.....
.....
.....
No. of readings taken.....

No. of ground rods driven	Kind		Cost
No. of bond strips used	Kind		Cost
No. of bond connectors used	Kind		Cost
No. of bonds disconnected	Kind		Cost
Soldering	Hours		Cost
Hours moving	Hours actual work		Total
No. men employed	Rate		Cost
Car fare			Cost
Miscellaneous			Cost
	Total		

Remarks .....
.....
.....
.....
Foreman.

to 24 inches in diameter. The upper part is constructed of 3-16-inch steel and the lower part one-quarter-inch steel. The seams are all double-riveted, while the turns are single-riveted, five-eight-inch rivets being used throughout. It is made up in 32-foot sections, with steel flange joints bolted together.

Constructed of concrete, the power house has walls 12 inches and foundations 24 inches in thickness. The floor is of cement and the machinery foundations and tailrace, which extends 12 feet below the floor, are all of concrete.

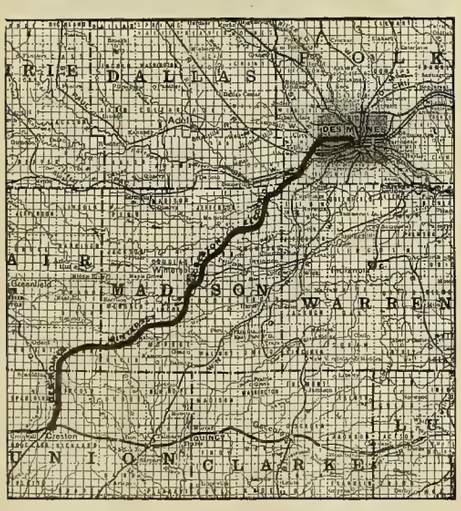
The turbine is of the Allis-Chalmers type, designed especially for this installation. All of the turbine is above the floor of the power house, and the working parts are directly under the eye of the operator. The turbine has a working head of 365 feet and runs at 600 revolutions a minute.

Directly connected to the turbine, as shown by the illustration, is an Allis-Chalmers 450-kilowatt 6,600-volt three-phase 60-cycle generator, of the revolving-field type. The exciter is belted to the shaft of the generator and also supplies electricity for lighting the power house and the operator's cottage. Both the hydraulic and the electric equipment of the plant were supplied by the Allis-Chalmers Company of Milwaukee.

The transmission line running from the power house to the mine is 11,554 feet in length. The poles, which are of tamarack, are 40 feet in length and are set five feet in the ground. That portion of the pole which is underground has been treated with a creosote asphaltum preparation for preservation against decay. The wire used is seven-strand aluminum cable mounted on Locke porcelain insulators. A secondary distributing circuit, for which the electromotive force is reduced by transformers to 110 volts, is run from the mine to the town of Loomis. All of the business houses and many of the residences of this town are now using the current for arc and incandescent lamps. A modern 300-ton mill, equipped with automatic appliances throughout for quick and economical handling of the ores, will be installed in the near future.

Proposed Des Moines-Creston Single-phase Road.

Engineering and financial details are being worked out for the early construction of an electric railway from Des Moines to Winterset and Creston, Iowa. The route of the new road is shown by the accompanying map. The company which will build the road is known as the Des Moines, Winterset and Creston Electric Railway Company. It has a strong board of directors, Mr. A. E. Park of Des Moines being the general manager.



DES MOINES, WINTERSET AND CRESTON ELECTRIC RAILWAY.

A terminal contract with the Des Moines City Railway Company provides for a loop in Des Moines, and the company has a terminal franchise in Creston. Between the two cities the distance is 65 miles, of which distance the company will own a line 60.14 miles long. A power plant of 2,000 kilowatts capacity will be constructed which will furnish power for the operation of the cars on the single-phase alternating-current system. Construction of the road will be in accordance with heavy freight practice, and in addition to a passenger business, equipment will be provided for the handling of heavy freight. The grades are light, and the route is through a prosperous country. Last year there was produced in the territory tributary to the line 376,711 tons of produce, of which 265,000 tons was available for hauling.

At the start the company will operate 10 passenger cars, two heavy electric freight locomotives and such additional freight equipment as may be found necessary to care for the business. The company has offices in Des Moines.

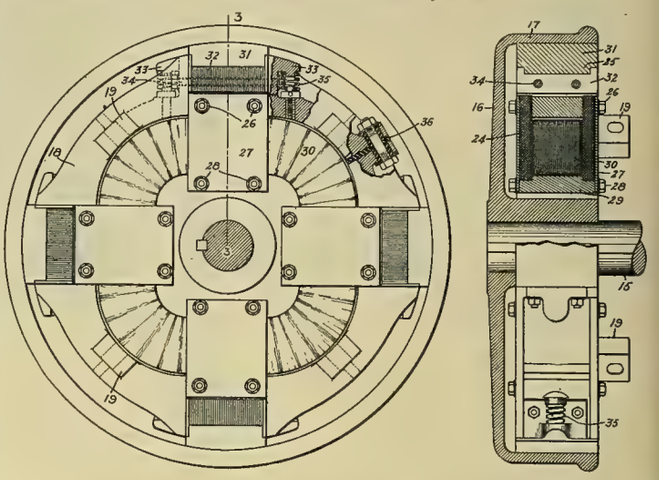
A Compact Magnetic Brake.

A new and interesting magnetic-brake mechanism which may be operated by either alternating or direct current is provided in an invention of Carl W. Larson of Schenectady, N. Y., upon which he has just received a patent. The invention, which is applicable to electric motors, is intended to give the maximum braking power for the space occupied and to be compact in structure and cheap to manufacture.

One of the novel features of construction consists in the radial arrangement of the brake-shoe magnets in combination with the brake shoes movable relative thereto. Another feature lies in energizing the brake-shoe magnets from a single coil, and still another in employing a flanged outer element mounted upon the motor, so that the more complicated parts of the brake mechanism will be practically enclosed and protected from injury.

The following description of the invention shows the brake as applied to an electric motor.

The motor is of the enclosed or ironclad type, in which a casing completely encloses the field coils and armature of the motor, the heads of the casing being provided with bearings for the armature shaft. To the end of this shaft is securely keyed a flanged member which constitutes the rotatable element of the brake. The flange of the rotating member extends toward the casing of the motor so as fully to protect the interior parts of the brake. The other element of the brake comprises a fixed member of non-magnetic metal, which is provided with four laterally projecting lugs through which it is adapted to be connected to the head of the motor casing. This connection may be made in any desired manner. Of the accompanying drawings the left-hand one is a side view of the brake mechanism and the other is a sectional view illustrating the rotatable element of the brake in section and a portion of the fixed element in section on the line (3) (3) of the side view.



The fixed member (18) is provided at four points with pole-pieces (24 24) of iron or other magnetic material, which are symmetrically arranged and constitute the pole-pieces of four magnets adapted to draw the friction members (25) out of engagement with the flange (17) of the rotatable member (16). These pole-pieces are built up of laminations and are secured by bolts (26) to the member (18) at one end, and through the agency of the exterior plate (27) and bolts (28) are fitted to a yoke (29) at the other end. Located within the space thus formed is an energizing coil (30), which is concentrically arranged with reference to the member (18) and serves to energize all the magnets of the brake. The friction members (25) which co-operate with the brake magnets are each composed of a brake shoe (31) of wood or other suitable material, and an armature (32) formed of laminations of iron or other magnetic material. The shoe and the armature are securely clamped between the members (33 33) by bolts (34). The members (33) are provided with overhanging portions, between which and corresponding shoulders on the fixed member (18) are located coiled springs (35). These springs are compressed by the action of the magnet in drawing the armatures inward and serve to force the armatures outward when the magnets are de-energized.

When current is supplied to the coil (30) the pole-pieces (24) of each magnet will be magnetized and the shoes (31) will be drawn out of engagement with the flange (17). As soon as the current is cut off, however, the springs (35) will force the shoes (31) outward into engagement with the flange so as to apply the brakes. By bringing the point of contact of the shoes and the rotatable element of the brake near the periphery of the latter a maximum braking effect is obtainable with a minimum of space for the operating parts. By laminating the pole-pieces (24), armature (32), and yoke (29) the brake may be used with either alternating or direct current. Of course where the brake is intended for use with direct current only the pole-pieces (24), armature (32), and yoke (29) may be solid. It will also be clear that when the coil is supplied with alternating current the fixed member (18), being located so close to the coil, would ordinarily form a closed secondary circuit. In order to prevent this the member is split at one point and the contiguous surfaces separated by suitable insulation (36). This insulation interrupts the electric continuity of the member (18) and thus prevents the induction of a current therein. It is obvious that the coil (30) may be included directly in circuit with the motor or in shunt thereto or in an independent circuit. When included in circuit with the motor, which is a common arrangement, as soon as the motor current is cut off the coil (30) is de-energized and the brake is applied.

The Making of a Simple Transformer Diagram.

By E. D. M.

In the working out of transformer diagrams, vectorically, having made the proper tests, one has the tendency to make of it a hard problem. Below are given the various tests to be made upon a transformer and their application to a simple transformer diagram.

The first test to be made, so as to lay out the vector diagram, is that for core loss and exciting current. The core loss should be measured from the low-potential side of the transformer, to avoid the introduction of high voltage in the test. Estimate the current capacity of the instruments to be used and connect up the low-potential side of the transformer with an ammeter and wattmeter in the circuit. Connect the voltmeter and the pressure coil of the wattmeter to the terminals of the transformer; correction may be made for the current consumed by them in the readings of the instruments.

The wattmeter reading gives the core losses and the ammeter the exciting or open-circuit current. From these two readings, together with the voltmeter reading, the power factor is found, and also the current due to the core losses.

To plot the vectors representing these results, lay off any vector to represent the flux Φ. The energizing current leads the flux Φ by 90° and may be represented by the vector I_i. Knowing the power factor on open circuit, the value of the open-circuit current I_o may be plotted in phase and magnitude. The magnetizing current is in phase with the flux, and its value is found by completing the parallelogram of which I_o is the resultant, I_o being the vector sum of the magnetizing current and the energizing current. It is now desired to find the vector relations for any given load.

The secondary electromotive force induced in the secondary is 90° behind the flux Φ, and its measured value for the given load may be represented by the vector E_s. The power factor for the load being known, the secondary current may be represented by the vector I_s at ω° behind E_s. The value and direction of the primary current is now located, the open-circuit current being the resultant or vector sum of the primary and secondary currents. The primary-current vector is found by completing the parallelogram, and is represented by I_p.

For commercial purposes the resistance is most conveniently and accurately measured by the fall-of-potential method. In this method the current I and the voltage E are observed, and the resistance R calculated from Ohm's law, $I = \frac{E}{R}$.

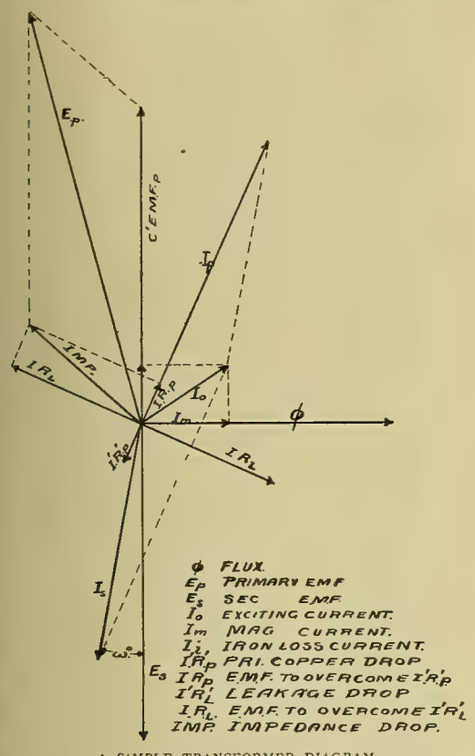
The ohmic drop I'R' is then drawn 180° from the primary current vector I_p, and the electromotive

force necessary to overcome the ohmic drop is represented by the vector IR in phase with I_p.

The impedance, which is the vector sum of the ohmic drop and the reactance drop, is given by the expression $IMP = \sqrt{R^2 + \omega^2 L^2}$.

The reactance or leakage drop (ωL) is represented by the vector $I'R'_L$, and lags the primary current by 90°. The electromotive force to overcome the reactance is represented by IR_L, and is darwn opposite in direction.

To find the value of the impedance, short-circuit the high-potential side through an ammeter, the capacity of which can be estimated, and connect the low-potential side through an ammeter to the



A SIMPLE TRANSFORMER DIAGRAM.

supply. The loss in the voltmeter, connected across the transformer terminals, may be subtracted from the ammeter reading. The impedance may be considered constant for all loads. It is generally measured at full-load current, and the impressed voltage is then known as the "impedance volts," and when expressed in per cent. of the voltage of the transformer as the "impedance drop" per cent.

Since the value and direction of the impedance drop is known, the value of the reactance drop is found by completing the parallelogram, with the electromotive force necessary to overcome the impedance drop plotted as the vector sum of the electromotive forces necessary to overcome reactance and the IR drop.

The electromotive force necessary to overcome the counter electromotive force of the primary, or, rather, the electromotive force in the primary that produces the necessary flux in the core, which in turn is necessary to produce the secondary electromotive force, will be almost equal to, and lie in the opposite direction from, the secondary electromotive force, and is represented by the vector C'EMF$_p$. The vector sum of this counter electromotive force and the impedance gives the primary voltage both in value and direction. This gives a simple completed vector diagram which may be used to find readily any of the desired quantities.

The Wireless Stations of the World.

Space-telegraph stations of the world, to the number of 265, have been catalogued by the Bureau of Equipment of the Navy Department, and the list will be published in a small book. The various systems of space telegraphy used are also given in each case.

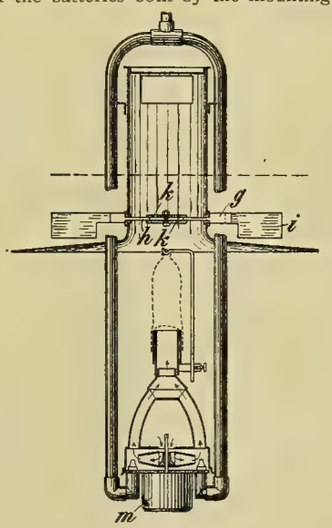
According to this authority, the number of stations in each country is: United States, 88 (of which 10 are in the possession of the United States and 32 are directly under the control of the navy); United Kingdom, 43; Italy, 18; Germany, 13; Belgium, 1; Denmark, 4; France, 6; Holland, 8; Spain, 4; Portugal, 1; Gibraltar, 2; Malta, 1; Montenegro, 1; Norway, 1; Austria-Hungary, 2; Roumania, 2; Russia in Europe, 8; Sweden, 3; Turkey, 6; Argentina, 5; Brazil, 5; Canada, 5; Chile, 1; Costa Rica, 1; Mexico, 2; Panama, 2; Uruguay, 1; Trinidad, 1; Tobago, 1; Audaman Islands, 2; Burma, 1; Hongkong, 1; China, 5; Hawaii, 5; Japan, 2; Dutch East India, 5; Russia in Asia, 1; Egypt, 2; Morocco, 2; Mozambique, 2, and Tripoli, 1.

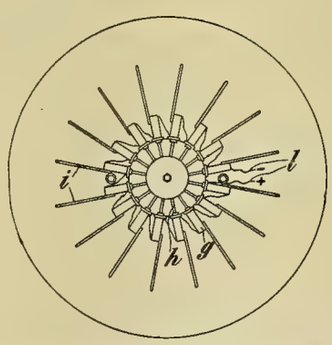
Proposed Utilization of Heat from Gas-mantle Lamp to Produce Electric Power.

What most people will consider a "freak invention," but which is also a great testimonial of the heating power of the "gas arc," is illustrated by the accompanying cut, which shows "a certain new and useful improvement in intense-light lamps," for which Paul Lucas of Schöneberg, near Berlin, Germany, has obtained a United States patent. The idea is to attach a thermo-battery to a powerful gas-mantle lamp, above the flame. The current from this battery is supposed to be sufficient to operate a small electric motor in the base of the lamp, which is arranged to force the necessary quantity of air into the mixing channel of the gas burner and around the gas nozzles to insure the complete combustion of the total amount of gas admitted. This interesting cycle of operations is to result in "an exceedingly quiet flame of very high heating power," which, in turn, results in "producing the most perfect efficiency of the incandescent mantle."

On one interesting point the inventor is not very explicit, and that is, the exact efficiency and operation of his thermo-electric couples. Here is what he has to say on the subject, reference being made to the accompanying diagrams, the upper one being a sectional view of the lamp and the lower one a plan view of the top of the lamp, the chimney and gas-admission tube not being illustrated:

"The source of power comprises a series of thermo batteries, the construction of which is immaterial, but which has to be such as to produce a constant force. The batteries used in the present instance, given by way of example, consist of a piece of metal (g), to the front part of which a heating stud (h) and to the rear part of which a cooling metal sheet (i) are attached. The batteries are arranged above the flame, and in the present case they are mounted particularly above the reflector—that is to say, the base parts of the elements constitute directly the reflector. The powerful radiation of the heat of the flame is kept off as much as possible from the exterior soldering joints of the batteries both by the mounting of the





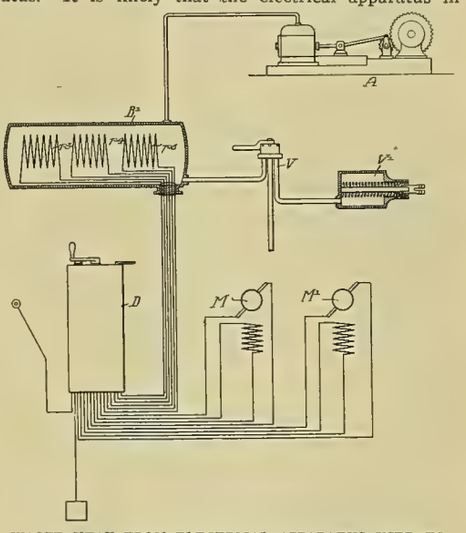
PROPOSED UTILIZATION OF HEAT FROM GAS-MANTLE LAMP TO PRODUCE ELECTRIC POWER.

batteries above the reflector and by the arrangement of the centrally placed chimney. The heating studs of the batteries extend through suitable guides arranged in the chimney wall and are reaching radially into the chimney. In order to produce a uniform powerful heating of the said studs only at the connecting places of the same with the battery, a cover (k), consisting of an asbestos plate, is mounted upon the free ends of the said studs in the center of the chimney, whereby the hot waste gases of the lamps are compelled to rise in the annular space between the asbestos plates and the chimney wall, so as to impart a powerful heat to the studs in the neighborhood of their connecting places with the battery. By means of this arrangement a very excellent effect of the battery is produced. The current generated thereby is conducted to the motor (m) by means of a conductor (l) and by way of the base of the lamp."

Passing over the questions of cost and efficiency in this curious proposed lamp, the electric-light man will notice with a chuckle the "powerful radiation of heat" so freely confessed for the gas-mantle lamp. This is hardly a recommendation for indoor illumination in August.

Waste Heat from Electrical Apparatus Used to Increase Efficiency of Air Compressor.

In several systems of train control, and indeed elsewhere in mechanics, compressed-air and electrical apparatus are operated in conjunction. Observing this fact, Arthur C. Eastwood of Cleveland has invented an interesting device for increasing the efficiency of systems employing apparatus operated by compressed air as well as electrical apparatus. It is likely that the electrical apparatus in



WASTE HEAT FROM ELECTRICAL APPARATUS USED TO INCREASE EFFICIENCY OF AIR COMPRESSOR.

such a combination will generate considerable heat, which has been simply wasted hitherto. Mr. Eastwood's idea is to employ the heat generated by the electrical apparatus for the purpose of raising the temperature of air while confined in a reservoir under pressure prior to its use. The diagram given herewith illustrates one application of the invention.

In carrying out this application in order to produce an increase in efficiency, the inventor employs it in connection with the air-brake system on electrically operated cars and locomotives. For this purpose an air compressor is employed, ordinarily operated by power derived from the line, the air being compressed and delivered to a storage tank or receiver and the compressor being automatically stopped when the pressure in the receiver reaches a predetermined maximum and again started when the pressure has dropped to a predetermined minimum.

With most railroad systems at present in use the control of the speed of the driving motors of the locomotive or car is almost universally effected by means of a resistance in circuit with the motor windings, there being a very considerable amount of heat generated in this resistance, which heat is generally wasted.

According to the present invention, all or a portion of this waste heat is utilized by inclosing any desired amount of the controlling resistance within the receiver or reservoir of the air-brake system, as shown in the drawing, in which (A) represents the compressor and (B') the receiver, in the latter of which are inclosed several banks of controlling resistance (r^3 r^4 r^5) for the car motors (M) and (M'), the controlling valve for the air-brake system being shown at (V), and the brake cylinder being illustrated at (V'). The motors are operated in any desired manner by means of a controller (D).

It will be seen that under operating conditions heat from the resistance (generated when the motors are being started or operated at slow speeds) is communicated to the air in the receiver, thereby increasing its pressure while maintaining it at a constant volume, and consequently decreasing the amount of work which must be done by the compressor to maintain a mean pressure in the receiver. As a consequence of this arrangement of apparatus a smaller compressor may be employed for a given service with a consequent smaller demand for power from the source of supply. This invention is covered by a patent.

WESTERN ELECTRICIAN

EVERY SATURDAY.

PUBLICATION OFFICES:

507 Marquette Building, - CHICAGO.

TELEPHONE, MAIN 1746.

Eastern Office, 150 Nassau Street, New York.

Telephone, 5220 Beekman.

Trade Supplied by Western News Co.

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DATES AHEAD.

Ohio Electric Light Association (annual convention), Put-in-Bay, Ohio, August 21st to 23d.

Colorado Electric Light, Power and Railway Association (annual convention), Denver, September 18th to 20th.

Illinois State Electric Association (annual convention), Springfield, Ill., September 19th and 20th.

Central Electric Railway Association (outing), Robinson Park, near Fort Wayne, Ind., September 26th.

Old Time Telegraphers and Historical Association, and United States Military Telegraphers (annual meeting), Arlington Hotel, Washington, D. C., October 9th, 10th and 11th.

American Street and Interurban Railway Association (annual convention), Columbus, O., October 15th to 19th.

THAT there is much room for improvement in devices intended to protect electrical apparatus and electrical service from lightning no one conversant with the industry can doubt. Several of the important electrical societies are investigating the subject, and at least one electric-railway company in Indiana, as reported this week, is taking steps to make a thorough investigation of the subject on its own account. Neither street-railway, power-transmission nor electric-light companies are satisfied with existing protection, and although the problem differs to some extent for these various services, they are at one in looking for something better. But absolute protection for overhead lines is a difficult thing to achieve, although it is no doubt true that the constant study and investigation devoted to the subject will result in great improvement in arresters and methods of application.

ELECTRO-MEDICAL quacks are accorded vigorous treatment in England. One named Richard—"Professor" Richard, he styled himself—was recently sentenced in Staffordshire to 12 months' imprisonment for obtaining various sums of money by falsely pretending to be able to cure human ailments by electrical treatment. One witness, a servant, said she took her sister, who was totally blind, to see the "professor" at Nottingham. He told her sister that her nerves were dormant and wanted waking up with electricity. On his undertaking to restore her sight she paid him 26 guineas. His treatment did her sister no good. The defense tried to prove that there was no evidence to show that the defendant guaranteed to cure his patients, but the jury, after an absence of one minute, found the prisoner guilty. In passing sentence the judge referred to Richard as a dangerous person.

While there seems to be less gross electro-medical quackery in the United States than in former years—at least it is not so patent by advertising—there is probably not a little of this kind of fraud still in existence, and a few convictions such as this one would no doubt have a wholesome effect.

PROF. D. C. JACKSON'S recent paper before the American Institute of Electrical Engineers on "Economies to Be Derived from the Utilization of Waterpowers of Low Head in the Central West" calls to mind the increasing number of such plants in the Central States. Indeed, about all the water-power plants in the Central West are of low head, owing to the topography of the country. A notable example is at Sault Ste. Marie, Mich. Another is in process of erection on the Chicago Drainage Canal. There is one at Rock Island, on the Mississippi. Several examples occur in Michigan, and in Wisconsin there is the plant at Janesville, described by Professor Jackson and also in the Western Electrician of March 4, 1905, the Black River plant at Hatfield, for which work has scarcely been begun, and several others, to say nothing of the Taylors Falls plant on the St. Croix River, between Wisconsin and Minnesota. A respectable list of hydro-electric plants in operation or under construction in the Central West could be made out, leaving out projects such as that at Keokuk on the Mississippi and at New Albany, Ind., on the Ohio, which are in the discussion stage. This is in a region, too, where coal is generally cheap, and indicates that waterpowers can often be utilized to advantage where the general conditions would not seem to be particularly favorable. But in all hydro-electric problems a careful individual study should be made of each case.

WASTE GASES, such as those from blast furnaces, have been for the last few years considered a promising source of cheap power with the improved gas engine. As readers of this journal are aware, it is planned to utilize for power purposes the blast-furnace gases of Gary, Ind., the new made-to-order "steel city" near Chicago, where, with mammoth iron and steel works, there will be gases, otherwise wasted, in profusion. On this subject Dr. H. Hoffman recently read a paper before the Society of German Engineers, in which he estimated that in Germany no less than 600,000 horsepower might be obtained from the surplus gases of coke ovens, and an additional 1,000,000 horsepower from the waste gases of blast furnaces. The first gas-engine plant dealing with coke-oven gases was put into operation in 1894 in Germany, and there are now constructed or under construction gas engines capable of delivering no less than 400,000 horsepower when operated with "poor gases." During last year alone one German firm is reported to have constructed 140 such engines of a combined capacity of 120,000 horsepower. Less progress has been made in the United States, but as noted above very extensive works are now under way. If these prove as successful as hoped, it is probable that before many years such a thing as waste gas—in any considerable volume, that is—will have ceased to exist.

STEAM TURBINES form the subject of this week's installment of the series of articles on "The Small Central Station" now running in the Western Electrician. When one stops to reflect on the rapid advance of the steam turbine in power houses he is struck by the remarkable change—almost a revolution—wrought by this form of prime mover in the short space of four or five years. It was in 1904 that the Committee for the Investigation of the Steam Turbine of the National Electric Light Association presented its first report. This committee made a second report in 1905 and its third and last at this year's convention of the association, when it was discharged at its own request. In its last (1906) report the committee says: "The turbine situation has very materially changed since our first report. Today the steam turbine is recognized as a standard piece of apparatus, and turbines of some type are being installed in nearly all of the newer power houses." And further: "During the discussion at the meetings of the committee it was decided that it was unnecessary to continue any further tests on economy, as there were now so many turbines installed in regular operation giving satisfactory results; and the most important matters receiving attention were the various details which go to make up reliability and insure continuity of service." Truly the steam turbine, like Cæsar, has come, has seen and has conquered. It would be difficult to name an equal triumph in so short a space of time in the art of steam power engineering.

RADIUM presents many wonderful characteristics, certainly; but it may well be doubted whether it demonstrates as possible the dream of the alchemists—the transmutation of the elements. Lord Kelvin has protested against the proposition submitted to the British Association that the production of helium from radium has established the fact of the gradual evolution of one element into others. This view is vigorously sustained by Prof. H. E. Armstrong, professor of chemistry in the City and Guilds of London Central Institution, who, in a letter in the London Times, raises his voice for the conservative faith. "No one," says the professor, "has yet handled radium in such quantity or such manner that we can say what it is precisely. That helium can be obtained from radium appears proved, but no proof has yet been given that it is not merely contained in it."

Continuing, Prof. Armstrong points out the danger of substituting imagination for research. "There was a time," he says, "when the expression 'scientific caution' meant the highest degree of caution, and it was supposed to be an attribute of workers in science. Workers in the radium school appear to have cast caution to the winds and to have substituted pure imagination for it. Among ourselves we should always be at liberty to postulate the most crack-brained hypotheses, to dream the wildest dreams, as a means of guiding inquiry, but we should not court popularity on such a basis. By so doing we lose all claim to guide public opinion."

In other words, imagination in scientific investigation is not only permissible but desirable; the man absolutely devoid of imagination would be but a poor and lifeless searcher after truth. Nevertheless, imagination is to be used only as a help, a tool, in arriving at the conclusion. The actual results which are said to be established should be as clearly susceptible of proof as the steps of a mathematical demonstration.

Niagara Falls-Syracuse Power Transmission.

By transmitting power in large quantities 160 miles from Niagara Falls, Ont., to Syracuse, N. Y., the Niagara, Lockport and Ontario Power Company has accomplished a feat in electrical power transmission worthy of attention. Power has been transmitted for a longer distance, but not, it is believed, in considerable quantity. The Syracuse Herald of August 12th has an article on the subject of considerable interest. While intended for popular perusal, the account is accurate as far as it goes, and gives some interesting facts. What follows is taken from this publication.

Paul T. Brady, the only Syracusan who is a director of the Niagara, Lockport and Ontario Power Company, returned yesterday after having been out of the city for the most of the time since the Niagara power was put to practical use in propelling the street-railway system of this city. Mr. Brady said that he was able to make the statement, after a thorough canvass of the situation, that the use of the power transmitted the immense distance from Niagara River, was an unqualified commercial success. When asked by a Herald reporter regarding the practical possibilities of the power here, now that it was actually in use, he said:

"In Western New York the people little appreciate the value of the enterprise to-day. Their realization of its value and importance will come from time to time. Especially will it come to the people of Syracuse when it is understood that there is no further occasion for a single smokestack making itself a nuisance to the people. Niagara power is here and all throughout Western New York to stay. When our lines are finished, when the additional line we are now building is completed, the liability to accident and interruption in the service will be very slight."

"Did the two instances when the current was cut off here in electric storms during the two weeks the power has been used show any defect in the system?" was asked.

"Not at all," said Mr. Brady. "The disturbance was slight. The necessity of the Rapid Transit Railway Company for power became so great and so urgent that we had to furnish the current before the transmission line was entirely completed. But the work is going forward without delay."

Asked further concerning these two instances, Mr. Brady said:

"The starting of any 5,000-horsepower engine would be attended with now and then an interruption until it got in perfect working order. The electrical installation in any big new building would likely show some weak places when first put in service, but they would soon be remedied. We would like to have started the services later, after these minor defects were found and corrected, but, as I said, the power was demanded at once. The interruptions were not serious and mean nothing."

Mr. Brady's remark about the lack of need of a single smokestack in Syracuse led to further inquiry as to the amount of power the company can supply. The present lines have a capacity of 15,000 horsepower at Syracuse. The maximum demand of the Rapid Transit under normal conditions is 5,000 horsepower. "This should leave some for commercial light and power," was suggested.

"We can furnish," said Mr. Brady, in answer to this, "all the power to run all the lighting and power plants of Syracuse and have power to spare. There is no occasion for any more black smoke in Syracuse."

He was asked if the Niagara power could be used practicably for lighting. He said that the current, with the use of the proper machinery, could run any kind of machine that is propelled by electrical power and do anything that any other mechanical power can do. By the use of the proper electrical machinery, the Niagara current can be used for arc and incandescent lighting, storage batteries or anything of the kind.

The Niagara, Lockport and Ontario Power Company is not now taking its current from Lockport, as is well known, but is using power generated by the Ontario Power Company on the Canadian side of the Niagara River. The intention is to erect a huge plant at Lockport, fed by canal from Niagara River, because the fall will be higher at Lockport and for other engineering reasons. This will take years to complete, and the demand for early transmission led to the Ontario arrangement.

When completed the Ontario Power Company's plant will have a total capacity of 200,000 horsepower. With the present installation 50,000 horsepower can be developed, ten times the amount required by the Rapid Transit and more than three times the present capacity of the Syracuse line.

The Niagara, Lockport and Ontario Power Company was incorporated in 1894 by some citizens of Lockport, ostensibly to furnish power to industries to be brought to that city. The promoters expected to take power from Niagara River near North Tonawanda, convey it to Lockport by canal, where there would be three separate falls, at each of which there would be a power plant. At Lockport the sheer fall is greater than at Niagara Falls. The water was to be conveyed thence to a creek emptying into Lake Ontario, thus making an artificial island of all the northwestern corner of the state.

Surveys, soundings and other preliminary work were done, and estimates were made as to the cost of developing power. But the men interested never succeeded in raising the necessary funds. The project dragged along until 1902, when the Lockport men who had it in hand were in New York, trying to secure capital. Paul T. Brady of Syracuse, who is a representative of the Westinghouse Electric and Manufacturing Company, met them and secured control of the franchises, believing that the project could be carried through on a farther reaching scale than had been planned. He brought into the enterprise John T. Robin, a banker of New York, and John Bogart, a former state engineer.

The Iroquois Construction Company was organized by Mr. Robin; George C. Smith of New York, representing George Westinghouse, the multi-millionaire head of the Westinghouse Company; the late Robert E. Drake of this city, Mr. Brady and others. This company was to build the necessary plant.

According to the terms of the charter of the Niagara, Lockport and Ontario Power Company, if work was not begun before May 20, 1904, it would lapse and be forfeited. It was deemed advisable to secure further extension, and some additional rights were also desired, including permission to increase the capitalization to more than $10,000,000. This led to the memorable attempts to get legislation in 1903 and 1904, which were unsuccessful owing to the clamor of the press and powerful opposition that came in many forms. The newspapers objected to any further use of Niagara River and to jeoparding the falls for commercial purposes. The power company laid this and other opposition to the power companies at Niagara Falls, which did object to having additional entrants in the field.

The opposition defeated this legislation and has since led to a national movement for the preservation of the falls and further encroachments thereon, and to the limiting, to some extent, of the water that may be taken from Niagara River for commercial purposes.

Without going over the merits of the controversy, which are now so well known, it is sufficient to say that the Niagara, Lockport and Ontario company had a charter which its lawyers considered enough without further legislation and the work was begun. Since then, under the State Lighting Commission law, passed in 1905, the company has exercised the power of condemnation of land for its transmission line.

In 1904, realizing that it would take several years to develop power from this canal enterprise, Mr. Brady suggested that terms be made with the Ontario Power Company, which had its large plant on the Canadian side nearing completion. This brought into the enterprise the men interested in the Ontario Company, including John J. Allbright of Buffalo and his associates, so that the two companies are more or less allied.

The task was then taken up of building the transmission line to this city. The late Robert E. Drake, the street-railway lawyer of Syracuse, was placed in charge of securing rights-of-way, and he did the work so well that the company has now communicated electricity half way across the state.

It has a right-of-way 300 feet wide from the Niagara River to Lockport, a distance of 20 miles; one 200 feet wide from Lockport to a point south of Rochester, 60 miles; another 100 feet wide from Lockport to and around Buffalo, 30 miles, and a partial right-of-way on the distance of 85 miles between Rochester and Syracuse. All the land is owned in fee, making the company one of the largest real estate owners in Western New York.

In order to hasten the completion of the line to Syracuse, where a contract was entered into through the Mohawk Valley company—which owns the street-railway stock held by the so-called Vanderbilt-Andrews interests—to supply the power for the entire Rapid Transit system, an arrangement was made whereby a portion of the West Shore Railroad right-of-way was secured in addition to the rights owned in fee between Rochester and Syracuse.

W. K. Archbold of the Archbold-Brady company of Syracuse made the first estimates of the cost of the line, and that company was given the contract to build the steel towers. Two lines of these were built between the Niagara River and Rochester, one line from Lockport to the plant of the Lackawanna Steel Company, south of Buffalo, and one line from Rochester to Syracuse. Each line requires about 12 steel towers to the mile, and there are 200 miles of towers. Work is progressing on a duplication of the line between Rochester and Syracuse over private right-of-way, and when this is completed the capacity to Syracuse will be doubled and the liability to interruption reduced to what the company's experts believe will be practically nothing.

The Niagara, Lockport and Ontario Power Company's engineers say that this is the largest and most comprehensive system of long-distance power transmission and power distribution ever completed. There are other lines that are longer, but they carry smaller amounts of power compared with what the Niagara, Lockport and Ontario lines are laid out to take care of.

At the plant on the river, at the base of the falls, to which the water is communicated around the falls by means of tunnels, electricity is generated at 12,000 volts. Then by step-up transformers it is raised to 60,000 volts and carried at that voltage to the point where it is to be used. At that point it is reduced by transformers to the proper voltage necessary to accommodate the machinery to be used.

Power men have stated that the progress to this point is best illustrated by the fact that as late as 1892 a most elaborate set of plans was prepared by the best American and European engineers to transmit power from Niagara Falls to Buffalo by compressed air. These plans are now in the office of John Bogart in New York.

"The work is in no sense an experiment," said one of the Niagara, Lockport and Ontario men. "It is a success and a triumph of modern electrical engineering."

The lines to Rochester have a capacity of 40,000 horsepower; between Rochester and Syracuse, 10,000 to 15,000 horsepower, and from Lockport to Buffalo about 20,000 horsepower. Lines are now under construction to Auburn, Batavia and numerous other points at which the company is under contract to deliver its power. The company is supplying the Rapid Transit system of Syracuse and is preparing to supply several other railways controlled by the Mohawk Valley company.

It is asserted that the company could now supply the Syracuse Lighting Company, in addition to the Rapid Transit, and have power to spare. Men connected with the company declare that the crying need in Syracuse is for cheaper power, and that when it is had at the small cost they say it can be furnished with waterpower behind it, it will revolutionize and vastly increase industrial business in Syracuse and elsewhere.

The company is now controlled by George Westinghouse, H. H. Westinghouse, George C. Smith and Paul T. Brady for the Westinghouse company, and John J. Allbright, General Hayes and associate of Buffalo, with General Francis V. Greene of the Ontario Power Company.

The electrical engineer in charge for the Niagara, Lockport and Ontario is Ralph D. Mershon of New York. The engineer in charge of construction is F. B. H. Paine of Buffalo.

Cost of Lighting in Newcastle, England.

Reduced rates for electric light have recently been promulgated in Newcastle, England. Reporting on the subject, H. W. Metcalf, consul at Newcastle, says:

"The Newcastle Electric Supply Company inaugurated the reduction in tariffs and the Durham Company followed suit, both bringing the price of lighting down to a flat rate of 3¾ pence (7½ cents) per unit (kilowatt-hour), less five per cent., or practically 3½ pence (seven cents) net, a reduction by the former of 17 per cent. and by the latter of 46 per cent. It has been an established principle in the electrical industry for many years that when the cost of a unit of electricity represents about one-seventh of the cost of 1,000 cubic feet of gas the expense of the two for lighting purposes is about the same. This rule has been accepted by electrical engineers for some time, but it is only recently that they have been able to show that electricity could hold its own with gas in the matter of price. Gas in Newcastle costs two shillings (49 cents) per 1,000 cubic feet, or one shilling 10 pence (45 cents) net, and electricity costs 3½ pence (seven cents). The two electric companies are now supplying over 36,000,000 units per annum."

Sub-station Apparatus for the Chicago Drainage Canal.

Sealed proposals are asked by the Sanitary District of Chicago for furnishing electrical apparatus and materials and installing the same in the sub-station of the Chicago Drainage Canal for power transmission. The proposals are invited on the following divisions of work:

Division A, switchboards and instruments; division B, oil circuit-breaker switches and knife switches; division C, bus-bar compartments; division D, transformer connections and station wiring; division E, electrically driven pumps, motor generators and transformers; division F, electric traveling cranes; division G, storage battery.

Proposals will be opened by the board of trustees on October 3d. All bids must be made in accordance with the plans and specifications of the Sanitary District (American Trust Building, Chicago) and upon blank forms furnished by the District.

Illinois State Electric Convention.

The annual convention of the Illinois State Electric Association will be held at Springfield, Ill., on September 19th and 20th. The headquarters will be at the Leland Hotel. It is believed that there will be a large attendance, and manufacturers and supply houses are invited to send representatives. Secretary H. E. Chubbuck of La Salle says that in the last two or three years the supply men have been very kind in exhibiting novelties, and exhibits of anything of interest to members will be gladly received at this year's convention. D. Davis of Litchfield is president of the association.

THE SMALL CENTRAL STATION.

Practical Hints on Its Construction and Operation.

CHAPTER VII.

Steam Turbines.

General Observations.—While it is true that in stations of the size considered in this series of articles steam turbines are not, as yet, extensively employed, nevertheless turbines are now available in small sizes; and this type of prime mover has come to be used so extensively in central-station work, considering the whole industry, that the managers of all stations, large and small, should be familiar with the characteristics and advantages of this class of apparatus, which, within five years, has contested in such a remarkably successful manner

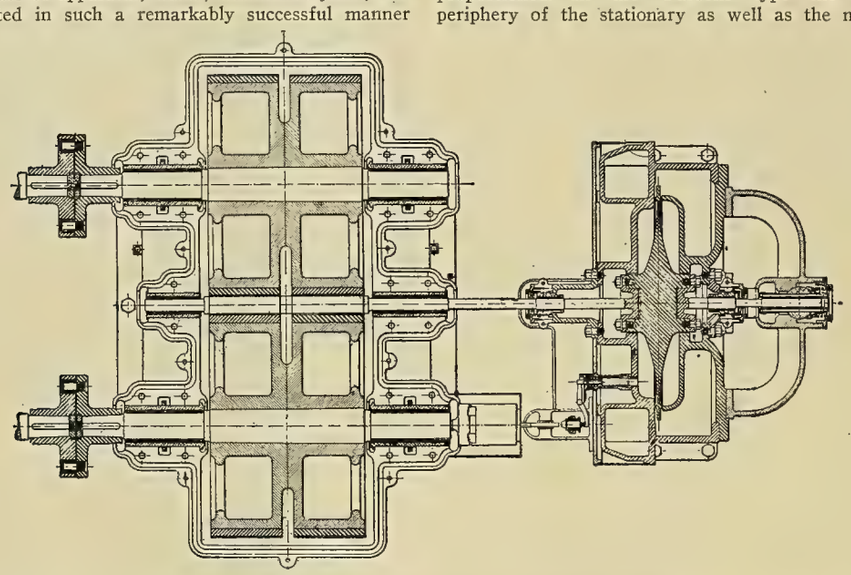


FIG. 13. SECTIONAL PLAN OF DE LAVAL STEAM TURBINE.

the supremacy of the piston engine in the great steam-driven electric power plants of the world.

The nature of the turbine was of course understood much earlier than that of any other form of the steam engine, but, due to difficulties of construction and application, the machine could not be put to any practical use until very recent years.

Parsons and De Laval may be considered the fathers of this type of prime mover, though they really worked from opposite ends of the problem. De Laval planned to utilize the simplest possible form, that of a jet of steam impinging on a single wheel, as in the Pelton waterwheel, while Parsons very shortly produced the more highly developed form, from the standpoint of steam distribution, in which there are a great number of blades or buckets arranged in numerous rows. The great difference between the two types is that in the De Laval as much of the energy in the steam as possible is first converted into the kinetic energy of velocity, by expanding through a suitably formed nozzle, and then as much of this energy as possible is absorbed by the buckets of one moving wheel. In the Parsons turbine, on the other hand, between numerous rows of revolving blades are placed similar rows of stationary blades, these latter acting as nozzles, as well as guides, to give the proper direction to the steam. In going through the first row of these stationary blades a small part of the energy in the steam is converted into the kinetic or velocity form and is immediately absorbed by the corresponding row of moving blading, and so on throughout the length of the turbine, each pair of rows converting and absorbing its share of the available energy, or, in other words, forming of itself a simple turbine with a small range of pressure.

In the single-wheel type the steam, expanding from the initial pressure to the final, attains a velocity of from 2,000 to 3,000 feet per second before impinging upon the moving wheel, which therefore has to travel at a peripheral velocity as nearly one-half of this as is practical. In the other type, however, the velocity of the steam is between 150 and 600 feet per second in each set of rows, and the whole runs therefore at a corresponding peripheral velocity of from 75 to 300 feet per second, giving a much lower speed of revolution.

It was of course natural that modifications of these two types should be designed, numerous machines being brought out which follow one or the other type more or less closely, and later machines which are combinations of the two.

One of the first of these was that of the single-wheel type, in which, instead of having a single row of buckets running at a high velocity, the steam left the first moving row with considerable velocity left, was then redirected, but not re-expanded, and the remaining velocity absorbed by successive rows of buckets. Examples of this type are the Riedler-Stumpf, the Kerr and the Curtis, though the latter uses from two to four rows of nozzles.

Variations of the other type are the Rateau, the Zoelly, Hamilton-Holtzworth, and others. In the machines of this type the proper areas are allowed through the blades, in order to get the required expansion; in the other the nozzles only are so proportioned. In the Parsons type the entire periphery of the stationary as well as the moving rows are filled with blading, so that all the open space inside the turbine is filled with the moving steam, and the proper areas obtained as the steam expands, by lengthening the blades and increasing the diameter of the rows. A further result of this is that part of the expansion in each elemental set takes places in the moving row, giving up its energy by the reaction on the blade as well as by the impulse of the steam striking it, also reducing the relative velocity of the steam and blading.

Modifications of this type, as the Rateau, might also be said to belong to the other, as the first stationary rows of blades have only a few openings, which act as nozzles, all the expansion of the set taking place at this point. Space for the expanding steam is allowed by increasing the number of these openings in the successive rows.

Of the combinations of the two types, the Warren-Crocker turbine is an example. In the first part of this machine the expansion takes place in nozzles, and in the latter portion in rows of blades.

There are of course many other forms and modifications of the above and new ones are being constantly brought out.

The De Laval Turbine.—As stated above, the De Laval turbine consists of a single wheel, on which are mounted the blades or buckets, propelled by the steam, expanded through one or more nozzles.

The wheel itself consists of a solid steel disk of a thickness at the center about one-fifth the diameter and tapering off to the rim to a very small part of this, the object of this section being to give equal radial and tangential stresses throughout the wheel. The blades or buckets are drop forgings, dovetailed into the rim of the wheel and then lightly caulked into place. The shaft is of small diameter and of exceptional length between bearings, so that the wheel will revolve about its gravity axis at the high rate of speed required, eliminating all vibration. In the smaller sizes the shaft is in one piece, passing through the wheel, but in the larger designs the wheel is solid and the shaft is in two parts, bolted to the face of the wheel by means of suitable recessed flanges, so that the whole runs perfectly true. The design of the various parts is shown very clearly in Fig. 13.

As the speed of the turbine wheel is so high it was found necessary to reduce it for transmitting the power. This is done by means of spiral gears of a ratio of about one to 10. The pinion is cut on the same shaft that supports the turbine wheel, and this is supported by bearings at three points, one on each side of the pinion, and the third at the opposite end of the shaft on the outside of the wheel. There is a fourth bearing between the pinion and the wheel, but this serves merely as a gland to prevent steam leaking out or air leaking into the casing which surrounds the wheel. This fourth bearing is also free to move in a radial direction with the shaft so not to check the flexibility desired. The bearings are made in halves, lined with anti-friction metal, lubricated by a continuous stream of oil, those on each side of the pinion being rigidly supported by their pedestals, while the one at the outer end of the shaft is of the ball-and-socket type, the ball on the bearing being held up against the socket support by means of a coiled spring, making it thus self-aligning and free to follow any oscillations of the shaft.

Surrounding the wheel is the casing, which also carries the nozzles and the connection to the exhaust pipe. There are a number of the nozzles, some of them having hand-operated valves to use in case of overload and the others being always open to steam.

Driven from one of the spiral gear shafts is a very compact and simple governor of the spring-loaded fly-ball type. It operates a butterfly valve in the main steam line, thus regulating the amount of steam passing into the turbine for the varying loads. The momentum of the moving wheel is so great that when there is a sudden dropping off of the load, when running condensing, the turbine would speed up excessively if it were not for a vacuum-breaking valve, also actuated by the governor. This valve merely admits air to the inside of the casing, increasing the density of the medium in which the wheel is revolving, and thus checking very effectively a rise of speed. When the wheel reaches the proper speed again the valve closes and the vacuum immediately goes back to its former condition.

In the smaller sizes there is one main power shaft having on it two opposed gears, so that there is no thrust in either direction. On the larger machines there are two of these shafts, and therefore two generators or pumps, as the case may be.

The De Laval turbine is used for the smaller sized generators up to about 300 horsepower, both direct current for exciting and similar purposes and alternators. They are also used extensively for conoidal and centrifugal pumps.

The Riedler-Stumpf Turbine.—Very similar to the De Laval in principle, the machine now under consideration differs from it in that it is more nearly of the form of the Pelton waterwheel, the buckets being milled in the periphery of the wheel, and the steam acting on them from nozzles placed in the plane of the wheel and tangential to it, and then passing off at the sides, the angle of the buckets being just sufficient for the off-going to clear the oncoming steam. In some cases this turbine is also built with a second wheel on which are similar buckets, the steam leaving the first set being turned through an angle of 180 degrees and acting on it as on the first wheel.

In these turbines the diameter of the wheel used is considerably larger than in the De Laval, so that for the same peripheral velocity the revolutions of the wheel are considerably less, doing away with the reducing gears.

This type of turbine is built in units of as high as 2,000 kilowatts.

Crocker-Wheeler-Terry Turbine.—This turbine of the De Laval type receives its steam from the nozzles tangentially to the bucket-wheel. The jet of steam from the nozzle impinges on the moving buckets, leaves them with a residual velocity, passing into a chamber fastened to the casing, is there reversed in direction and again impinges tangentially onto the same wheel as before, but, as the wheel is moving, onto buckets that are free from other steam, and this is repeated until the velocity is totally absorbed, finally passing out through a suitably placed hole in the casing into the exhaust pipe. There are four nozzles and groups of reversing chambers, the nozzles being opened and closed by valves operated from the outside of the casing, so that the number in use may be proportioned to the load. The buckets and reversing chambers are semi-cylindrical in form, with their open sides facing each other, and are so inclined to the surface of the wheel that the steam, after being reversed in each chamber, passes onto the next moving bucket, etc. The wheel consists of two steel disks mounted on the shaft and bolted at the circumference, where they hold the forged buckets.

Bearings and glands of the usual form are used, and, due to the moderate speed of the turbine, the wheel is directly connected to the generator.

The Curtis Turbine.—As pointed out in the first part of this chapter this turbine is a development

or modification of the simple De Laval type. The general form of its construction, showing the vertical design, is illustrated in Fig. 14.

This machine consists of two or more stages or expansions, in each of which the velocity of the steam is absorbed by two or more rows of blades. The steam passes through suitably designed nozzles and impinges on the first row of blades, leaving it with considerable residual velocity, is then redirected onto a second row of blades, and so on till all the velocity is absorbed. There is then usually a second set of nozzles which allows the steam to expand to the final pressure, the velocity being

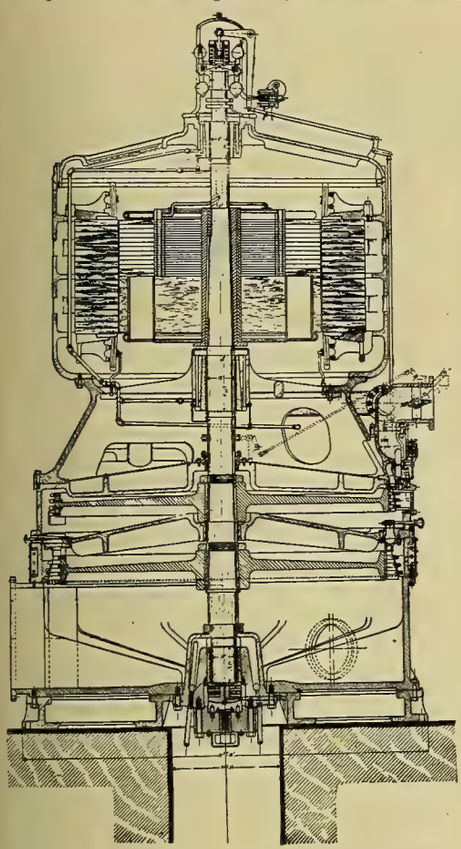


FIG. 14. CONSTRUCTION OF CURTIS STEAM TURBINE.

absorbed as in the first wheel. In some designs there is a third and fourth set of nozzles.

It is of course desirable that, for maximum economy, the pressures at the different points be the same at all loads, and this is attained by varying the number of nozzles in use. The first set of nozzles is therefore regulated by a spring-loaded fly-ball governor, and this may also be applied to the second set, although usually the nozzles are regulated by hand. The nozzles are so designed that the velocity of the steam leaving the various sets shall be the same, utilizing wheels of the same diameter.

This turbine is different from all the others, in that it is constructed with a vertical shaft, as shown in the cut. Mounted on the lower end of this shaft are the driving wheels of the turbine. They consist of steel disks, with hub and rim all of one piece. The revolving blades are either milled out of the rim as in the smaller machines, or are milled in sections from steel or bronze blocks, and these bolted to the rim of the wheel. Over the ends of the blades is riveted a band or shroud of steel to prevent the steam from passing out in any but the proper manner. The stationary or guide blades are also cut in segments and are then mounted on plates which form part of the walls of the enclosing casing. After the revolving wheels are put into place the stationary blades on these plates are slipped into position from the sides and bolted into the frame of the casing, forming a steam-tight joint. The nozzles are cut in groups, and placed with their admission openings in a horizontal plane, with usually one group on each side of the turbine. Mounted on top of these nozzle plates are the steam chests, with openings in the bottom corresponding to the nozzle openings. These ports are provided with valve seats and are opened or closed by means of poppet valves, operated by some positive means controlled by the governor.

Various means of operating these valves are employed, mechanical, electrical and by steam. In the electrical system electromagnets open and close the valves. The governor moves a drum which makes contact by light fingers pressing against it, these fingers completing a circuit through the various magnets, operating the valves. There are several different mechanical systems, but the control becoming the most used is that by steam, in which there are pistons on the valve stems, and the steam, being admitted to one side or the other, opens or closes the valve as the case may be, this admission of course being controlled by an operating or relay valve connected to the governor.

The revolving wheel is of course enclosed by the cast-iron casing supported by the walls of the exhaust chamber and base of the machine. Mounted on the cylinder are the steam chests and also the frame which carries the generator and guide bearings. There are three of these bearings, at the bottom, middle and top of the shaft. The bottom one is really part of a step bearing under the end of the shaft, and which supports the whole weight of the revolving parts, and all three merely serve to keep the shaft in line and have no real pressure upon them at all. The upper two are readily adjustable, so as to bring the shaft into line, and once adjusted should not need any further change. The thrust or step bearing consists of two cast-iron blocks, one held on the end of the shaft and the other in the base of the machine, immovable horizontally but capable of vertical adjustment by means of a powerful screw. The blocks are recessed slightly in the center, and into this recess, from up through the lower block, the oil or water is forced under sufficient pressure to keep the two blocks apart and support the required weight.

Mounted on the upper end of the shaft is the revolving portion of the generator. This, in the case of alternators, is the field, and with direct-current machines is the armature. On the extreme upper end of the shaft is the governor. Usually the shaft is all in one piece, although in some cases there may be a coupling between the turbine proper and that part used for the generator. There are special glands around the shaft where it passes out of the casing. These are packed to prevent leakage of steam. All bearings are supplied with oil from a separate oil pump.

Machines of this type range in size from 500 to 8,000 kilowatts and vary very little in form for the different sizes. In the larger units the condenser is incorporated in the base of the turbine so that the exhaust steam passes directly off of the last row of blades onto the condenser tubes. Smaller sizes, from 25 to 300 kilowatts, are built in a horizontal type of Curtis turbine, both vertical and horizontal designs being made by the General Electric Company.

The Parsons and Westinghouse-Parsons Turbine.—This turbine, developed in England by Parsons, has been brought out in this country by the Westinghouse Machine Company. This latter form is shown somewhat in detail in Fig. 15. It consists of a long horizontal spindle or rotor, supported at each end by bearings. On the spindle are drums, usually three in number, of varying diameter, the rows of blades, of increasing size to allow for expansion, being mounted in grooves cut in their surfaces. Surrounding this is the cylinder or casing which contains rows of blades corresponding to those on the spindle, and alternating with them. Also mounted on the spindle, and extending in the opposite direction from the blading, are further drums, of the same number and corresponding to the mean diameter of those containing the blading. In the surface of these drums or pistons are cut small grooves, intermeshing with collars or strips fastened in the inner surface of the cylinder. Steam passages connect similar sides of the two sets of drums, so that there are always two equal and opposite pressures on the spindle, causing it to be balanced in an axial direction, and therefore there is no end thrust. Steam is admitted in the space between the smallest diameter drums and passes through the blading, expanding as it progresses, giving up part of its energy in each set of blades. While there is no actual contact between the grooves on the balancing pistons and the cylinder, the space between them is so small that the leakage of steam is reduced to a minimum.

The bearings, one on each end of the spindle, are supported by pedestals which are part of the same casting as the casing, but are located entirely outside of the cylinder, so that they are very accessible and can be completely removed without taking out the spindle. Where the spindle passes through the cylinder there are water-packed glands, to prevent all leakage. There is no oil used upon them and no solid contact of any kind. There are two types of bearings used, one for the smaller, higher speed turbines (from 1,200 to 3,600 revolutions per minute) and the other for speeds below 1,200, this speed depending on the size of the machine.

In the large size turbines, 5,000 kilowatts and over, with a speed of about 750 revolutions per minute, the bearings are of cast iron, lined with anti-friction metal, and with the globe type of mounting, so that they are self-aligning. Those used with the higher speeds consist of several concentric brass tubes, or sleeves, the inner one serving as the bearing proper, in turn held in a heavier cast-iron sleeve which rests on the pedestal. These sleeves do not fit each other exactly, but have a small space between each one filled with oil, forming a cushion, thus giving a certain freedom to the spindle, allowing it to revolve around its gravity axis. Both styles of bearings are supplied with a continous stream of oil which, on leaving the bearing, is returned through a strainer and cooler and pumped back to the bearing again. All bearings have liners, by means of which the spindle may be adjusted in any radial direction for purposes of alignment.

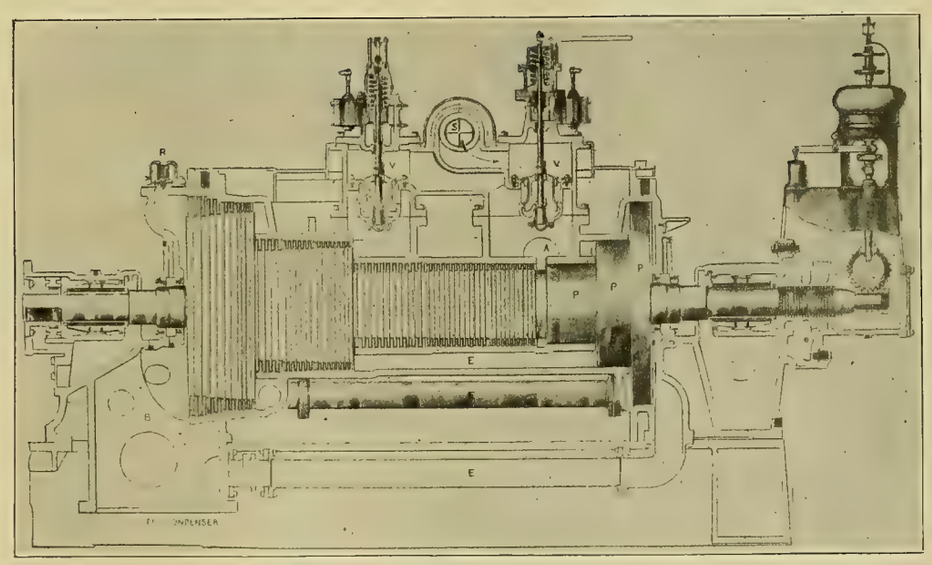


FIG. 15. TYPICAL WESTINGHOUSE-PARSONS STEAM TURBINE.

Grooves are cut in the high-pressure end of the spindle, outside of that bearing, and in them mesh the corresponding grooves of a thrust block. This block is in halves, an upper and lower, adjustable in opposite directions by means of indexed screws. As there is no thrust to overcome, the block serves merely to hold the spindle in the proper position, at the same time giving it a slight freedom of axial movement. On the end of the spindle is a worm driving a shaft which operates the governor and the oil pump.

The governor is also of the fly-ball, spring-loaded type, and controls the two steam-operated admission valves. These valves are of the double-seated poppet form, one of them for all loads up to full and the other for overloads. The first or primary valve admits steam to the first set of blades, and when it is wide open the secondary valve begins to open, admitting the steam to the second diameter drum, thus increasing the capacity of the machine to any desired amount up to 100 per cent. overload. Mounted on the valve stems are small pistons,

working in corresponding cylinders. Steam is allowed to leak past the stem under the piston, from which space there is a port leading to a small piston valve or plunger, operated by the governor. When this port is closed the steam accumulates under the piston, raising it and admitting the steam to the turbine. The plunger is given a reciprocating motion by a system of levers leading from the governor mechanism, and the governor itself regulates the extent that the port is closed each time the plunger goes down, the main valve thus also having a beat of more or less magnitude according to the load. A heavy coiled spring tends to hold the valves closed.

In this type of turbine the blading is usually cut from strips of steel drawn to the proper shapes and then inserted in grooves in the spindle and cylinder. The blades are separated the proper distance by small pieces of the same material, which are caulked down into the grooves, holding the blade very securely. These machines are also provided with automatic stop valves on the steam line, which are operated by a small separate governor on the end of the spindle.

The revolving portion of the generator, usually the field, is mounted on bearings similar to those on the turbine proper. The pedestals supporting these are independent of the turbine but rest on the same bed-plate. The two shafts are connected by means of a flexible coupling, and the generator bearings are capable of the same adjustment as those of the spindle.

[*To be continued.*]

Nichtheroy Power Transmission in Brazil.

The City of Nichtheroy, some 30 miles north of Rio de Janeiro, South America, has given its name to a new electric transmission system for supplying power and light to the towns of Cascatinha and Mage, as well as the city named. Electricity is to be generated by waterpower and transmitted at 44,000 volts to sub-stations at the cities mentioned. At the main generating station the initial equipment will comprise three three-phase revolving field, 2,000-kilowatt generators, built by the General Electric Company. These machines, as well as two 75-kilowatt exciter sets, will be driven by waterwheels made by J. M. Voith & Co. of Wurtemburg, Germany. The excitation current for the main generators will be furnished at 220 volts, the generator voltage being 2,300. This voltage will be stepped up to 44,000 volts in a bank of six water-cooled transformers, each having a capacity of 1,000 kilowatts and operating at 60 cycles. There is to be a spare 1,000-kilowatt transformer and a 3,000-kilowatt generator as a reserve. A very complete switchboard will be installed, all switches as well as rheostats being electrically operated from the board by remote control, so that there will be no high-tension wiring at the switchboard. From the main generating station the power is to be delivered over a steel tower line to the three sub-stations. At the sub-stations the transmission voltage is reduced to 6,600 volts for the local delivery. For this purpose there will be four 750-kilowatt transformers at Nichtheroy and four 350-kilowatt transformers at each of the other stations, Cascatinha and Mage. In each station one of the four transformers will be installed as a reserve. The complete electrical installation for this latest South American development will be furnished by the General Electric Company through its representatives, Guinle & Co.

Tungsten Lamps to be Commercially Available.

From time to time during the last year or so there have been rumors of the coming of the commercial tungsten lamp, and now the General Electric Company makes the important announcement that for many years it has been engaged in the development and perfection of a pure tungsten filament for the manufacture of high-candlepower incandescent electric lamps.

Tungsten possesses the property of withstanding very high temperatures, and when used as a filament for an incandescent lamp shows an efficiency of between one watt and 1¼ watts per candle. The life of the tungsten lamp, it is said, will be at least equal to that of the ordinary carbon-filament incandescent lamp.

The recent results attained by the General Electric Company in the production of tungsten filaments place it in the front rank of those investigators who have been engaged in working upon this difficult problem. Preparations are being made by the company named for the manufacture of these lamps of high candlepower upon an extensive scale.

QUESTIONS AND ANSWERS.

Operation in Synchronism and Power-factor Meter.

QUESTION.

W. E. M., Chicago Heights: Can I synchronize a 180-kilowatt and a 350-kilowatt machine, two-phase, 60-cycle, 440 volts, successfully? Is it the practice in a plant that has machines of these sizes to have a power-factor meter on the switchboard? How many connections has a power-factor meter, and how is the meter connected to a two-phase four-wire 60-cycle 440-volt system?

ANSWER.

These sizes of machines should operate successfully in parallel if they are wound to give very close to 440 volts at the speed of synchronism and if the engines which run them govern closely. It is the

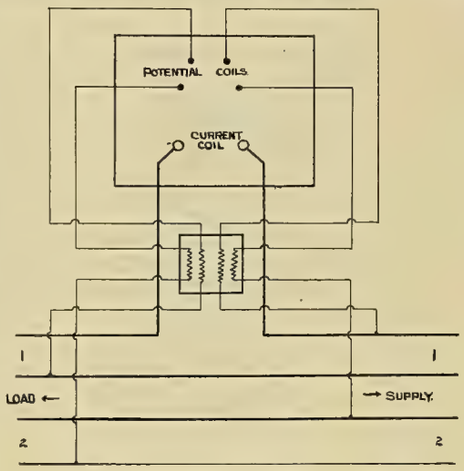


DIAGRAM OF CONNECTIONS OF POWER-FACTOR METER ON TWO-PHASE SYSTEM.

practice to have a power-factor meter in plants where there is likely to be considerable lag in the current part of the time. Such a plant would supply, for instance, partly a motor service and partly a light service.

The power-factor meter for a two-phase four-wire 440-volt system has six connections and is connected as shown in the accompanying diagram.

What Does "Multiple" Mean?

QUESTION.

W. F. H., Gordon, Neb.: In "Questions and Answers" in the Western Electrician of July 7th, C. A. P. used the expression "two receivers connected in multiple," and you also use the same phrase in your answer. I do not see how receivers can be in multiple if there are only two of them on the circuit. Please inform me as to the meaning of the word "multiple" as used in electrical work.

ANSWER.

The arrangement submitted by C. A. P. in a sketch (not published) consisted of a receiver and transmitter "bridged" or connected "in multiple" on a metallic circuit. With respect to the line upon which they were shown connected they could be said to be in multiple, in which case the meaning would be synonymous with the expression "in parallel."

Houston defines a "multiple circuit" as one "in which a number of separate sources or separate receptive devices, or both, have all their positive poles connected to a single positive lead or conductor, and all their negative poles connected to a single negative lead or conductor." The same authority gives a "parallel circuit" as "a term sometimes used for multiple circuit." With respect to the terminology, in this instance, the number of devices connected to the circuit makes no difference. A "multiple cable," however, is one having more than one conducting wire or circuit.

Telephone Receivers as Transmitters.

W. F. H. also protests: I think you are mistaken as to the distance over which a receiver will act as a magneto transmitter. I know by experience that two persons with fairly good hearing can converse over a distance of several miles, using receivers as transmitters.

The point brought up needs further elucidation, perhaps. With an artificial line representing very closely actual conditions in a fairly good line of No. 10 wire, conversation has been transmitted over an equivalent distance of as much as 100 miles. This was done without a battery supply and using two receivers only. But the common-battery system in which the fluctuating direct current carrying the conversation creates an alternating current at the repeating coil in the listener's circuit requires a moderately large current for proper action in the repeating coil. This consideration and the further fact that the carbon transmitter is far superior as a voice-current generator put the talking arrangement of receivers in the experimental class as a telephone system. And although it was inaccurate to say that the voice could be heard only a "few feet" with such an arrangement, emphasis was intended to be laid on the fact that the arrangement is not practicable for ordinary telephone service.

Charging Storage Batteries.

QUESTION.

O. L., Maroa, Ill.: I have a dynamo giving eight volts, two amperes. I also have two four-volt, 30-ampere-hour storage cells. Must these be connected in series or multiple when being charged, and will a higher voltage charging current shorten the number of hours it will take to charge the cells?

ANSWER.

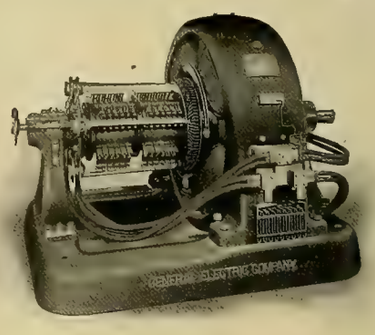
If your dynamo can be made to give 10 volts with two amperes current it will charge four 30-ampere-hour storage cells in series in approximately 16 hours, if in good condition. If the dynamo cannot be made to give more than eight volts and two amperes, it will be necessary to charge the cells, two sets of two cells each, in multiple, requiring approximately double that length of time.

High-speed, High-overload-capacity Motor for Testing Purposes.

Several especially interesting motors have recently been installed for testing purposes by the International Steam Pump Company in its New Worthington Hydraulic Works at Harrison, N. J. The motors were built by the General Electric Company and are used in testing blowers, pumps, air compressors, etc., being permanently installed on suitable foundations in such a way that the machinery to be tested can be easily brought up to them. The machines are remarkable because of their high overload capacity and wide speed range for these purposes.

The largest of these units is shown in the accompanying illustration. This motor delivers 200 horsepower at 220 volts, running at 750 to 1,500 revolutions a minute, and 100 horsepower and 110 volts running at 375 to 750 revolutions a minute. A similar range in capacity and speed is obtainable with each of the other motors, having full load rating of 100 horsepower, 30 horsepower and 10 horsepower, respectively, at 220 volts.

All the machines are of the four-pole type and will carry 50 per cent. overload for two hours at any speed within the range specified. The motors operate on the three-wire system, the fields being



HIGH-SPEED MOTOR WITH UNUSUAL OVERLOAD CAPACITY.

excited from the 220-volt mains, and the armatures being connected through double-throw switches to the 220-volt or 110-volt mains, according to the speed range required. The speed ranges are obtained by field control and the 200-horsepower and 100-horsepower machines are built with commutating poles. A German silver resistance, shown just below the terminal board in the illustration, is used to make the final adjustment of the current in the commutating field coils. By this arrangement sparkless commutation at all loads, including 50 per cent. overload, is assured.

Aside from the large capacity and high-speed range, these motors have several interesting structural features. On account of the high surface speed of the commutators in the 200-horsepower and 100-horsepower machines, an improved shrink ring type of commutator is used. The brush rigging is similar to the form recently adopted in high-speed direct-current Curtis turbine generators. The brush-holder studs are of stiff-ribbed design, and the brush-holders are secured to the studs by bolts passing through machined joints of special form, making the entire brush system extremely rigid in spite of the unusual length of the studs. The motors are materially lightened by making the

magnet frames of steel, and both armature and field coils are built to give proper ventilation at the overload capacity. Particular attention has been paid to balancing rotating parts, so that vibration within the wide variation of speed and load is eliminated.

Isolated-Plant Engineering.

In a paper recently presented before the University of Columbia Electrical Engineering Society, Mr. Putnam A. Bates, consulting engineer of New York city, discussed the subject of isolated-plant engineering. The first part of the paper was devoted to general observations concerning the factors entering into such determinations. The last part of the paper, however, was taken up with a concrete example of how to proceed in the calculation of an isolated plant for a factory building to displace an old equipment. The author's statement of the problem and its solution follows:

In order to bring out more clearly the practical application of what has been said, to particular cases, let us consider an isolated power station for a manufacturing plant consisting of several buildings spread over the greater portion of a city block and located about 600 or 800 feet from the river.

This plant consists of several machine shops for doing both heavy and light work, a forge shop, a pattern shop, a storage loft for patterns and an office building.

Power for the operation of machinery in the various shop buildings was originally supplied by two steam engines located at different points in the works, each supplied with steam from a single boiler nearby, and each driving a long line of shafting by means of a belt.

In time these engines became worn out and were discarded, and a number of electric motors were substituted for them, a semblance of individual drive being installed in some of the shops. Current for these motors and also for some lighting was obtained from the public-service main in the street and distributed from a switchboard in one of the shop buildings.

The two old boilers, however, were retained and kept in commission, as the steam was needed for driving a couple of small air compressors in the boiler-plate shop, a high-pressure hydraulic pump used to furnish water under pressure for the operation of hydraulic tools in the forge shop, a steam hammer, also in the forge shop, and for heating the various buildings.

This arrangement was obviously uneconomical both in operating cost and in space occupied, and it was therefore decided to install a central power-generating plant where all of the power required by the works could be economically generated and without occupying valuable space in the shops with boilers, feed pumps, coal piles or nonproductive machinery.

The space allotted to the power-plant building was approximately 35 feet wide by 60 feet deep, running back from the street to one of the shop buildings.

These, then, were the conditions, and the problem was how best to meet them to secure the greatest economy of operation and the greatest return on the necessary investment.

The first question to be answered was with regard to the type of plant to be installed. The high-pressure steam-driven hydraulic pump and, if necessary, the steam-driven air compressors could be replaced by electrically driven apparatus, but no suitable substitute for the steam hammer has as yet been marketed, and no form of heating is so well suited to the conditions which prevail at these works as that using direct radiation from steam or hot water.

The next point to be decided was the total capacity required and the most advantageous subdivision into units.

In order to obtain as much information as possible which would serve as a guide to help in determining this question, careful observations were made of the current consumption at different times of the day and under different conditions, and of the size, number and character of the various motors and tools in the shops. A careful study was also made of the coal, water and electric bills for the preceding five years in order to ascertain as nearly as possible how the load conditions changed from month to month and year to year.

As a result of this analysis it was decided to install three electric generating units—two of 60 and the third of 30 kilowatts capacity—and a single steam-driven air compressor, it being unnecessary to provide a reserve machine of this type, as the temporary crippling of this machine would shut down only a small portion of the works and would not interfere in any way with the other portions.

The type of prime mover and the relative advantages of operation with or without condensers came up next for consideration.

As has already been pointed out, the advantages to be gained in this instance by the use of exhaust steam for heating purposes were very great, and as the steam required for this constituted a very considerable percentage of the total amount of exhaust steam from the engines, the increased economy of power generation to be obtained by the use of a condenser, even if condensing water were cheaply available, would obtain only during the warmer months of the year and would not, for that reason, show a sufficient return on the additional investment necessary to warrant the installation of an equipment of condensing apparatus.

The rather limited amount of floor space and the desirability of not encroaching upon the second floor of the power-plant building any more than was absolutely necessary, as this space could be used to advantage for manufacturing purposes, eliminated the horizontal slow-speed type of prime mover from consideration in connection with the electrical generating units required for this plant, more especially as the air compressor must necessarily be of the slow-speed type of engine, and no vertical machine of the proper capacity could be found.

A careful comparison of operating efficiency, first cost, floor space occupied and general suitability of the various types of high-speed reciprocating engines and steam turbines showed a very decided advantage in favor of the vertical-compound reciprocating engine as applied to the conditions already mentioned.

Having reached this point in the solution of the problem in hand, the steam-generating equipment may now be taken up for consideration and the total capacity and sub-division into units, the type of boiler to be used and the nature of the auxiliary apparatus required decided upon.

The nature and amount of the load has already been determined in connection with the choice of the engine units, and to determine the total boiler capacity required it simply remains to ascertain the amount of steam which these engines will consume when furnishing the requisite power, as determined by the manufacturers' guaranties, and to add to this the amount of steam which will be consumed by the steam hammer. In this manner it was found that 300 horsepower in boiler capacity would be sufficient, the horsepower rating being based upon the well-recognized standard of 34½ pounds of water evaporated per hour from and at 212° F.

The steam boiler is a much more flexible unit than the steam engine or electric generator, it being possible to force it far beyond what would be a safe overload for a standard engine or dynamo, and to obtain a reasonably good efficiency from it even at light loads. This fact together with the small amount of floor space and the desirability of reserving some space for future enlargement of the boiler plant lead to the choice of two boilers, each of 150 horsepower set in a battery.

It still remained to determine the type of boiler best suited to the requirements.

The ability to make steam quickly together with the desirability of carrying a high pressure with as little risk as possible and of using superheated steam, in order to obtain the best possible economy from the steam-engine units and obtain the full advantages to be gained by the use of compound steam cylinders, lead to the choice of inclined water-tube boilers with four-inch drawn-steel tubes and wrought-steel headers equipped with superheaters also of the tubular type placed at the top of the boiler setting and between the first and second pass of the furnace gases.

A cross-drum type of boiler with 14-foot tubes was used in order to make it possible to set the boilers across the building, which arrangement was the most economical of floor space and lent itself best to the steam-piping arrangement, and at the same time to remove and renew tubes as occasion should require.

Having reached this point it became possible to proceed with the design of a suitable building for housing the apparatus to be installed.

The building decided upon is a two-story brick and steel fireproof structure having the boiler and engine room on the first or ground floor and a 100-ton steel coal bin on the second floor, the remaining portion of the floor being available for manufacturing or other purposes.

A steel-plate smokestack four feet in diameter, and with its top 125 feet above the boiler-room level, also rests upon the second floor and is connected with the flue openings of the two boilers by means of a steel-plate flue and breechings.

Coal is delivered by means of a chute from the sidewalk to a bucket conveyor running from a pit in the first floor, into which the chute opens, to a point above the coal bin on the second floor. This conveyor is entirely enclosed and provided with a spout at the top, by means of which the coal is deposited near the center of the bin. A motor on the second floor drives the conveyor by a belt.

The boilers are located in a room by themselves, the side wall of the setting being carried out to form a partition wall between the engine room and the boiler room. This arrangement necessitates the cleaning of one of the boilers from the engine room, but was necessary in order to obtain sufficient room for a possible future increase in boiler capacity.

The coal bin is located directly over the firing space in front of the boilers and has two pockets, from the bottom of each of which hoppers are carried down to a height of about five feet above the boiler-room floor and terminate in valves.

Under these hoppers a small coal-charging car runs on rails set in the cement floor, and from this car the furnaces are supplied. This arrangement makes it unnecessary to carry any coal upon the floor of the boiler room, and therefore it is possible to keep this portion of the plant in a neat and cleanly condition.

Owing to cramped space and the nature of the soil, which prevented excavating to any great depth, it was not possible to make any special provision for the removal of ashes, even if the quantity of these were sufficient to warrant the necessary expense which would be involved in providing for this in any other way than by hand through the ash-pit doors.

The boilers are built for a working pressure of 200 pounds per square inch, although for the present at least but 150 pounds will be carried, and are each equipped with a superheater designed to increase the temperature of the steam before it leaves the boiler 100° F. above the temperature of saturated steam at the same pressure.

Economizers were not installed for the reason it was found that a sufficient amount of surplus exhaust steam would always be available for use in a feed-water heater to maintain the temperature of the feed water at about 200° F.

The feed-water heater is of the open type, consisting of a cast-iron shell with copper drip pans or trays at the top, over and through which the feed water percolates, and a settling tank and filter at the bottom. A branch from the exhaust pipe connects with the feed-water heater, and the steam enters through an oil separator and mingles with the cold water trickling over the trays. In this manner the entering steam gives up its latent heat to the incoming water, is condensed and unites with the water, and the resultant hot water descends to the settling tank below to be drawn out and forced into the boilers by the feed pumps. No steam outlet is provided for the heater, only such quantities of steam being drawn into it as are required to replace that previously condensed.

Two boiler-feed pumps are installed, one being steam driven and the other electrically driven.

Steam is delivered from the boilers into a five-inch heater running across over the boilers and through the dividing wall into the engine room, where it enters a five-inch steam main, from which the various steam-driven units are supplied. The steam main is carried on brackets along the wall and near the ceiling. The exhaust main consists of eight-inch pipe with screwed flange joints and is carried along the side wall of the engine room directly under the steam main and up in one corner to a point above the roof. An oil separator is installed beyond the point where the last exhaust pipe enters the main.

The three generating sets are installed in a row along one wall, and on the other side of a central aisle is the air compressor, the electrically driven boiler feed pump, space for an additional electrical generating set and a controlling and distributing switchboard.

The generators are direct-current 240-volt compound-wound machines. The primary reason for the choice of this current and voltage was that all the motors installed throughout the works were wound for that and the use of it makes it possible to take advantage of the public service as an auxiliary should it ever prove desirable to do so.

The lighting is taken care of by means of a three-wire system fed from a rotary balancer installed near the switchboard. This arrangement was considered preferable to the use of a 240-volt two-wire lighting system for the reason that this higher voltage does not lend itself well to the operation of many of our higher power illuminants, such as the arc lamp, so useful in the economical lighting of large enclosures.

The switchboard consists of seven panels of marbleized slate mounted upon an angle-iron frame and set three feet from the wall. There is a generator panel for each of the three dynamos, a total output panel, an equalizer or balancer panel and a lighting-feeder and power-feeder panel.

From the switchboard the generation of the current and the distribution throughout the works is controlled. A somewhat knotty problem was presented in connection with the air compressor. Whenever air or any other gas is compressed, heat is generated, and the greater the compression the higher the temperature to which the gas is raised. This is what occurs in the air cylinders of the compressor, and unless this heat is removed the temperature to which the cylinder walls will attain will be destructive. To overcome this it is customary to provide water jackets around the cylinders, and in large two-cylinder machines intercoolers as well.

The amount of water necessary to cool the air compressor of the machine in question was estimated at 50 gallons per minute. The only available supply of water was from the city mains, and the cost of this amount from that source was too great to be considered.

To overcome this difficulty it was finally decided to install a cooling tower upon the roof, through which the water could pass after becoming heated in the jackets of the compressor and be cooled and used again.

A small tank was placed on the second floor, to which a water pipe terminating in a ball cock was run, and in the engine room below, near the compressor, a small motor-driven rotary pump was installed. A water pipe was run from the tank to the suction inlet of the pump, and from the discharge outlet of the pump another pipe was run and connected to the outlets of the water jackets. From the jacket outlets a pipe was carried to the top of the cooling tower and from the collecting pan at the bottom down to the tank on the second floor.

A by-pass and waste pipe was also provided which makes it possible to allow the water to run to waste when desired, as, for example, when it be-

comes necessary to clean or repair any of the parts.

By this arrangement only sufficient water is drawn from the street mains to make up the loss by evaporation, which is about five per cent., and the cost of the necessary electrical energy is trifling compared with the saving accomplished. The total investment necessary to accomplish this result was about equal to the cost of the water for one year if this water were allowed to run to waste after being used in the jackets.

Blank Forms for Use In Electrical Engineering Instruction.[1]

By Henry H. Norris.

The purpose of this paper is to set forth the facts regarding the use of mechanical means, such as blank forms, in connection with courses in electrical engineering. The state of affairs is practically the same in connection with other branches of engineering, but attention will be largely confined to this one branch, in order to make the results more concrete. That the subject is worthy of study is evident from the fact that there is a great variety of opinion as to the wisdom of using such forms, and the forms thus actually in use are of many different types. In presenting this topic to the society the writer has in mind the possibility of such an interchange of opinion and experience in connection with the discussion that the way might possibly be opened for preparing sets of standard blank forms which could be used in classes taught by the members. These forms are expensive to produce, especially in small quantities, and they require a great deal of care and thought to arrange in the most orderly and logical manner. Hence, if the use of blank forms is desirable, and if some of these forms could be made standard, it would be entirely practicable for the society to undertake such work if it were thought wise.

In studying this subject two facts are clearly brought out: First, that any kind of instruction is primarily for the purpose of developing the ability of the student to think for himself; and, second, that the instruction should give the student facility in turning out a great deal of good work in a limited time. Each feature of instruction must be adopted with these two points in view, and any plans which emphasize one at the expense of the other will produce unsatisfactory results. Aside from these considerations, there must be kept in mind the necessity for efficiently instructing a considerable number of students, and a plan that might be successful with a large number of students may not succeed with a small number, and vice versa. From these premises it is evident that there is no definite answer to the question, "Are blank forms desirable for use in electrical engineering instruction?"

Experience with students teaches that very little pedagogical value is to be attached to lecures and recitations, except as these force the students to put forth mental effort in doing something for themselves. Hence, the necessity for unlimited problems, both analytical and experimental. These problems must be designed to teach the desired lessons without unnecessary drudgery, and they may at the same time serve to convey a general impression of current engineering practice. The preparation of the problems and the examination of the results entail much labor on the part of the instructors, and this may be minimized by the use of printed or mimeographed blank forms calling for the several items desired. With such forms in use, the instructors are able to devote more time to the general principles involved, and their work is rendered less tedious. The students are also helped by the forms, in that they are able to go ahead with their work with little delay, and if the forms are properly designed, the students will not be relieved of the necessity of thinking for themselves. Obviously, students are not prepared to plan their own problems, and experiments in detail, for to do this requires a comprehensive view of the whole subject covered. They would be sure to omit important features, requiring the repetition of much work. The forms indicate the various features of the problems and the number of calculations or observations to be made. The objection to such mechanical helps is that the students are relieved of responsibility, and hence have no incentive to think for themselves. This is a real danger, and must be avoided in some way.

In order to ascertain the present opinion and practice in this matter correspondence was conducted with a large number of engineering schools and the professors were asked to state their views for the benefit of the society. A collection of blank forms was also made and arranged in book form for study. The results of this preliminary work show that opinion regarding the advisability of using blank forms varies from one extreme, in which it is not thought wise to use any blank forms, to the other, in which the general use of blank forms is recommended. The arguments advanced in the first case are that the student must be encouraged to put forth all the original effort possible, and that he gains more by doing a few pieces of work thoroughly from the bottom up than from doing a great quantity of work with mechanical assistance. In one institution the aim is stated to be to have so many instructors in the classes that the students can receive the necessary help without the aid of many blank forms. Those who advocate the use of blank forms to a considerable extent believe that the student gains more by covering a great deal of work in a limited time than he does by doing a few pieces more thoroughly.

The average opinion of all seems to be that a limited use of blank forms is desirable and that certain studies lend themselves more readily to the use of such forms than others. As a study tends to involve empirical information, the use of blank forms becomes more allowable. This class of problems includes particularly design and work of this kind. It may be said also that problems connected with the prediction of the operation of electrical machines also come under this head. Laboratory problems seem to require a limited use of forms. One authority who was consulted gave as his opinion that blank forms should generally be used, in order to produce facility, but that a few problems in each course should be given without any such assistance, in order that the student might be able to try his own ability to follow through a line of thought. This seems to be a rational attitude.

A few notes regarding the practice in various institutions may be of interest and are here given.

Syracuse University uses a complete and elaborate set of blanks for data on dynamos, motors, etc., these being about the most complete that were submitted.

Columbia University for laboratory reports uses a simple form calling for a few general matters and leaving the students to fill in the details. In the design courses, however, they use a more elaborate blank, and the completeness of the latter is shown by the fact that that for dynamo and motor comprises 327 items. Columbia University submitted an interesting blank form to be used in describing an electric-light or power station calling for the various items necessary to describe such a station completely.

In the electrical laboratory of Montana State College a small size of report form (7½ by 8¼) is used, the standard apparently being 8½ by 11.

The University of Missouri uses in the designing room a complete form for dynamo-electric machinery, covering all kinds of electrical and mechanical details.

The University of Vermont has a very complete set of blanks for experimental work and design.

The Armour Institute of Technology sent a sample blank covering the subject of power-plant engineering, in which the important details of dynamo and motor construction are compactly arranged.

Cornell University uses a large number of blank forms, Professor Carpenter of the experimental engineering department having developed a very complete set, covering all of the experiments performed in the junior and senior laboratories. At the present time a set is being made for the electrical engineering laboratory, the form being based upon the experience gained in the experimental engineering department, combined with the requirements of an electrical laboratory. Samples of both of these forms are submitted, as they show a successful practice in this line. The experience in Sibley College has shown the necessity for the use of such blanks, particularly in the instruction of large classes. The blanks have been so prepared that they contain all necessary information for carrying out and working up the experiments as far as these can be given in condensed form. In the electrical engineering department, aside from the laboratory, it has also been found very desirable to put the problems and other exercises into systematic form, the constants being varied so as to give individuality to the work of each student.

Blank forms received from the Charlottenburg Technical High School, and designed by Prof. E. Arnold, are as complete as any that have been available. The most minute details are covered, and if a student has thoroughly solved one of these problems he is presumably a master of the subject.

Two very interesting volumes were submitted by Professor Aldrich as samples of the methods followed by him in his work at the University of Illinois. Detailed instructions are given for conducting the experiments, and some blank forms are included, the spaces to be filled in by the students.

The University of Texas submitted a number of sample reports from students, from which it is evident that they do not supply printed forms, but they depend upon the students to rule their own blanks as needed. The experiments are enclosed in standard covers, on which are printed general instructions for conducting experiments.

In conclusion, the writer would state that for the conditions existing at Sibley College he feels sure that some blank form must be used for practically every problem or experiment. That this is true in all institutions is doubtful. It will be interesting to learn the opinions of the members of the society, as to whether the enforced use of these forms is an unmixed evil or whether as good results may be accomplished with a judicious use of the forms as without.

1. A paper presented before the 1906 meeting of the Society for the Promotion of Engineering Education. The author is professor of electrical engineering, Sibley College, Cornell University.

The Grounding of Transformer Secondaries.

[From the Question Box of the National Electric Light Association.]

Questions.

What progress, if any, is being made for the grounding of secondaries? Is there any standard method yet adapted for universal practice?

Answers.

H. B. Gear, Chicago Edison Company: In Chicago the neutral point of every three-wire transformer and one side of every two-wire transformer is grounded. No more trouble has been experienced with transformer burnouts since the practice of grounding was established, and no other disadvantages have been experienced as the result of a grounded neutral. On the contrary, several cases have arisen in which the grounded neutral served to prevent injury to consumer's property due to primary lines being crossed with secondary.

E. C. Deal, Hackensack, N. J.: One side of every secondary circuit should be perfectly grounded. It is preferable to ground one side of each service at or near the point of entrance to the building. If it is a three-wire system, ground the neutral side of each service.

W. H. Greenslit, Vicksburg, Miss.: Drive a one-inch galvanized-iron gas pipe down to the moist earth, which will serve as a satisfactory substitute for a ground plate. Plug the pipe about three inches from the top with asbestos. Make a spiral of one end of a No. 6 wire and solder into pipe, filling the entire three inches with solder. Run the No. 6 wire in continuous length to secondaries.

W. E. H.: We have grounded all our secondaries in every installation. We have for several years required that the service wires in buildings should be run into the basement. We require that contractors doing wiring in houses run a No. 4 wire from the point of entrance of the service wires to a point near the water-pipe entrance outside of the meter and connect it to the water pipe outside the meter by an approved ground clamp. We connect the other end to one side of the service ourselves, after testing the insulation resistance of the house wiring.

Question.

Do gas companies anywhere permit the connecting to their pipes of ground connections from secondary electric systems?

Answers.

Dudley Farrand, Newark, N. J.: Ground connections for secondary electric systems should not be made to gas pipes. Gas meters will not carry any amount of current without melting off the lead or soldered connections, and the iron pipes do not provide reliable grounds.

W. E. H.: It is not good practice to ground secondary electric systems on the gas pipe. It is better to ground them on the water pipe. We believe the gas company should not permit it.

Question.

Is the grounding of secondary electric systems by connection to water pipes being carried out anywhere in the country with knowledge and consent of the water company or municipality owning or controlling the pipes, and, if so, where?

Answers.

L. L. Elden, Boston, Mass.: No objection is made by a number of the towns and cities served by this company to the attaching of grounds for secondary mains to the water pipes.

S. R. Inch, Missoula, Mont.: In grounding the neutral wire of our alternating-current three-wire secondary circuits, we attach to fire hydrants or water pipes; in the latter case always make the connection ahead of the house shut-off cock. We own the water system, so have not needed permission from municipality; however, in the three years during which we have followed this practice, no trouble whatever has resulted therefrom.

W. E. H.: The grounding of secondary electric system by connections with water pipes has been carried out in the city of Newton and town of Watertown, with the consent of the water company owning and controlling the pipes and of the municipality through its inspector of wires.

H. B. Gear, Chicago Edison Company: In Chicago secondaries are grounded to water pipes, in addition to some other grounds, in cases where water pipes are conveniently accessible to the service wires. No damage has been done and no objections have been raised by the municipal authorities.

Questions.

Is the grounding of secondaries to water pipes in any way detrimental to the pipes? Is there any trouble to be anticipated from a universal application of this practice?

Answers.

L. L. Elden, Boston, Mass.: There is no trouble to be anticipated from the practice of using water pipes for grounds for secondary mains, and it is not detrimental to the pipes if properly done.

Toledo Railways and Light Company, Toledo, Ohio: Fluctuating voltage is likely to occur where

secondaries are parallel with street-railway lines and are grounded at more than one location.

G. R. Radley, Milwaukee, Wis.: Grounding of the secondary neutral to a water main can cause no harm to the latter if a heavy connection is made to the main at but one point, preferably near to the transformer. With but one point thus connected, no current flows in the water mains except during the moment of the occurrence of a ground on either of the outer wires.

QUESTION.

Where water pipes are not available for ground connections, either because they are not present or because their use is prohibited, what is the most satisfactory means of making effectual and permanent grounds for secondary systems?

ANSWER.

Edison Illuminating Company of West Chester, West Chester, Pa.: If possible, dig or drive to permanent moisture in the earth, or plant copper plate at some point where surface water may keep the earth permanently wet. If necessary, it is better to run a heavy ground wire for a considerable distance to get a good ground rather than take chances on one where permanent moisture is not obtainable.

QUESTION.

What have you found to be the most satisfactory method of making ground connections of secondaries to water pipes?

ANSWERS.

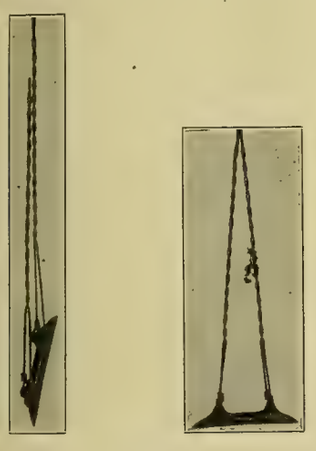
Ralph R. Laxton, electrical engineer, Victor Manufacturing Company, Grears, S. C.: Brass plugs screwed into pipe which is tapped about half way through. If possible, tap at least three lengths of pipe and bind the taps together around the joints.

W. E. H.: The most satisfactory method of making ground connections for secondary to water pipe is to run No. 4 rubber-covered wire from near the point of entrance of the secondary to a point on the water pipe outside of the meter. A special clamp is then soldered to the end of the No. 4 wire and attached to the water pipe outside the meter and fittings.

New Folding Guy Anchor.

A new folding guy anchor of simple, durable and inexpensive construction, in which there are rods for holding the body portion of the anchor at substantially right angle to the rods when it is placed in position in the ground for use, is being put on the market by the Holden Anchor Company of Des Moines, Iowa.

In practical use, and assuming that it is desired



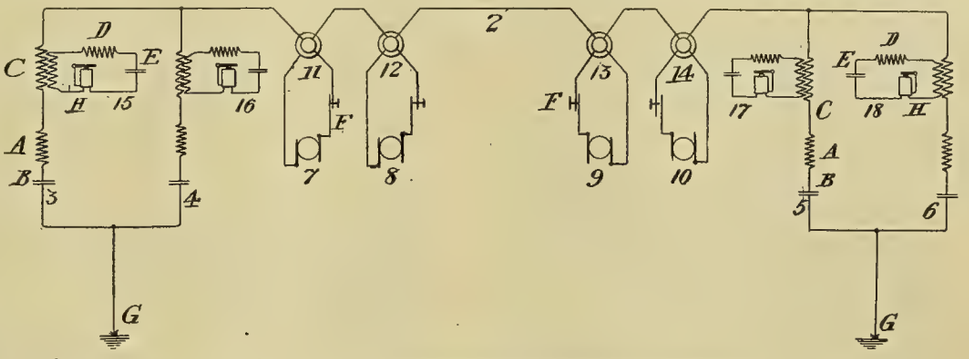
NEW FOLDING GUY ANCHOR.

to place the anchor in the ground for holding a telephone pole in position against any strain which may be upon it, a hole is made in the ground at the desired angle to the earth surface and the anchor is swung to a folded position and inserted into the hole, the hole being only of sufficient size to admit the anchor when in folded position. In digging the hole a post auger is preferably used. When the anchor reaches the bottom of the hole the upper end of the rod that is deepest in the ground is drawn upward, which will cause the rounded end of the anchor to enter the ground at one side of the hole, and, as the drawing is continued, the anchor will be swung to a substantially right angle to the rods. The hole is then filled with earth and the cable is attached to both loops in the anchor rods and to the pole. When the cable is attached to both loops it will be seen that the anchor cannot be swung from a right-angle position, owing to the fact that there is a tension on each end of it. It is said that these anchors will withstand a great strain.

The carrying of merchandise in carload lots through the freight tunnels of the Illinois Tunnel Company in Chicago was scheduled to be begun this week. About 45 miles of tunnel has been equipped. Transfer of freight is made by electric cars.

Pupin's Application of Resonance to Multiplex Telegraphy.

When a certain number of simple harmonic electromotive forces are impressed upon a line conductor, then a branch line may be adjusted so that it will offer a very much smaller impedance to one of these electromotive forces than to the others. This will take place when the natural period of the branch is the same as that of the selected electromotive force. Upon this physical fact, known as "electrical resonance," Dr. M. I. Pupin, the well-known professor of mechanics in Columbia University, New York, has based an ingenious system of multiplex telegraphy, for which he was recently granted a United States patent.



PUPIN'S APPLICATION OF RESONANCE TO MULTIPLEX TELEGRAPHY.

To produce electrical resonance between a circuit and an impressed electromotive force, the electromagnetic constants of the line—that is, its self-induction and electrostatic capacity—must be adjusted according to well-known rules. A resonating line is selective. The possibility of attaching to a main line a certain number of selective branches enables the foregoing principle to be applied to multiplex telegraphy. In practice, however, certain serious difficulties appear. These are, first, that the selective power of an electrically tuned branch circuit forming part of a system diminishes materially with the increase in the number of branches from the main conductor, and, second, that when there are several complex harmonic electromotive forces impressed upon the system the upper harmonics of one may come within the frequencies of the fundamentals of the others, especially if more than three or four frequencies be employed, with consequent confusion.

The invention consists, first, in the method of and apparatus for throwing upon a main line a number of alternating currents of different frequencies, independently of each other, and distributing the energy of these several currents each selectively to a separate electrical translating device; second, in an electrical system wherein one or more induced circuits may be tuned in electrical resonance respectively with the impressed electromotive forces of different periodicities and this independently of one another and of all the rest of the system to which they belong; third, in the method and apparatus for converting a complex harmonic electromotive force impressed upon an electrical system into a simple harmonic electromotive force; fourth, in the construction and arrangement of the multiplex telegraph.

Referring to the accompanying diagram, (7), (8), (9) and (10) are alternating-current generators giving four electromotive forces of four different frequencies. These generators are connected to the primary circuits of four transformers (11), (12), (13), (14), independently of each other and simultaneously or otherwise. The secondary circuits of these transformers form part of the main line (2). The cores of the transformers are of finely laminated iron and form closed or very nearly closed magnetic circuits. This fact is one of the important features of the invention.

Connected to the main line (2) and to the ground (G) are four branches (3), (4), (5), (6). Each one of these branches, as (3), has a primary coil (C) and another coil or coils (A). The coil (C) is called the active coil, and the coil (A) the auxiliary coil. Also in each branch is a condenser or condensers (B). The number of auxiliary coils and condensers in each branch may be any number, all of them connected in series. Each branch is placed by means of the active coil in inductive relation to a secondary circuit. Thus, for instance, the branch (3) is in inductive relation to the circuit (15), which includes a coil (D) of large and adjustable self-induction, a condenser (E) of suitable capacity for telegraphic purposes, and any suitable apparatus (H) which serves to indicate a current in this circuit by means of an electromagnetic, electrochemical, or electrostatic effect. Four keys (F) serve the purpose of making and breaking or simply varying the strength of the generator current. The four generators (7), (8), (9), (10), with the transformers (11), (12), (13), (14), and the keys (F) constitute the outfit for the four sending stations. The four branches (3), (4), (5), (6), with their four secondary circuits, constitute four distinct receiving stations.

The method of operating is as follows: Let the frequencies of the generators at the sending stations be, respectively, 600, 520, 440 and 360 periods per second. The branches (3), (4), (5), (6), being at the receiving stations are adjusted by means of the condensers (B) and the auxiliary coils (A), so as to be approximately in resonance with the frequencies aforesaid, respectively. These branches are adjustable independently of each other. The secondary circuits (15), (16), (17), (18) in each receiving station are put in perfect resonance with these frequencies, but in such a way that the resonance balance of any one of these branches is entirely independent of the physical constants of the branches themselves or the line or any of the other secondary circuits and depends solely upon the self-induction and the capacity of that secondary circuit alone. This is accomplished by making the auxiliary adjustable coils (D) of so large a self-induction that the self-induction of each secondary circuit is practically equal to the self-induction of its auxiliary coil. The capacities are then adjusted according to the well-known rules in order to produce resonance with the frequency at which each receiving station is intended to work.

By keeping down the resistance of the secondary circuits and by avoiding the use of iron in the auxiliary coils of these circuits they can be made easily to respond a thousand times more strongly to the frequency to which they are tuned than to any other frequency, and this independently of whatever variations in the electrical constants may be going on in the other parts of the system.

Suppose now that the four generators at the sending stations impress simple harmonic forces upon the line and that the primary circuits are closed, there will be electromotive forces of the above frequencies impressed on the line, and hence alternating currents of like frequencies, respectively, on the secondary circuits at the receiving stations. If the primary current from, say, generator (7) is interrupted, then the current in the corresponding branch—say (3)—will also be interrupted, whereas the currents in the other branches at the other receiving stations will not be affected. Hence if an operator works a key, as (F), the sounder (H) in the secondary circuit (15) will be operated, but not the sounders in any of the other secondary circuits.

It is evident that any number of transmitting and receiving stations can be working simultaneously on the same line, without disturbing each other. The limit to this number will be determined by the limiting frequencies at which the lines can work. On a line, say, 500 miles long, the highest frequency will probably be 600 periods per second and the lowest 40. Any frequency employed should be at least 15 per cent. of its own value distant from the next higher and the next lower frequency, so that a line 500 miles long could be worked conveniently at from 12 to 16 different frequencies, and therefore have 12 to 16 transmitting and receiving stations. This is, however, on the supposition that each transmitting station sends a simple harmonic electromotive force or current. It is, however, practically impossible to produce alternating-current generators capable of giving such a force. As a rule, they give alternating electromotive forces in which the upper harmonics, especially the third and the fifth, are of nearly the same order of magnitude as the fundamental. Hence, although the fundamental frequency of any one of the sending stations does not come within the proximity of the frequency of any other station, the harmonic will, especially when the line is worked at more than three or four frequencies.

The inventor uses a transformer whose iron core forms an ordinary closed magnetic circuit which when worked at saturation of between 1,000 and 15,000 c. g. s. lines of force per square centimeter will give in the secondary circuit a simple harmonic electromotive force whose frequency is equal to the fundamental frequency of the impressed electromotive force, no matter how complex the impressed electromotive force may be. This is especially true if the fundamental frequency is not below 35 periods per second, and if magnetic leakage is encouraged by arranging the primary and the secondary circuit in such a way as that they do not overlap, somewhat in the fashion of constant-current transformers employed for alternating-current arc lighting.

Operation of Direct-current Dynamos.

[From the Question Box of the National Electric Light Association.]

QUESTION.

Two belt-driven compound-wound generators—one 75-kilowatt and the other 100-kilowatt capacity—are arranged to be run in multiple. By itself the 75-kilowatt machine is slightly overcompounded, but the two run perfectly together. What would be the result if these machines were thrown together without the equalizer switch being closed?

ANSWERS.

A. M. Wilson, State College of Kentucky, Lexington, Ky.: What the result would be if the machines were thrown in parallel without closing the equalizer switch depends largely upon the difference in regulation. If the 75-kilowatt machine is compounded much over the 100-kilowatt machine it will take all the load; and a sudden change of load might reverse the polarity of the 100-kilowatt machine. I tried the experiment on two small generators. One is four-pole, drum-wound, and the other two-pole, ring-wound. The armature reaction of the ring-wound is much greater than that of the drum-wound. I found that when the no-load voltage of the ring-wound machine was about 115 and the no-load voltage of the drum-wound machine about 105, they could be thrown in parallel. Under these conditions, with no load, the drum-wound machine ammeter showed a negative current. Then, as the load was thrown on, both ammeters read positive. When the load was increased further the ring-wound generator took more than its share, until finally it carried almost the entire load. A quick removal of the load resulted in reversing the polarity of the ring-wound machine.

C. W. Higgins, General Electric Company, Duluth, Minn.: If the voltage has been properly adjusted, the generators may be thrown together without closing the equalizer switch. If the load is then adjusted in proportion to the machines they will run satisfactorily.

F. D. Sampson, Catawba Power Company, Charlotte, N. C.: The smaller machine, on account of its overcompounding, would endeavor to run larger machine as motor until its abnormal load would reduce its field; then the reverse condition would take place if the circuit-breaker on the smaller machine did not trip to prevent it. With the equalizer closed there should be no trouble if machine characteristics are the same.

George N. Tidd, Marion Lighting and Heating Company, Marion, Ind.: One machine would probably take all of the load and drive the other one as a motor. Unless characteristics of both machines are practically the same, cannot be operated to advantage in parallel without equalizer.

Ernest F. Smith, Chicago Edison Company, Chicago, Ill.: If the voltage were equalized and the machines were connected in parallel, with the equalizer switch open, the 100-kilowatt under-compounded generator would become motorized; its speed would become excessive and the progressive increase in strength of reverse current through series winding would reverse the polarity of the generator and build up its shunt field in reverse direction. The machines would then both generate in series in the same direction, causing heavy current to circulate through the local short-circuit formed by main direct-current buses, switches, generator leads, and so forth. The generators would slow down under the heavy load thus thrown upon them and would burn out unless the circuit-breakers or other protective devices properly performed their functions.

QUESTION.

In case of emergency, could a 550-volt, compound-wound generator be run at 250 volts on the same bus with shunt-wound, 125-volt machines running on three-wire system?

ANSWERS.

H. D. Larrabee, Hoosick Falls Illuminating Company, Hoosick Falls, N. Y.: A 550-volt compound-wound machine could not be operated in this way at normal speed, owing to its great instability at half voltage. It would be necessary to run it at approximately half speed to get the magnetic density high enough to make the machine stable. Then the fields of the 550-volt machine should be divided in halves and the two halves put in multiple, taking their excitation from the 250-volt buses. In this way the machine would operate very well if the field current was not heavy enough to overheat the rheostats, since this current would be about twice normal, due to the fields being in multiple. If the machine gave trouble from its compounding, the series field could easily be short-circuited. The kilowatt capacity of the machine is of course about half the name-plate rating when run this way.

W. T. Oviatt, Connecticut Railway and Lighting Company, Bridgeport, Conn.: Yes, by reconnecting armature so as to put two coils in parallel and increasing thickness of brushes so as to cover twice as many segments of commutator; also put fields in parallel and change field resistance to twice the ampere capacity. I have operated a General Electric 300-kilowatt four-pole belted 550-volt generator in this manner in parallel with one 250-volt and two 125-volt generators for a year or more.

Edison Illuminating Company, West Chester, Pa.: Have used 550-volt compound-wound generator to supply power for an Edison three-wire 125-250-volt system by placing jumper across the series coils and running it as a plain shunt machine. Would advise anyone attempting to rely on a reserve of this character to make test run in order to be fully acquainted with conditions when an emergency should demand the use of the machine.

M. C. Turpin, General Electric Company, Philadelphia, Pa.: In case of emergency almost anything has to be done in order to assure continuity of service. Under these conditions a 550-volt compound-wound generator might be run on the same bus with a 250-volt generator, but it would not be satisfactory on account of its being run at such a low point on the saturation curve. This would mean that any slight change in the field strength of the generator would produce a much greater change in voltage. It would probably be better to cut out the series winding and run the machine shunt-wound. It would also probably be necessary to furnish a new field rheostat, as the one designed for 550-volt generator would probably not give good regulation with the generator running at 250 volts.

George N. Tidd, Marion, Ind.: By cutting out the compounding, putting fields in parallel to secure full field strength, machine can be operated at 250 volts in parallel with shunt-wound 125-volt machines without difficulty. Capacity of the 550-volt machine reduced one-half.

Operation of Polyphase Systems.

[From the Question Box of the National Electric Light Association.]

QUESTION.

Why should a three-phase system, supplying rotaries and synchronous motors only, be other than in perfect balance, and how much does it vary in actual practice?

ANSWER.

William B. Jackson, M. E., consulting engineer, Madison, Wis.: A three-phase system supplying rotaries and synchronous motors operating at a reasonably high speed should be in perfect balance, if all the apparatus is as it should be. In case the rotaries and synchronous motors should be run with an extremely low power factor, there might be considerable unbalancing, owing to the magnifying of very slight variations in magnetic and electric circuits of generators and motors.

QUESTION.

Is it economy to buy a three-phase alternator and use it for single-phase lighting?

ANSWERS.

F. D. Sampson, superintendent, Catawba Power Company, Charlotte, N. C.: Yes; well-designed three-phase alternators will give 80 per cent. full-load rating on single-phase lighting. Power can then be taken from the alternator at some future time when the growth of the business demands, provided, however, 60-cycle apparatus is contemplated.

H. A. Strauss, Allis-Chalmers Company, Milwaukee, Wis.: Yes; a three-phase machine should be cheaper for the same output. You will save copper in your distribution and transmission system. You will be enabled to run alternating-current motors from your lines.

QUESTION.

A 500-kilowatt two-phase 66-cycle 2,500-volt Stanley inductor-type generator, which when running under full load of incandescent lighting will carry equal voltage on each phase at terminal board, with a power factor of 90, when running on one-half load, consisting mostly of Westinghouse two-phase and Wagner single-phase motors, will drop its voltage very much lower on one phase than the other, and will give a power factor of only 65. What is the trouble, and what is its remedy?

ANSWER.

W. H. Thomson, Jr., Corsicana Gas and Electric Company, Corsicana, Texas: We have an approach to this same trouble. The phases at the light load are most likely unbalanced, probably due to the single-phase motors, and, if so, the armature reaction distorts the field and causes the difference in voltage. If the amperes on the two phases differ, or, the amperes being the same, the power factors differ, this distortion will occur and the voltage be unbalanced. The remedy is to keep the phases absolutely balanced, both as to amperes and power factor.

QUESTION.

How can we improve our power factor, which today has a minimum of 60 to 65 per cent. and a maximum of 80 to 85 per cent., according to the load and to the time of day? Our generating unit consists of one 400-kilowatt and one 600-kilowatt three-phase 60-cycle 2,300-volt GE generators. Our day load averages 500 kilowatts, 90 per cent. of which is three-phase power. Our street lighting, which is from the tub system, and amounts to 155 kilowatts, has a power factor of 60 to 65 per cent. Our commercial, incandescent and arc lighting, which has a peak load of from 200 to 300 kilowatts, has a power factor of about 90 per cent. Under the very best present operating conditions an 80 per cent. power factor is about as high as we obtain. A loss of 20 to 25 per cent. in generating capacity of central station is a serious condition.

ANSWER.

William B. Jackson, M. E., consulting engineer, Madison, Wis.: In case there are any power installations wherein synchronous motors can be installed, it is both possible and practicable to improve the conditions stated. In case it is found necessary to take care of a great amount of lagging current, it might be found desirable to install synchronous motors of considerably larger capacity than the power required of them, so that the reserve capacity could be used in taking care of lagging current.

Indiana Telephone Items.

The Merchants' Mutual Telephone Company, with principal offices in Rochester, has been incorporated. The articles state that it is the purpose of the company to build and operate telephone lines and exchanges in Fulton County.

According to report, an unusually large amount of money will be expended in Indiana for the improvement of telephone properties this year. Appropriations have been made by the directors of Independent telephone companies as follows: At Clinton, $35,000; Covington, $10,000; Columbus, $9,000; Franklin, $7,900; Indianapolis, $17,600; Richmond, $150,000. The Franklin Telephone Company is installing a new telephone board at Trafalgar, and the Wabash Home Telephone Company is building a new exchange building and pushing its underground system as fast as material can be secured.

The Terre Haute Citizens' Independent Telephone Company has just completed its new exchange building and is pushing the new conduit system to a rapid completion. This improvement will give the company a 5,000 board capacity and the wires will be cut in within a short time.

The New Long-distance Telephone Company of Indianapolis has completed two new copper circuits this season and is now working on four others, and when these are completed the company will have 80 toll-line circuits entering Indianapolis, constituting, it is said, the largest Independent toll board in the United States.

Detailed plans of the office building to be erected by the Central Union Telephone Company on the Meridian Church site in Indianapolis have been given out. The building will be eight stories and constructed of colonial red brick, with brown terra-cotta trimmings. It will have its own lighting, heating and water plants and is especially designed to fit the peculiar needs of the telephone business. There will be a roof garden at the top for employes, rest rooms and hospital wards for their convenience and comfort. The two top stories will be reserved for the operating department. The sixth floor will be taken up by the offices of the president and his staff, and the fifth floor will be reserved for the vice-president and general manager and assistants. The remaining floors will be occupied by the various departments of the company, pay station, counting offices, etc. A clubroom will also be fitted up for the use of the employes who now maintain a clubhouse. The club is social in its nature. The estimated cost of the building is $350,000.

After a bitter contest that has lasted for more than two years the Citizens' Telephone Company of Kokomo has succeeded in getting the City Council to amend the franchise under which the company is operating so as to permit it to enter into a contract with the Central Union Telephone Company for long-distance service. The opponents of the ordinance assert that its passage marks the close of a deal whereby the Central Union gets control of the Citizens' Telephone Company's plant. Mayor Brouse has indicated his purpose to veto the ordinance, as he has done once or twice before, but the supporters of the measure say they have the votes to pass it over his veto.

The Indiana state tax board has made valuation assessments as follows upon the following-named companies for taxation: Indianapolis Telephone Company, $570,119 as against $497,170 for 1905; Central Union Telephone Company, $1,082,643 against $1,022,200 last year; Western Union Telegraph Company, $127,236 against $79,980 last year; Postal Telegraph Company, $22,290 against $13,931 last year.

S.

Ohio Telephone Notes.

According to reports, the Central Union Telephone Company is arranging to do a large amount of work about Zanesville and Muskingum County. Over 400 new orders have been received since the first of the year. Six carloads of material have been received, and the work of laying cables will be commenced at once. The proposed improvements will cause an outlay of about $75,000.

An Independent plant will be built at Georgetown, Brown County, material having already been

purchased. The plans include about 30 miles of country line, which will be sufficient to connect the plant with Clermont County and all points in the state.

It is reported that the Bell people are offering to put telephones in homes at Sebring for three months free. If the service is not satisfactory, it is agreed that they shall be removed at the end of that time. In case they are retained, the company is to make a fair charge.

The People's Telephone Company of Akron has refused to sell its plant at Barberton to the Barberton Independent Telephone Company. The management states that other plans are now in view. C.

Enlarged Factory of Automatic Electric Company.

The growth of the business of the Automatic Electric Company since its incorporation in 1901 has been remarkable, and goes far to refute those who declared that the automatic telephone system would not be popular with the operating companies or the public.

The Automatic Electric Company has been obliged for the third time since its incorporation to enlarge its plant to enable it to meet the increasing demand for automatic equipment, and is now erecting on the property adjoining its present plant, southwest corner of Van Buren and Morgan streets, Chicago, a duplicate of the building now in use, to be joined to it by a smaller structure, the administration building, in which will be housed the company's offices.

ENLARGED FACTORY OF THE AUTOMATIC ELECTRIC COMPANY IN CHICAGO.

The new buildings, which will be completed and operated by December of this year, will be of mill construction, brick, with a cream-brick facing exactly similar to the present structure.

The factory addition will be 85 feet front on Van Buren Street and 165 feet deep. It will be six stories high. The administration building will be 40 feet front and 40 feet deep, the same height as the factory buildings, but the first story will be omitted and the space underneath the second floor used for a driveway to the large court between the two factory buildings. This arrangement is clearly shown by the accompanying illustration. The court will be 40 feet wide by 123 feet deep. Fire walls will separate the administration building from the factory buildings.

The entire frontage of the plant on Van Buren Street will be 210 feet. The monotony of this long frontage will be broken by recessing the administration building two feet from the line of the factory structures.

While the actual floor space of the plant will be a little more than doubled, by reason of a most economical arrangement of space, machinery and the routing of the product from start to finish of manufacture, the capacity of the plant will be trebled.

The enlarged plant will be supplied with all that is most modern and most efficient in machinery and appliances for rapidity of manufacture and the comfort and convenience of operatives.

The various manufacturing departments will be so arranged that the raw material will enter at one part of the plant and will take a direct route through, coming out as finished material at another point.

The completed plant will be one of the finest and best arranged factories in Chicago. The architect is W. Carbys Zimmerman, while the contractor is the Wells Bros. Company.

GENERAL TELEPHONE NEWS.

The McRae Independent Telephone Company, McRae, Miss., has been incorporated by Sam O. Bell, W. M. McRae, J. H. Adcock and a number of others.

The Council of Fergus Falls, Minn., has voted to charge the Northwestern Telephone Exchange Company a rental of $25 a year for the privilege of setting poles in the streets.

At a meeting in Henderson, Ky., on August 9th the fourth district of the Kentucky Independent Telephone Association elected F. G. Hoge of Hopkinsville president and W. G. Turpin of Henderson secretary and treasurer. Thirteen lines were represented.

The District Court in St. Paul has held that the telephone exchange building owned and used by a telephone company is not subject to taxation, that being covered by its payment on gross earnings. The case was that against the Twin City Telephone Company for taxes on its exchange building in St. Paul.

The following-named telephone companies are among those recently incorporated: Chillicothe Telephone Company, Chillicothe, Texas; Sarpy Mutual Telephone Company, Richfield, Neb.; Hillsboro Telephone Company, Hillsboro, Texas; Northwestern Hydro Telephone Company, Hydro, Okla.; Lillian Telephone Company, Lillian, Texas.

The improvements in the telephone system in the City of Mexico are proceeding rapidly under the efficient direction of Mr. William B. Hale, late of Chicago, but now general manager of the Mexican Telephone and Telegraph Company. All the conduit is now laid, and the cables are being pulled in. A fine new switchboard is being installed and will be ready for operation in about a month. Soon the capital of Mexico will have a telephone service second to none.

The Home Telephone and Telegraph Company of Spokane, Wash., has bought a site for $25,000 in the business district, and it is announced a $60,000 office building will be erected the coming fall. The company will operate the automatic system, for which it has already signed 5,000 contracts in Spokane. Negotiations have just been completed by which the company will have long-distance connections with every Independent telephone company in Washington and Idaho.

Southern Indiana Telephone Men In Session.

The third quarterly meeting of the Ninth District of the Indiana Independent Telephone Association was held in Evansville in the office of the Citizens' Telephone Company on August 9th. W. H. Moore, manager of the Knox County Home Telephone Company of Vincennes, was elected vice-president in place of W. D. Curll of Pittsburg, who has removed to Texas. A flattering resolution to Mr. Curll's zeal and worth as an Independent telephone man and good wishes for his success in Texas was adopted. After the business of the association was concluded the Citizens' Telephone Company, which is asking for a franchise in Evansville, entertained the delegates at the Elks' Home and at Cook's Park. The next meeting will be held at Vincennes on the first Thursday in November.

CORRESPONDENCE.

Great Britain.

London, August 2.—One of the most curious happenings in connection with the electric power companies among which England is now parceled out is the position of the South Wales company. This was the first of the new companies to get into working order and it has one of the finest industrial districts in the country, yet its present financial position is such that a committee has been formed by the debenture holders in order to safeguard their interests and to make an endeavor to bring the undertaking to a flourishing condition. So far, no one has ventured to express an opinion as to the cause of the disaster which will surely overtake the company unless something is done and quickly. It can hardly be credited to the management as we know it at present, for a most eminent firm of consulting engineers has advised from the commencement, and no less an engineer and manager is on the spot than the late chief of the electrical department at Glasgow. Further, the late manager of the undertaking was one of the first to acknowledge the load-factor system of charging. The cause may be traced, in part, to the company's parliamentary power, for it is debarred from giving a supply in any of the large manufacturing and industrial towns in its area. This is only my own conjecture, for, on the other hand, unlike at least one other power company, it is at liberty to supply to manufacturers, etc., in any other part of the area. Mr. Merz, who has now established a reputation as a power-supply expert, has been called upon to give his views on the position, and these rather tend to the impression that the undertaking was not dealt with on a sufficiently large scale from the commencement and that sufficient inducement is not offered to the consumers that are undoubtedly available. It is to be hoped that the undertaking will be pulled around—it seems impossible that it should be otherwise—for its failure would have much more than a local influence. Municipal trading has reached such a pitch here now that it is real hard work for private enterprise to get along. Electric power companies have felt the full force of municipal opposition all over the country, and any further baneful influences would seriously mar the prospect of electric supply in scattered districts, which is the raison d'etre of such undertakings.

The next municipal telephone exchange to go over to the postmaster-general is that of the Brighton Corporation, which has been bargaining for some little time. They appear now to have succeeded in inducing the postmaster-general to depart in some slight degree from his standard offer of 60 per cent. of the capital expenditure for any of the municipal systems, and a slightly increased offer has been accepted. There is no doubt that the municipalities are in a very awkward position, and their only salvation seems to lie in making the best bargain possible under the circumstances. One of the mysteries of municipal telephone finance has been that whereas licenses have only been granted for 11 years, yet in these cases the period for the repayment of the loan has been much longer, and absorption by the Postoffice may, after all, be a blessing in disguise for the ratepayers.

It is satisfactory to notice that the disagreement between the Greenwich Observatory authorities and the London County Council is being approached in an amicable and sensible way. Without any public fuss, a committee of three experts has been appointed and is studying the difficulty, and it would be a surprise to many were their efforts to be fruitless.

The terms of the late Mr. Alfred Beit's will have, of course, been telegraphed all over the world and need not be repeated by me, but a word of satisfaction may be expressed at the donation toward technical education in London in aid of the new branch which it is proposed to set up. Lack of sufficient funds has long been a serious drawback, and although Mr. Beit's generosity will not completely see the scheme through, yet the responsibilities of those who have the matter in hand will be lightened to that extent.

Electric-railway matters in London have, as is well known, traveled much in an American groove for several years now, and probably one of the most important innovations which at any rate the late Mr. Yerkes and his associates looked to was the introduction of the zone fare, i. e., a uniform fare for any distance. The anticipations of the successful application of the method have been gradually dispelled, despite the fact that the Central London Railway Company continues with a four-cent fare for any distance. After much consideration the system was never adopted on the District Railway—the Metropolitan Railway Company, I believe, did not contemplate it—and now the Baker Street and Waterloo Railway Company has abandoned it after a trial and severe competition with motor omnibuses. In one or two other directions, too, American methods have hardly suited themselves either to the British conditions or temperament; a fact which is slowly being realized. G.

New England.

Boston, Mass., August 11.—Edmund Baker, a motorman employed by the Boston Elevated Railway Company, was overcome by the intense heat in Malden, Mass., last Tuesday. He will probably recover. On Monday Albert Anderson, an employe of the Edison Illuminating Company of Boston, was prostrated by the heat and fell, coming in contact with a transformer and receiving a severe shock. He was severely burned on both arms and was taken to the hospital.

The Haverhill Electric Company has filed an appeal from a municipal order with the Massachusetts Gas and Electric Light Commission. The order gives to Charles H. Hayes the right to lay and maintain wires, cables and conductors for the purpose of transmitting electricity in the Bradford District of Haverhill.

A severe thunderstorm passed over several places in Central Massachusetts on Monday, causing some damage. At Uxbridge the main feed wire of the Uxbridge and Northbridge Electric Company became crossed with a guy wire of the Milford and Uxbridge Street Railway and a flash of lightning was followed by a blaze at the point of contact, which lasted until the feed wire was severed. A steel ceiling in a doctor's office became so heavily charged with electricity that it threw off sparks.

The order authorizing the establishment of a municipal electric lighting plant came before the Woburn, Mass., Common Council last Monday night, but final action was postponed for a week. William H. Lott appeared before the Woburn Board of Public Works on the same evening and argued in favor of a new lighting contract with the Edison Illuminating Company. He read a clause which provided that if the city should decide to establish a municipal plant the contract could be terminated upon 90 days' notice.

The municipal lighting scheme is not running over smooth places in Boston. The city government's municipal lighting committee held a meeting on Tuesday afternoon, but two ex-mayors and an ex-superintendent of streets did not respond to an invitation to appear before the committee and tell it about gas and electric light contracts so the meeting adjourned after waiting half an hour for them. The committee has engaged John Campbell, president of the Electrical Auditing Company, as an electrical expert.

The contract for building Section 10 of the Washington Street subway in Boston has been awarded to Coleman Brothers of Boston, who are to receive $84,856 for the work, provided they complete it by December 31, 1906. The five other bids ranged from $86,805 to $95,940. The section will consist of 300 linear feet of subway wide enough for two tracks, to be built on the easterly side of the present subway from the foot of Union Street, across Haymarket Square, to the junction of the two subways.

The Boston Central Labor Union has asked the mayor of Boston to call for the arbitration of the city's contract with the Edison Electric Illuminating Company, and Mayor Fitzgerald has requested the company to submit to arbitration the question whether the city is entitled to a reduction of the present price of $125 per lamp per year. The mayor believes that the present price is too high, but he thinks that the company is not making an excessively large profit at that price. An expert has declared that the city should pay only $75 per lamp per year and that it could save $400,000 a year by getting a reduction in the price, but Mayor Fitzgerald ridicules this statement and asks what the company is doing with such an enormous profit, saying that the company cannot be paying dividends on watered stock, as the Gas and Electric Light Commission would not allow the issue of such stock, and the company's dividends on its stock is limited by law to a percentage which would not call for $400,000. In 1904 the city's arbitrator reported that the city was entitled to no reduction in price, as the company was supplying municipal lights at a price less than cost.

The New York, New Haven and Hartford Railroad Company will instal an electric hoisting device at the coaling station it will build at Danbury, Conn., the contract for which has been awarded to the Fairbanks company of Chicago.

The Eastern Cahill Telharmonic Company has filed its certificate of incorporation with the Maine secretary of state. It has a capital of $3,000,000, half its stock being preferred, and it proposes to acquire, develop and sell inventions for the generation and electrical distribution of music. Charles McH. Howard of Baltimore, Md., is president of the company.

The Connecticut Railroad Commission has issued its annual report for the year ended June 30, 1905. It shows that the electric railway companies' gross earnings were $5,423,616 against $4,924,151 the previous year. The Consolidated Railway Company's gross earnings for the year ended July 30, 1905, were $2,024,503, and the Connecticut Railway and Lighting Company's gross earnings were $1,420,094.

The American Telephone and Telegraph Company has laid an armored cable 1,600 feet long across the Connecticut River, between Windsor and South Windsor, Conn. The cable contains 40 wires and it will replace three which have been seriously impaired by the action of high water. B.

New York.

New York, August 11.—The New York Telephone Company is experiencing considerable trouble through its new rates. Subscribers are objecting and disputing many recent bills. When the reduced-rate order went into effect on July 1st it was generally supposed that it applied to all pay stations. As a matter of fact, it applied to only a comparatively small number. The explanation is that there are two classes of pay stations—those installed by the company at its own expense and those for which the subscriber contracts and manages for his own profit. The company's stations are those to which the reduction order applies. In the case of the other class the reduction from 10 to 5 cents a call is not only not compulsory, but it cannot be inaugurated except at a loss to the subscriber. Company pay stations, as they may be called, are put in large stores, usually where there is every reason to believe that the telephone business done will be of considerable magnitude. In the opinion of many subscribers the company will have to reduce its rates so that the small storekeeper can sell telephone calls at five cents.

Justice Gaynor or the Appellate Division of the Supreme Court in Kings County handed down a decision to-day in which he declared that the collection of two fares for a ride to Coney Island was illegal. He therefore discharged Dr. Thomas J. McFarland, who was arrested on July 24th for refusing to pay a second fare while returning from Coney Island.

Kenneth Moody, an employe of the New York and New Jersey Telephone Company, and Thomas Gould of the Edison Electric Light Company, were killed in Brooklyn on Wednesday while repairing breaks in the wires caused by the storm of Tuesday. A live electric-light wire struck Mr. Moody in the face while walking on the elevated tracks and he was thrown to the ground. Mr. Gould was killed by a live wire while descending into a manhole.

A thunderstorm combined with a broken water main flooded the Subway below Fourteenth Street on Tuesday evening, completely tying up traffic and leaving the tracks a foot under water. With considerable difficulty all passengers were finally able to reach a station platform, but the motormen and guards, according to rule, were compelled to stay with their trains all night. By Wednesday morning the water had been pumped out and except for a bad smell, no damage was apparent. The flood demonstrated the wisdom of having the Subway lighting separate from the power. Though the power was cut off from the third rail, none of the lights went out. What interested the Subway people even more than this, however, was who was responsible for the flood, and who, therefore, should pay the bill.

Unusual interest is being manifested in automobile trade circles over the prospect of a December show. Not only do the home manufacturers welcome the opportunity of an early exhibit to show their 1907 models, but the same expressions of satisfaction are voiced by the foreign agencies. Provided the actual exhibits keep pace with assurances already made the 55,000 square feet available in the Grand Central Palace will be taken long before the show opens on December 1st.

A peculiar lightning freak was reported from Glen Cove, L. I., yesterday. Two men and a boy were standing under a large locust tree when it was struck by lightning, splintering the tree and striking the men to the ground. One of the men was killed and the other was partially paralyzed. The boy was unconscious, and, according to the report, when his upper clothes were removed the doctors found a long, distinct image in blue of the stricken locust tree on his body. The image was clearer than if it had been tattooed by hand. The tree picture reached from the boy's shoulder to his waist line, covering one entire side of his body.

All-steel cars have been adopted for the New York city tunnels by the Pennsylvania Railroad, which company announces the development of the first fireproof, collisionproof, soundproof passenger coach, a type of which will be used exclusively in the future on the road. The car which has been developed and is being tested weighs 103,550 pounds against 84,900 for the standard wooden coach. No inconsiderable part of the additional weight is due to the burden involved in carrying storage batteries and battery boxes. All the new cars are to be lighted by electricity. It is said that the new car is absolutely non-collapsible. This safety against telescoping is secured by the use of steel girders, the principal feature in the body of the car being a central box girder 24 inches wide by 19 inches deep extending throughout the length of the coach. C. I. C.

Southeastern States.

Charlotte, N. C., August 11.—In Richmond, Va., the movement for issuing $250,000 bonds for an electric-light plant to be owned by the city is again coming to the front, after the movement for municipal ownership seemed to have been killed.

George W. Vanderbilt has signed a contract with the Weaver Power Company for electric power for Biltmore, N. C., and for the Biltmore House.

The Corporation Commission of Virginia has taken steps to enforce the act of the Assembly requiring all railroads to maintain telephones in their ticket and freight offices for the use of passengers and patrons of the roads.

The Southern Power Company has made arrangements to supply about 2,000 horsepower to Chester, S. C., at the rate of $20 per horsepower for 12 hours' use, the power to come from the Great Falls development.

The Supreme Court of South Carolina has decided that the Columbia Water and Power Company is exempt from taxes, in a suit brought by the county treasurer of Richland. The canal was bought by the power company, and it is held that the exemption allowed the city trustees, former holders, is also to be granted the last owners.

An engineering society is being organized at Charlotte, N. C., composed of electricians, mining engineers and others, and promises to become an important factor among the expert men in these various lines in the state.

A new electrical concern, the Greenville (S. C.) Electric Company, is being organized, with $25,000 capital. The company proposes to do a general electrical business, wholesale and retail.

Bids have been opened at Hyattsville, Md., for the installation of an electric-light plant. These were submitted to the mayor and Common Council. The Potomac Electric Power Company of Washington was awarded the contract for 10 years, to light the streets.

The Charlotte (N. C.) Consolidated Construction Company, E. D. Latta, president, has been granted the right-of-way out of the city for a line to run 12 miles to the Catawba River, with a three-mile line to suburban cotton mills. Vestibuled cars will be used and the line will be one of the most up-to-date in the South. A park will be built on the river.

The new electric line from Bessemer to Jonesboro, Ala., has been started in operation, making an 18-mile route from Birmingham.

The Progressive League of business men of Columbia, Miss., is interested in securing electric lights and water for the town.

Philadelphia and Baltimore capital is reported to be interested in building an electric line from Norfolk, Va., to Elizabeth City, N. C., a line that has been much talked of previously.

The Raleigh (N. C.) Electric Railway Company will make extensive additions to its plant in that city. It also supplies light to Raleigh. L.

Ohio.

Cleveland, August 11.—Considerable discussion over the proposed extension of the franchise of the Cleveland Electric Railway Company has taken place within the last week. The company has shown its willingness to be fair by agreeing to incorporate in the franchise many matters that were omitted, but which the company said in other ways that it would do. President Andrews will not agree to Councilman Hitchins' request that the life of the franchise be made 20 years. Nor would he concede anything further on the rate, the offer being seven tickets for a quarter. Mr. Andrews said that the company would agree to a clause providing for the sale of the property to the city at the expiration of the franchise, provided it was properly protected; the portion relating to transfers will be made more specific, and transfer stations named, so far as possible. The matter, if the company has its way, will be submitted to a vote of the people.

The Cleveland Electric has secured a franchise in Cleveland Heights and will extend the Cedar Avenue line to that section. The matter of paving has been settled between the company and the village of Newburg, and the road will be built there.

Judge Lawrence has continued the temporary injunction against the Forest City Railway Company of Cleveland and declared that it cannot proceed with track laying on Fulton Road until further orders from the court. The decision also declares that the resolution passed by the City Council, requiring the Cleveland Electric Railway Company to move its tracks to the east side of that thoroughfare, is illegal, because it was read but once and voted upon orally. While the Cleveland Electric won its contention in one way, the court decided that it did not have a vested right in the location of its tracks.

Mansfield seems to be in the throes of a three-cent agitation. A franchise ordinance has been before the City Council for some time and was brought up for consideration a few days ago.

Work has been commenced on the Youngstown and Southern, which is to be extended to Leetonia and electrified. At present, steam is used. At Leetonia it will connect with the Youngstown and Ohio River line, which is to be built through to East Liverpool.

It is stated that the Findlay-Marion Railway and Light Company has been financed and that most of the right-of-way has been secured.

The City Council of Youngstown has taken up the matter of establishing a municipal light plant, and a committee has been appointed to look into the cost and other details. The question may be put to a vote of the people.

The annual picnic of the employes of the Cleveland and Southwestern Traction Company took

place at Chippewa Lake Friday. Athletic contests and other features made up the programme.

At Middleport the Mutual Electric Light Company has been incorporated with a capital stock of $50,000 by John Murtha and others.

Since the disastrous head-on collision on the Lake Shore Electric a few days ago, it has been decided to double-track all the bad curves, to prevent the possibility of a recurrence of such an accident. The entire system is to be double-tracked eventually, but the work on the curves will be done at once.

The Cleveland Electric Illuminating Company has announced an increase in its capital stock from $3,500,000 to $5,000,000. The company has been paying six per cent. on preferred stock and eight per cent. on common stock for several years, aside from several extra payments.

The Lima, Kenton and Marion Traction Company of Kenton has been incorporated with a capital stock of $100,0000 by W. W. Embert, Frank D. Bain and others.

Commissioners of Marion County have granted the Findlay-Marion Railway Company a franchise good for 25 years.

The idea of diverting the water of the Sandusky River between Tiffin and Fort Seneca for power with which to operate electric plants has been given up, it is reported. Columbus and Pittsburg men were interested in the matter.

O. M. C.

Indiana.

Indianapolis, August 11.—Two new electric-railway companies were incorporated in Indiana during the week. The New York, Boston and Chicago Electric Railway Company, capitalized at $100,000, proposes to construct an electric line across Northern Indiana, touching Hammond, Laporte, South Bend, Mishawaka, Elkhart and Fort Wayne. The directors are W. B. Robinson, E. W. Curtis, J. L. Knox, Charles Schisano and W. M. Watson.

The Chicago and Western Indiana Traction Company, to be known as the "College Route," with a capital stock of $100,000, will build an electric line from Lafayette southwest, connecting Crawfordsville, Greencastle and Bloomington, four of the leading college towns of the state. It is the plan finally to make the road's terminals at Louisville and Chicago. The promoters say that they expect to have the road in operation within a year. The company's headquarters are in the Lemcke Building, Indianapolis, and the incorporators are E. H. Barrows, D. W. Bolen and J. S. McCullough.

The assessments made on local corporations by the Indiana tax board at its final session were along lines of increase. The Indianapolis Street Railway came in for $7,537,825 as against $4,111,405 last year. The Indianapolis Traction and Terminal Company will have to pay on $1,001,620 as against $766,405 last year. The table shows slight increases and decreases among some of the interurban companies in the state.

The city comptroller of Evansville recently discovered, he said, that the Evansville Electric Light Company agreed to pay to the city five per cent. of the gross receipts annually in return for the franchise. A bill for five years, amounting to $3,247.44, was presented.

The Farmers' Heat and Light Company of Evansville has been incorporated with a capital stock of $10,000. The purpose is to construct gas and heating plants. The directors are Hiram A. Gooch, Smith Wiltshire and William Wiltshire.

S. S.

Illinois.

Peoria, August 11.—The East St. Louis, Granite and Alton Suburban Railway has been incorporated with a capital stock of $2,500. The principal office is to be at East St. Louis. The road is to be constructed from East St. Louis to Alton and Edwardsville. The incorporators and first board of directors are L. C. Haynes, G. C. Pierce, T. W. Gregory and F. H. Thomas of East St. Louis and F. E. Allen of St. Louis.

The Effingham and Olney Interurban Railroad has been granted incorporation papers to construct a railway from Effingham southeasterly through the counties of Clay and Richland to Olney, the principal office to be at Eberle, Ill. The capital stock is $2,500. Incorporators include Dr. R. S. Wishard and Henry Richards of Eberle, Ill.

The Mutual Construction Company of Greenville has been incorporated with a capital of $10,000, to furnish telephone service. Incorporators are George Grube, Ward Reid and G. B. Hailes.

The Electric Novelty Manufacturing Company, Chicago, has changed the name to Clarke Electric and Manufacturing Company and increased the number of directors from three to five.

The Mount Pulaski Telephone and Electric Company has increased the capital stock from $5,000 to $50,000.

The Dunlap and Alta Telephone Company of Dunlap has been incorporated with a capital stock of $10,000. Walter Alten heads the incorporators.

The City Council of Ottawa has modified the franchise recently granted the Illinois Traction Company to make it more acceptable to the McKinley syndicate. They will file a certified check for $5,000 to have the road in operation by January 1, 1908.

A delegation of 10 members of the Order of Railway Telegraphers visited Springfield this week. They came from St. Louis and came to organize a local order.

The gas and light committee of the City Council of Pekin was instructed to ask the lighting company to install new lamps throughout the city, as the candlepower is claimed to be below contract.

At Jacksonville the McKinley syndicate gave the Y. M. C. A. the receipts of the car lines on Friday. The Y. M. C. A. furnished the conductors, who were young ladies, and the proceeds went to the institution to help pay off a debt of $12,000.

One of the 200-foot concrete smokestacks on the new power house has been completed here and the balance of the power house is ready for the roof.

V.

Northwestern States.

Minneapolis, August 11.—The electric-light plant at Virginia, Minn., may arrange to put on a day circuit for power purposes if sufficient business can be secured there and at the neighboring town of Eveleth. There is not enough day business in either town to justify a day circuit, but if both will bunch it is believed that it can be done successfully.

The Mesaba Range Traction Company, which proposes a trolley line along the Mesaba Range in Northern Minnesota, will be reorganized as the Mesaba Traction Company, the old charter not being completed in some details.

Bids are being taken for the construction of an electric power dam at Otter Rapids, below Eagle River, Wis. Jacobson & De Guerre of Grand Rapids, Wis., are the engineers of the work.

A. O. Fox, who proposes an electric railway from Platteville, Wis., to Dubuque, Iowa, has renewed his option to service over the high bridge at Dubuque, Iowa, by paying $500, this to expire January 2, 1907, or is subject to a renewal to April 1st, on payment of $1,000 more. All becomes forfeited if the bridge is not then purchased.

The Consolidated Light & Power Company of Pluma, S. D., has completed arrangements for transmitting electric power to the mines. A new switchboard has been installed, carrying a voltage of 11,000 volts on the larger wires.

The Duluth Edison Electric Company has submitted a bid for furnishing the city of Duluth with arc lamp lighting at $55 per annum.

The City Council of Eau Claire, Wis., has granted a new franchise to the Chippewa Valley Electric Railway Company, with the maximum rates cut to $60 and $55 per annum, a reduction of $15 for arc lamps.

The Council of Duluth will appoint a wire inspector.

R.

Pacific Slope.

San Francisco, August 9.—The labor situation on the United Railroads street-railway system in this city is still unsettled. The company is keeping the present lines in operation, but has not yet succeeded in starting up the McAllister Street trolley line, which has just been changed over from a cable road. The officials say they have over 100 track laborers at work on this line, notwithstanding the efforts of the recently organized laborers' union, which is on strike, to prevent any work being done. The opening of this line is expected in a few days. The electric wiremen and most of the crews operating the machinery at the electric generating stations of the street-railway company are also out and doing all they can to cause the new non-union recruits that have been secured to desert the company. A general tie-up of the lines would be very unpopular with the public at the present juncture, as the street-car service is indispensable to cover the long stretches of burned district separating the present centers of business. It is understood that many strike-breakers have been quietly brought into the city from the East and South, but very few have remained at work and a large proportion of those who arrived refused to work.

The San Francisco gas and electric system of the Pacific Gas and Electric Company has made a large number of new service connections during the last month or two. It was estimated in July that over 3,000 new buildings had been completed since the fire and that at least 1,000 more were in course of erection. Most of these are temporary structures but a large proportion will probably be permitted to stand for two years, or until they are superseded by permanent buildings. The lighting company has had nearly four months in which to repair the damage caused by the fire and earthquake and has accomplished a great deal. The distribution on the commercial circuits in the heavy business districts of Van Ness Avenue, Fillmore Street and the Mission is still very poor during the peak load at night, and some of the merchants have threatened to order out the electric lights and put in the rival company's gas.

The Portland and Sandy Electric Company has been incorporated at Portland, Ore., with a capital stock of $100,000. The company will erect a hydro-electric plant about 24 miles east of Portland and transmit the current to Portland and other points. The company has a franchise to light the town of Gresham. Construction will be commenced immediately and 2,500 horsepower will be developed. Among the incorporators are Dan J. Malarkey, K. F. Donohue and others.

The Electric Railway and Manufacturers' Supply Company has filed a certified copy of its articles of incorporation with a capital stock of $50,000. The incorporators are A. St. J. Bowie, S. H. Taylor, F. Frisbee, H. P. Bowie and H. S. Hagan. The place of business is San Francisco.

The Standard Electrical Works has been incorporated at San Francisco with a capital stock of $100,000 by R. J. Davis, Harrison Dibblee, A. M. Funke, A. S. Armstrong and H. C. Thaxter.

The Ventura County Power Company has been incorporated at Ventura with a capital stock of $2,500,000 by C. H. McKevett of Santa Paula, J. A. Driffill of Oxnard and J. H. Adams, T. W. Phillipps, J. S. Torrance, J. R. Martin and W. R. States of Los Angeles and Pasadena.

The Board of Trustees of Bandon, Ore., has granted a 30-year electric franchise to A. J. Burrows of Aberdeen, Wash. Construction of the plant will be begun in about three months and operations will be begun within five months from the time of the beginning of the work.

The Tacoma Railway and Power Company of Tacoma, Wash., has made application to the commissioners of Pierce County, Washington, for a franchise to construct and operate a single pole line for transmitting electric power, together with the right to erect, place and string wires and place other appurtenances along certain streets and roads in Pierce County.

A contract has been closed whereby the Russell Electric and Machine Company of Yuma, Ariz., will extend the electric power to the foot of the Tucson mountains and install a 30-horsepower electric motor.

The Desert Power Company of Kingman, Ariz., which has been organized with a capital stock of $10,000, is preparing to erect a power plant at Kingman.

An application has been made to the Board of Trustees of Covina, Cal., for a franchise for an electric light, power and heating plant at that place.

The Martinez and Contra Costa County Railway Company has been incorporated at San Francisco with a capital stock of $100,000 by Purcell Rowe, M. R. Jones, W. A. Golschard, Carl A. Johnson and A. H. Flynn.

The trolley system of the Vallejo and Napa Valley Electric Railroad has been changed from the bow trolley system to a pantograph trolley. Besides the new trolleys two 500-kilowatt transformers have been installed.

A.

PERSONAL.

W. M. Hendry has been appointed by the Stanley-G. I. Electric Manufacturing Company as agent for the state of Washington, with headquarters at Seattle.

J. M. Maloney, manager for the Northwestern Telephone Exchange Company at Albert Lea, Minn., has been made district manager for the company, with headquarters at St. Cloud, Min.

George K. Blakely, manager for the Northwestern Telephone Exchange Company at Grand Forks, N. D., has been made district manager for the northern half of North Dakota, with headquarters in Grand Forks.

ELECTRIC LIGHTING.

The city of Paragould, Ark., is considering the installation of an electric light plant.

W. A. Curtis contemplates establishing an electric-light plant in Cambridge, Iowa.

M. R. Rutherford has asked the city of Plains, Mont., for an electric-light franchise.

Boston, Ga., has voted in favor of issuing $10,500 bonds to construct an electric-light plant.

J. D. Beardsley has begun the erection of an electric-light plant in Mineral Wells, Texas.

Carman & Holbrook will install a $25,000 electric-light plant in their flour mill in Culdesac, Idaho.

Carterville, Mo., has granted a franchise to the Consolidated Light, Power and Ice Company.

The Broken Arrow Electric Light and Power Company of Broken Arrow, I. T., has been incorporated.

The Chelsea (I. T.) Electric Light and Water Company has been incorporated with a capital stock of $50,000.

The Crystal Lake Amusement Company of Sioux City, Iowa, will install a large electric-light plant at Crystal Falls, near Sioux City, Iowa.

Bids will soon be asked for the construction of waterworks and electric-light plant in Clinton, Mo., for which a $100,000 bond issue was voted recently.

Sealed proposals will be received at the office of the city clerk, Wayne, Neb., until August 23d, for the furnishing of all labor, equipment, material and supplies necessary for reconstructing and improvements of the electric lighting system for Wayne, Neb., in accordance with the plans, specifications and instructions to bidders on file at the office

of the city clerk and at the office of the city's consulting engineer, Edw. F. Schurig, 319 Thirteenth Street, Omaha, Neb.

Fred S. Moore of Monmouth, Ill., has been granted a 20-year franchise for an electric-light plant at Oquawka, Ill., with a four-year street lighting contract.

Winfield Scott of Grayson, Ky., and H. L. Woods of Olive Hill, Ky., and associates, have incorporated as the Grayson (Ky.) Light Company. The capital is $5,000.

H. M. Byllesby & Co., engineers, Chicago, have been appointed engineers and managers of the Mobile Electric Company of Mobile, Ala. A new modern power house will be erected immediately, and the lines of the company extended and rebuilt.

The Sheffield Company of Sheffield, Ala., has contracted with the Westinghouse Machine Company for a 1,250-kilowatt Westinghouse-Parsons steam turbine to be installed in the plant at Sheffield. The turbine will run under rather poorer operating conditions than usual, a steam pressure of 125 pounds and 25-inch vacuum. It will be direct connected to a Westinghouse three-phase turbo-generator of the enclosed type, delivering current at 2,300 volts to a light and power system.

The central stations of this country are rapidly awakening to the necessity of giving their customers not only the maximum amount of light but also the best illumination possible. An example of this awakening is that of the Portland General Electric Company, Portland, Ore., which has secured the services of Mr. H. M. Lauritzen of the engineering department of the Holophane Glass Company for a period of two months to assist it in designing the lighting of numerous installations which are now under way by assisting the architect in the correct laying out of the lighting scheme before the buildings are wired; also to instruct the salesmen to lay out the lighting in order to get the best illumination possible. So great has been the demand for this class of work that the Holophane Glass Company announces that for the present no more engagements can be made for members of its engineering staff for this class of work.

ELECTRIC RAILWAYS.

W. H. Blair has petitioned for a franchise for the use of the city streets in Howard, S. D., for an electric railway.

The Rochester, Corning and Elmira Traction Company of New York has been incorporated with a capital of $4,000,000 by Max H. Schultze, Horace G. Abel and Henry Brunssen of 42 Broadway, New York, and others.

Charles P. Lun of Spokane, Wash., is at the head of a company which will build an electric railway between Spokane and Cheney, Wash., 18 miles. Franchises have been granted by the towns of Hayford and Cheney.

The Union Trust Company of Pittsburg has taken the bond issue of $3,500,000 of the Pittsburg, Newcastle, Butler and Harmony Street Railroad Company. Contracts for the construction of the line, about 70 miles in length, have been made.

The Rio Janeiro Tramway, Light and Power Company will install at Rio Janeiro, Brazil, a 300-kilowatt Westinghouse compound-engine unit, operating under a steam pressure of 150 pounds and direct connected to a Westinghouse alternating-current generator.

July traffic on Chicago elevated railways is reported as making good gains over July, 1905. In the daily average of passengers carried the Metropolitan increased from 113,578 to 123,370, the South Side from 85,272 to 92,976 and the Northwestern from 67,488 to 73,308.

The Ohio Valley Banking and Trust Company has been appointed receiver of the Henderson City Railway, Henderson, Ky., with instructions to operate the property. This company was organized by A. L. Rich of Cincinnati, who disappeared some time ago. Owing to some hitch in the contract a proposed bond issue failed to go through.

The Yakima Valley Traction Company has been incorporated in Spokane, Wash., with a capital of $500,000. W. A. Bell of North Yakima is at the head of the organization, which proposes to operate an electric railway for freight, mail, express and passenger business. It is the intention to operate in the Spokane and Yakima valleys, the road being 120 miles in length.

The proposition of the management of the United Railways Company of St. Louis to merge the St. Louis and Suburban system, on the basis of an exchange of United Railways preferred stock for the stock of the St. Louis and Suburban Company, has been ratified by vote of the stockholders of the United Railways Company. The stockholders of the Suburban system voted to accept the offer of the United Railways Company. This consolidation of two street-railway systems of St. Louis involves a total of $108,000,000 in the deal.

POWER TRANSMISSION.

The Toronto Street Railway Company says that power from Niagara Falls will be delivered in Toronto, Ont., by October 1st to supply the street-railway system and for power and lighting purposes. Tests have been made by engineers, who report that the various devices for receiving the current from the Falls at 16,000 volts, reducing it to a commercial standard, and then distributing it to the sub-stations answer every requirement.

William A. Otis and associates, including G. A. Taff, president of the Pike's Peak Hydro-Electric Company of Colorado Springs, announce that they will soon begin the erection of a new electric power plant at Manitou, Colo., to cost $300,000. In addition, they propose to expend $200,000 on pipe lines and reservoirs and $500,000 in general improvements. They have organized the Empire Water and Power Company, and a meeting has been called to authorize the issue of $1,000,000 of bonds.

The Chickasha Waterpower Company of Chickasha, I. T., will develop the waterpower of the Washita River by building a dam 1,000 feet long and ranging from seven to 30 feet high, to be constructed of stone and cement or steel and cement. About 1,000 horsepower will be developed and transmitted to Chickasha by 66,000-volt three-phase alternating current. C. E. Ross is secretary-treasurer of the company and Beardslee & Brockway of Lincoln, Neb., have charge of the construction of the dam.

The Copenhagen correspondent of the London Electrician says that a Swedish engineer has recently prepared statistics showing that waterpower is available to the extent of 10,000,000 horsepower in Sweden, 28,000,000 horsepower in Norway and 4,000,000 horsepower in Finland, or, leaving out of the question waterpower in out-of-the-way or inconvenient places, the figures are approximately 3,800,000 horsepower, 4,800,000 horsepower, and 500,000 horsepower, respectively. It is suggested that this power might be utilized in Sweden in the manufacture of chemical manures, paper, etc., in ore smelting and other industries, and that imports of coal would thereby be greatly reduced.

PUBLICATIONS.

Volume XXIV. of the Transactions of the American Institute of Electrical Engineers, January to December, 1905, has been issued by Secretary R. W. Pope. It is a book of 1,160 pages. The valuable information contained in the book is illustrated with half-tones, diagrams, curves and charts.

A folder from the Wagner Electric Manufacturing Company, St. Louis, is devoted to transformers. The company builds transformers of any capacity and for any voltage. Standard transformers are in stock at convenient shipping points. Bulletin 72, telling more about transformers, is offered by the company for the asking.

The Gould Storage Battery Company of New York has just issued Bulletin No. 7, which contains the article entitled "Twenty-four-hour Service from Small Central-station Plant at Odell, Ill.," printed in the Western Electrician of May 13, 1905. It shows among other things, the advantages of a storage battery installed in connection with a small plant.

New Stanley-G. I. literature has been issued as follows: Bulletin 609, superseding Bulletins 25 and 194, devoted to G. I. floor and wall outlet boxes; circular 786, devoted to the new type K arc lamps; circular 787, devoted to direct-current motors and generators. All Stanley-G. I. literature is obtainable by addressing the Stanley-G. I. Electric Manufacturing Company at Pittsfield, Mass., or any of the branch offices.

Bulletins No. 1080 and 1081 are being sent out by the Fort Wayne Electric Works of Fort Wayne, Ind. They contain, respectively, descriptions of multiphase revolving-field engine-driven generators and type A transformers. Both are well illustrated, showing the complete apparatus and the various parts. The former contains pictures of direct-connected alternators in service and gives some reasons why alternators of large output should be direct connected to their prime movers.

The Electric Storage Battery Company of Philadelphia has just issued the sixth edition of price-list A, which includes a description of all types of the Chloride accumulator applicable to central-station lighting and power, electric-railway power, isolated lighting and power stations, railway car lighting, etc. In this edition is also catalogued auxiliary apparatus used in connection with Chloride accumulator installations. This price-list will be forwarded upon application to the general offices at Philadelphia or to the sales offices throughout the United States.

SOCIETIES AND SCHOOLS.

A new list of the officers and members of the Western Society of Engineers, together with the constitution and by-laws, has been issued in pamphlet form, dated July, 1906. J. H. Warder is the secretary, 1734-41 Monadnock Block, Chicago.

SPACE TELEGRAPHY.

M. Schneider, an electrician in the United States Navy, has equipped the converted yacht Wasp with a wireless telegraph outfit at his own expense. The apparatus sends messages 35 miles and has received them from points 30 miles away. The commandant of the Training Station at Newport recommends to the Navy Department that the electrician be permitted to communicate with other ships and continue his experiments. This plan has been approved by the chief of the Bureau of Equipment.

TELEGRAPH.

Telegraphic communication between the United States and interior points in Manchuria has been re-established. The Western Union Telegraph Company will now accept messages via Khabarovsk for Guirine, Hailar, Harbine, Koantchensi, Ningouta and Tzitzikar in Manchuria, at a rate of 25 cents a word beyond London. Messages are sent by way of this route only when expressly ordered and then only at sender's risk of delay or non-delivery. Messages to other places in Manchuria cannot be accepted via Khabarovsk.

MISCELLANEOUS.

City officials of Baltimore, Md., propose to purchase electric elevators for the City Hall to take the place of the hydraulic elevator now in use.

The king of Spain has signed a decree creating a committee empowered to undertake the reform of the telegraph administration, and fixing a term of three months for the organization of a new telephone service.

The tonnage of zinc and lead ores produced in the Joplin district in 1905, according to a report by Mr. Charles Kirchhoff of the United States Geological Survey, was considerably below the normal capacity of the district. Cold weather in January, February and March, floods in July and August and heavy rains in October cut down the output.

The City Council of Joliet, Ill., has authorized the employment of a board of expert engineers to ascertain whether the walls now being constructed north of Joliet are safe for the development of additional water power in the Drainage Canal power scheme. It is alleged the cement is of an inferior quality and that the walls will not hold the volume of water that will be turned against them when the new channel is opened.

The Knoxville Woolen Mills and the Knoxville Cotton Mills, Knoxville, Tenn., will run their entire plants with electricity as soon as the motors can be installed. The power will be furnished by the Knoxville Railway and Light Company. These mills have purchased 37 motors, and they are now being installed in the buildings. The companies figure that electricity is cheaper and gives better satisfaction than steam power.

A correspondent of the Daily Chronicle of Newcastle, England, mentions a self-recording target, the invention of Lieut.-Col. Peters, a Canadian. The hits are electrically recorded at the elbow of the firer by numbers on a disk. The target is a metal one, there being a row of sensitive hammers behind it. The bullet on striking the target operates a hammer which completes the electric circuit and records the value of the hit at the firing point.

The California Powder Works has added another steam turbine to its plant at Pinole, Cal. This machine runs parallel with a 400-kilowatt Westinghouse-Parsons unit already installed at the plant, and through static transformers with 250-kilowatt reciprocating-engine units, with which the present 400-kilowatt unit is now operating successfully. The latter turbine was started on July 27, 1905, and has operated continuously since, with but one shutdown, it is said, for the purpose of inspection.

TRADE NEWS.

Albert Halstead, United States consul at Birmingham, England, writes that there is an excellent opportunity for American manufacturers of brakes for electric cars to extend their sales in the United Kingdom.

John S. Musser, manager of the Arrowsmith Electric Company, 434 Market Street, Harrisburg, Pa., writes to the Western Electrician to say that while Mr. A. V. Arrowsmith, formerly vice-president and general manager of the concern, is no longer connected with the company, the business will be continued as heretofore. Mr. Musser reports that the store at Harrisburg and also the one at Reading are doing a good business.

Representatives of the American Advertising Indicator Company of St. Joseph, Mo., a concern capitalized at $310,000, are in Indianapolis for the purpose of considering the feasibility of establishing a factory in that city. The product of the company is an automatic street announcer for use in street cars. The device, placed in the car, automatically announces every street and all transfer points. The indicator is operated by the electric current used

in propelling the car and requires, according to the manufacturers, no change in the equipment of the car more than the attachment of a "spur" on the trolley hangers at such points as it may be desired to make announcements. The device was invented by G. R. Livergood, a St. Louis conductor.

Among the new locations of electrical contracting and supply firms recently noted in San Francisco are the following: Edison Electric Construction Company, 515 Broderick Street; Holabird, Reynolds & Saylers Company, 527 Mission Street; First National Electric Company, 664 Presidio Avenue; Breck Electric Manufacturing Company, 550 Grove Street; Bay Shore Electrical Construction Company, 186 Second Street.

BUSINESS.

The sound-proof telephone booth is no longer a business luxury, according to the Western Electric Company, but rather has become a necessary detail in the office and factory equipment. The annoyance occasioned by unsatisfactory telephone service is due frequently to noise and publicity unnoticed until the telephone is used. The sound-proof booth obviates all this and affords privacy and quiet. The Western Electric Company of Chicago and New York has prepared an attractive catalogue and price list that it will furnish on application.

The Electric Construction Company of Baltimore, Md., has been incorporated with capital stock of $5,000 to manufacture and deal in electrical materials. Ambrose Fleming, Kenneth Fraser, B. Carroll Shipman, 3002 Clifton Avenue; Harry K. Brooks, 19 East Saratoga Street, and Elmer J. Jones are the incorporators.

The Westinghouse Machine Company of East Pittsburg has recently sold to the United States government, for use in connection with the Panama Railroad, two compound steam engines; one direct connected to a 325-kilowatt 250-volt engine-type generator, and the other to a 200-kilowatt 60-cycle alternating-current two-phase 220-volt generator. Both operate under a steam pressure of 150 pounds.

Nineteen cars were needed to hold a recent single shipment made from the works of the Westinghouse Electric and Manufacturing Company at East Pittsburg to the Hauser Lake power plant of the Helena Power Transmission Company at Iron Siding, Mont. Among other apparatus in the consignment were four 2,800-kilowatt Westinghouse revolving-field generators, intended for direct connection to water-wheels; two 200-kilowatt direct-connected exciters, also for direct connection to water wheels; nine 2,000-kilowatt water-cooled transformers, 70,000 volts primary, 2,400 volts secondary, and a large quantity of auxiliary detail apparatus. The capacity of the plant at East Pittsburg is being taxed to keep up with orders.

Economies to be effected by Gould storage batteries are recognized by the Galt, Preston and Hespeler Railway of Galt, Ontario, Canada, which has installed a battery of 230 Gould cells, having a capacity of 107 kilowatts, to be used as a floating battery. Before the installation the power required by the passenger cars prevented any development of the freight traffic, and attempts to push the latter seriously interfered with the passenger service. The company is now runing freight trains of six to eight cars without interference with the regular passenger schedules. The Lexington Street Railway Company of Lexington, Ky., has also installed a battery of 280 Gould cells, having a capacity of 346 kilowatts and working with a Gould counter electromotive force booster. With the aid of the battery, peaks are being taken care of, while the arc-light circuit, power load and car service of the town is handled without trouble.

ILLUSTRATED ELECTRICAL PATENT RECORD.

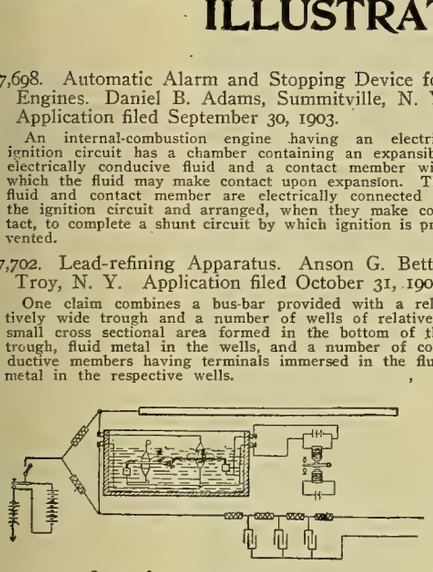
Issued (United States Patent Office) August 7, 1906.

827,698. Automatic Alarm and Stopping Device for Engines. Daniel B. Adams, Summitville, N. Y. Application filed September 30, 1903.

An internal-combustion engine having an electric-ignition circuit has a chamber containing an expansible electrically conducive fluid and a contact member with which the fluid may make contact upon expansion. The fluid and contact member are electrically connected to the ignition circuit and arranged, when they make contact, to complete a shunt circuit by which ignition is prevented.

827,702. Lead-refining Apparatus. Anson G. Betts, Troy, N. Y. Application filed October 31, 1902.

One claim combines a bus-bar provided with a relatively wide trough and a number of wells of relatively small cross sectional area formed in the bottom of the trough, fluid metal in the wells, and a number of conductive members having terminals immersed in the fluid metal in the respective wells.



NO. 827,916.—SUBMARINE TELEGRAPH.

827,710. Electric Tram Car. George J. Conaty, Smethwick, England. Application filed October 17, 1904.

A four-wheel tramcar or truck has two axles, bearings for the axles, the bearings permitting movement of each axle radial to the track or curve, two inner bearing boxes for each axle in which the ends of the axle revolve, outer boxes having vertical movement and radial guides in the outer boxes in which the inner boxes are adapted to move endwise with the axles.

827,717. Process of Making Composite Metals. Thomas A. Edison, Llewellyn Park, N. J. Application filed March 30, 1905.

The process of making a nickel-cobalt composite consists in first obtaining a solution of sulphate of nickel and sulphate of cobalt in the desired proportion, then in precipitating by means of an alkali, hydroxides of the two metals in intimate physical admixture, and in finally subjecting the hydroxides to heat in a reducing atmosphere to reduce the hydroxides to the metallic state and to weld the metallic particles together.

827,770. Electrostatic Separator. Millard Woodsome, Boston, Mass., assignor to the Huff Electrostatic Separator Company, Boston, Mass. Application filed January 29, 1906.

The combination consists of a repelling electrode, means to feed material thereto, an opposed electrode, electrical exciting mechanism and connections therefrom to the electrodes, and an electro-static shield inclosing and shielding portions of the repelling electrode which are not in immediate opposition to the opposed electrode.

827,772. Electric Railroad Gate. Andrew C. Worland, Jasper, Ind. Application filed April 7, 1906.

Electrically controlled means are provided for governing the operating means of a gate for railroad crossings.

827,777. Form for Making Fiber Insulating Coverings. William H. Baker, Lockport, N. Y., assignor of three-fifths to Jesse Peterson, Lockport, N. Y. Application filed March 21, 1906.

A form for shaping articles from moist pliable sheets consists of a composite frame or body having air-passages therein, and trimming members secured thereto to give the article the desired shape.

827,781. Interrupter for Electrical Circuits. Herman Besser, New York, N. Y., assignor of one-half to Israel Cobe, New York, N. Y. Application filed September 25, 1905.

This method of interrupting electrolytically an electric current is by subjecting metallic mercury within a cell to the electrochemical action of the electric current during its passage from one of the electrodes to the other electrode. (See cut.)

827,782. Electrical Interrupter. Herman Besser, New York, N. Y. Application filed November 22, 1905.

In an electrolytic interrupter adapted to be placed in a circuit containing a source of electrical energy are a positive and a negative electrode of like cross-sectional area and an electrolyte and metallic mercury, the electrodes being adjustable in order to determine the extent of the immersion of the positive electrode into the electrolyte and the extent of the immersion of the negative electrode into the metallic mercury.

827,783. Light Fixture. Will B. Brown, Goshen, Ind. Application filed August 28, 1905.

A socket, fixture and shade for incandescent lamps is described.

827,787. Telephone System. Elmer R. Corwin, Chicago, Ill., assignor to the Monarch Telephone Manufacturing Company, Chicago, Ill. Application filed December 15, 1904.

Relays and condensers are so arranged as to give a conversation condition in which the line relay, cut-off relay and supervisory relay in series with each other and with the line and substation equipment furnish path for current supply for that line to which the relays pertain.

827,802. Process of Treating Iron or Steel Objects. Henry L. Hollis, Chicago, Ill. Application filed July 7, 1905.

A method of providing a protective coating for iron objects is provided and consists in inserting the object to be treated in a suitable electrolyte, passing electric current through the electrolyte and objects, whereby oxidation will take place at the surface of the object and oxygen will there be united with the iron to form a protective coating, withdrawing the object from the solution and drying it, and then immersing the object in oil.

827,811. Lamp Guard. Charles Molitor, Chicago, Ill. Application filed October 3, 1904.

The patent covers an improved guard for portable incandescent lamps.

827,825. Party-line System of Telephones. Harry B. Stocks, Manchester, England. Application filed September 5, 1905.

In each subscriber's set is a shunt circuit including the fine-wire coil of a compound-wound relay with a parallel circuit including the coil of thick wire in the compound-wound relay, a selection switch drum and an electromagnet for operating the selection switch drum, the parallel circuit being normally open but closed by impulses of current through the fine-wire windings of the compound-wound relay.

827,827. Rail Bond. Charles R. Sturtevant, Mansfield, Ohio, assignor to the Ohio Brass Company, Mansfield, Ohio. Application filed December 2, 1904.

A rail-bond terminal is provided with means for offsetting its surface from that of the rail or other part to provide a space therebetween.

827,836. System for Charging Storage Cells. Asbury G. Wilson, Wilkinsburg, Pa. Application filed January 13, 1906.

The system includes a charging circuit, two independent sets of storage cells, translating devices supplied from either set of storage cells, switches for connecting either set of storage cells with the translating devices and simultaneously disconnecting the other set from the translating devices, and another switch and circuits for connecting the charging circuit with the disconnected set of storage cells, through the switches.

827,843. Self-lubricating Trolley Wheel. Theophil Bednarowicz, South Bend, Ind. Application filed March 8, 1906.

A hollow body portion has radially disposed partitions arranged therein to form pockets for holding lubricating material, the partitions having communicating openings at their outer corners.

827,849. Extensible Electric Light Pendant. George B. Clarke and Ruggles C. Clarke, Vancouver, Canada. Application filed February 12, 1906.

An extensible bracket permits the lamp to be raised or lowered from its overhead support at will.

827,861. Secondary Battery. William Gardiner, Chicago, Ill., assignor to the Universal Electric Storage Battery Company. Application filed September 23, 1904.

In an accumulator cell are a positive-pole element comprising outer retaining walls of conducting material, spacing bars therebetween, a sheet of fabric on the inner face of the lower wall, binding strips secured around the edges of the walls and material to become active carried between the walls, there being registering apertures through the walls and space bars.

827,904. Igniter for Explosive Engines. John Boyle, Peabody, Mass. Application filed November 21, 1903.

The patent describes co-operating rigid sparking electrodes.

827,914. Electric Battery. Isidor Kitsee, Philadelphia, Pa. Application filed June 12, 1901. Renewed May 3, 1905.

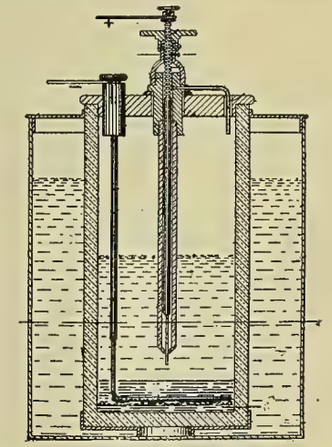
An electrode for electric cells consists of a conducting material shaped so as to provide a series of spaces or recesses, and active material placed in the spaces or recesses, the active material consisting of porous carbon the inner pores of which are lined with platinum in its finely divided state.

827,915. Electric Battery. Isidor Kitsee, Philadelphia, Pa. Application filed June 12, 1901. Renewed May 3, 1905.

An electrode for an electric cell consists of the conductor proper, active material in contact with the conductor, the active material consisting of platinized charcoal and means to keep the active material in contact with the conductor.

827,916. Submarine Telegraphy. Isidor Kitsee, Philadelphia, Pa. Application filed February 12, 1904.

Means to translate the received impulses of submarine or other cables embrace a receiving device provided with a free swinging coil, mechanical means adapted to move in unison with the swinging coil, a local circuit, a source of current for the circuit, a transmitting device for the circuit and means whereby, through the contacting of part of the mechanical means with part of the receiving device, a shunt around part of the translating device is made or broken. (See cut.)



NO. 827,781.—INTERRUPTER.

827,917. Electric Cell. Isidor Kitsee, Philadelphia, Pa. Application filed February 20, 1904.

The patent covers an electric plant consisting of a series of voltaic cells of the one-fluid type, the cells being provided with inlets and outlets. The inlets are connected to a common distributing pipe provided with hand valves, the distributing pipe being connected to two reservoirs, one containing the electrolyte and the second containing the depolarizing fluid. Each reservoir is provided with electromagnetic valves, a circuit for each of the valves and a switch common to all of the circuits, the outlet means of the cells also being provided with electromagnetic valves adapted to be actuated by the common switch. (See cut on next page.)

827,918. Electric Circuit. Isidor Kitsee, Philadelphia, Pa. Application filed April 1, 1904.

One claim describes a line of transmission consisting of alternating sections of iron and copper conductors conductively conducted together each section running only part of the entire length of the line of trans-

mission, the sections being connected together so that each successive section shall overspan a successive part of the length to be covered by the line of transmission.

827,919. Telegraphy. Isidor Kitsee, Philadelphia, Pa., assignor of one-half to William J. Latta, Philadelphia, Pa. Application filed October 14, 1905.

Means are provided by this patent to transmit over a cable of comparatively great capacity simultaneously two messages in one direction, the means embracing means adapted to transmit characters of one message, each character comprising one impulse of one polarity followed by a space impulse of opposite polarity, the difference in time between the two impulses symbolizing the character. There are means adapted to transmit characters of a second message. A variable resistance is provided, each character comprising a series of impulses induced in the line through the variation of the variable resistance, the number of the impulses symbolizing the character.

827,923. Electrical Controller. David Larson, Yonkers, N. Y. Application filed June 19, 1905.

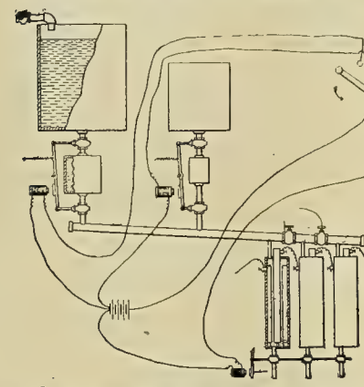
Combined are a source of alternating-current supply, a movable device, a magnet comprising a field and armature of laminated magnetic material and a winding, the armature being disconnected from the movable device but resting upon it and preventing movement of the movable device when the winding of the magnet is not energized.

827,924. Electric Elevator. David Larson, Yonkers, N. Y. Application filed July 24, 1905.

In combination with a motor are a reversing switch therefor, electromagnets having cores free from the reversing switch but arranged to control the same and independent means for actuating the reversing switch when one of the magnets is energized.

827,925. Electrical Controller. David Larson, Yonkers, N. Y. Application filed September 8, 1905.

The patent has 37 claims, one of which reads: "A source of alternating-current supply, an alternating-current motor arranged to be energized thereby, a controlling device for the motor, the controlling device comprising a plurality of circuit closers and a plurality of electromagnets having cores disconnected from but arranged to control the circuit closers, said magnets being arranged to be energized by alternating current and to be actuated one by one from the same source of supply as the motor but at a lower voltage."



NO. 827,917.—ELECTRIC PLANT OF VOLTAIC CELLS.

827,968. Secondary Battery. William Gardiner, Chicago, Ill., assignor to the Universal Electric Storage Battery Company. Application filed August 31, 1904.

A number of non-connected vertical strips of insulating material are arranged on opposite sides of a metallic receptacle in an accumulator cell and provided with with grooves in the inner faces thereof, plates being engaged in the grooves. An independent sheet of wire gauze inserted between adjacent plates and between the plates and the walls of the receptacle has metallic contact with the receptacle. An electrolyte is adapted to form a metallic deposit on the gauze in charging. (See cut.)

827,988. Coupling Apparatus for Electric Circuits. Nicholas F. Niederlander, St. Louis, Mo., assignor to the Westinghouse Automatic Air and Steam Company, St. Louis, Mo. Application filed September 2, 1902.

An automatic electric coupler is described comprising a fixed frame, a head mounted for vertical movement in the frame, a gathering mechanism on the head and a resiliently mounted contact member in the head, the gathering mechanism being adapted to bring the contact member in engagement with a similar one on a complementary head by sliding movement thereon.

828,000. Fire-alarm System. Pearl E. Tarlton, Ada, Ohio, assignor to the American Magnetic Fire Alarm Company, Ada, Ohio. Application filed June 10, 1905.

The device embraces an electromagnetic indicator, a magneto-electric generator having a circuit-controlling device comprising a rotary drum provided with stepped contacts, means for rotating the drum, means for stopping the drum at the completion of one revolution, a shiftable contact brush, and a selector for positioning the brush. There are circuit-wire connections between the indicator and generator.

828,014. Electromagnetic Railway Switch. Rollin A. Baldwin, South Norwalk, Conn., assignor to the Baldwin and Rowland Switch Company. Application filed July 17, 1903.

The combination consists primarily of a bar having two opposite motions, an electromagnet, an armature therefor and an element moved by the armature on its forward stroke, the bar and element having corresponding cam surfaces whereby the movement of the element will cause the bar to move.

828,029. Elevator. Charles W. Jackson, San Diego, Cal., assignor of one-half to Isaac A. Lothian, Los Angeles, Cal. Application filed November 1, 1904.

A number of tracks extend longitudinally of the elevator-shaft and are provided with screw-racks. An elevator-cage is mounted to travel between said tracks and has a false bottom and screw members engaging the respective screw-racks. An electric motor mounted on the false bottom has driving connections between the motor and the screw members.

828,033. Process of Electric Welding. Laurence S. Lachman, New York, N. Y. Application filed July 28, 1905.

A process of electrically welding one piece of metal to another is described.

828,045. Fire-protection System. James G. Nolen, Chicago, Ill., assignor to the Automatic Fire Protection Company. Application filed September 17, 1904.

This and the following patent relate essentially to a fire protection signal system combined with a receptacle containing fluid under pressure. A signal system comprises a suitable circuit, a signal transmitter and a signal-responsive device, and there are electroresponsive means for conditioning the signal transmitter for operation arranged for a functional operation upon the rupture of the circuit containing it. Circuit connections are provided for the electroresponsive means, and a time switch is controlled by the pressure in the receptacle, arranged to control the circuit connection of the signal-responsive means, and, under normal conditions of pressure in the fluid receptacle to maintain the circuit connection of the electroresponsive means closed.

828,046. Fire-protection System. James G. Nolen, Chicago, Ill., assignor to the Automatic Fire Protection Company. Application filed September 6, 1904.

828,047. Fire-protection Signal System. John E. Shepherd, Chicago, Ill., assignor to the Automatic Fire Protection Company. Application filed September 6, 1904.

The combination is for use with a main pipe and a valve therein and consists of a by-pass around the main valve, a part in the by-pass movable from normal position when water flows through the by-pass and to normal position on the cessation of water flow. The signal system has a normally wound signal transmitter adapted when maintained in condition for operation to transmit a number of separate signals, and when conditioned for inactivity to stop upon the completion of the signal then being transmitted.

828,061. Telephone Exchange System. Charles E. Scribner, Jericho, Vt., assignor to the Western Electric Company, Chicago, Ill. Application filed April 10, 1905.

The patent covers an improved party-line telephone system.

828,077. Method of Commutating Alternating-current Electric Motors. Hans Weichsel, Wilkinsburg, Pa. Application filed August 28, 1905.

One claim provides for maintaining the short circuit of a given amature coil until the commutated line current is equal to and in the same direction as the current flowing through the armature coil, and at that moment breaking the short circuit.

828,083. Power Table and Power Attachment for Tables. John T. Beswick and David Beswick, New York, N. Y. Application filed January 24, 1906.

The combination consists of a support, an electric motor, a motor brake and a rheostat mounted upon brackets adjustably secured to the support, and a spring retracted controlling device connected to operate both the rheostat and the brake.

828,089. Switch-key. Edward B. Craft, Chicago, Ill., assignor to the Western Electric Company, Chicago, Ill. Application filed July 5, 1904.

A signaling device for party-line ringing keys is described.

828,090. Electromagnetic Locking Switch. Henry M. Crane, New York, N. Y., assignor to the Western Electric Company, Chicago, Ill. Application filed May 9, 1904.

With an electromagnet is combined a return pole piece therefor, a lever pivoted upon the pole piece, a push button for moving the lever, switch contacts closed by the lever when moved by the push button, and an armature for the magnet pivoted to the pole piece and adapted when attracted to abut against the lever to hold the same in its actuated position. (See cut.)

828,092. Electric Motor Support. John G. Crawford, La Grange, Ill., assignor to the Western Electric Company, Chicago, Ill. Application filed January 2, 1904. Renewed September 18, 1905.

The patent covers a support for motors as applied to sewing machines.

828,101. Automatic Telephone Exchange. Claude D. Enochs, La Crosse, Wis., assignor to the Western Electric Company, Chicago, Ill. Application filed October 16, 1905.

Details of the operation of an automatic telephone system are covered by the patent.

828,210. Means for Controlling Electric Lifts, Elevators, Conveyers, Etc. Henry C. E. Jacoby, Harrow, England. Application filed December 15, 1905.

A Star-wheel and a locking device is arranged and adapted to engage the same and also to complete its motion, one of these elements rising and falling with the elevator cage or platform. There are means for controlling the lifting and lowering of the cage operated by the star-wheel.

828,217. Electric Transmission of Intelligence. Isidor Kitsee, Philadelphia, Pa. Application filed June 23, 1906.

An all-metallic line is provided with necessary transmitting and receiving devices, a resistance joining the two legs of the line and an inductive circuit comprising four wires divided into two pairs, one wire of each pair connected to the resistance.

828,218. Telephone Apparatus. Koby Kohn, New York, N. Y., assignor of one-half to Louis A. Ksensky, Denver, Colo. Application filed November 20, 1903.

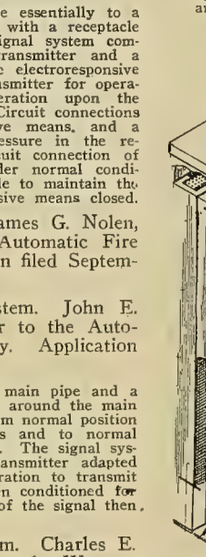
A party-line telephone system is described.

828,235. Call System. William J. McCollom, Paterson, N. J., assignor of one-third to F. Eliot Low, Paterson, N. J. Application filed February 24, 1906.

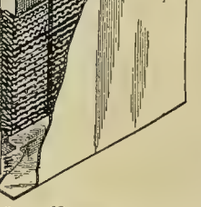
The patent covers a call system for telephone circuits.

828,262. Automatic Stopping Device and Alarm. Daniel B. Adams, Summitville, N. Y. Original application filed May 23, 1902. Divided and this application filed November 30, 1903.

The combination, in an internal-combustion engine or the like, consists of a water-jacketed cylinder, electrical igniting means, an alarm and automatic means operated by diminution of water pressure for operating the alarm and breaking the circuit of the igniting means.



NO. 827,968.—SECONDARY BATTERY.



NO. 828,090.—ELECTROMAGNETIC LOCKING SWITCH.

828,271. Telephone Apparatus. Charles A. Bucklin, New York, N. Y., assignor to Barbara J. Francis, New York, N. Y. Application filed July 3, 1903.

A disabling device and a bell mounted in the branch circuit are both operated from the central station, and a relay, also in the branch circuit, coacts with the disabling device to hold the same in operative position after the device has been thrown to such position from the central station.

828,292. Pocket Audiphone. Eugene W. Schneider, New York, N. Y. Original application filed August 11, 1905. Divided and this application filed December 8, 1905.

The transmitter of this device is rigidly attached to one end of the battery case. A flexible circuit connects the receiver to the transmitter.

DESIGN.

38,155. Electric-light Cluster. Maurice E. Bates, Kansas City, Mo., assignor to the Benjamin Electric Manufacturing Company, Chicago, Ill. Application filed June 12, 1905. Term of patent 14 years.

A cluster of incandescent electric lamps is shown.

PATENTS THAT HAVE EXPIRED.

Following is a list of electrical patents (issued by the United States Patent Office) that expired on August 13, 1906:

408,740. Filament for Incandescent Electric Lamps. A. F. Oppermann, Chicago, Ill.
408,753. Electric Motor for Street Cars. W. S. Salisbury, Chicago, Ill.
408,754. Motor for Street Cars. W. S. Salisbury, Chicago, Ill.
408,762. Fire-alarm Box. J. Speicher, Jersey City, N. J.
408,768. Dynamo-electric Machine. J. T. Van Gestel, New York, N. Y.
408,778. Electromagnetic Mooring. H. P. Wellman, Catlettsburg, Ky.
408,785. Electric Gas Lighter. T. J. Zoeller, Louisville, Ky.
408,809. Electrode for Secondary Batteries. A. V. Meserole, New York, N. Y.
408,829. Electric Stop Motion for Drawing Frames. V. I. Comnock, Lowell, Mass.
408,846. Automatic Signaling Device for Time Service. C. H. Pond, Chicago, Ill.
408,855. Electric Railway. W. M. Schlesinger, Philadelphia, Pa.
408,875. Method of Electric Metal Working. W. M. Dewey, Syracuse, N. Y.
408,887. Arc Lamp. J. A. Lightipe, Philadelphia, Pa.
408,901. Insulation for Electric Conductors. C. T. Snedekor, St. Louis, Mo.
408,910. Electro-dynamic Machine. G. F. Card, Covington, Ky.
408,948. Electric Arc Lamp. W. H. Barker, Lawrence, Kan.
408,968. Electric-mechanical Bell-striking Machine. T. F. Gaynor, Louisville, Ky.
408,984. Contact Carrier for Electric Railways. J. C. Love, Philadelphia, Pa.
408,986. Apparatus for Filling Secondary Battery Plates. H. G. Morris and P. G. Salom, Philadelphia, Pa.
408,992. Alarm. J. M. Schmidt, Saginaw, Mich.
409,015. Electric Welding. C. L. Coffin, Detroit, Mich.
409,088. Alarm. G. M. Williams, Wilkesbarre, Pa.
409,097. Insulated Nippers and Cutting Instrument. F. M. Casey, Mount Vernon, N. Y.
409,104. Conduit Electric Railway. B. Jennings, San Jose, Cal.
409,106. Electrode for Secondary Batteries. W. P. Kookogey, Brooklyn, N. Y.
409,135. Electrical Resistance. E. M. Bentley, New York, N. Y.
409,146. Electric Railroad Signal. W. F. Grassler, Williamsport, Pa.
409,156. Double Suspended Conductor System for Electric Railways. C. J. Vandepoele, Lynn, Mass.
409,157. Harmonic Telegraphy. F. Van Rysselberghe, Brussels, Belgium.

WESTERN ELECTRICIAN

EVERY SATURDAY

Vol. XXXIX. CHICAGO, AUGUST 25, 1906 No. 8

Electrical Decorations for the Eagles' Convention in Milwaukee.

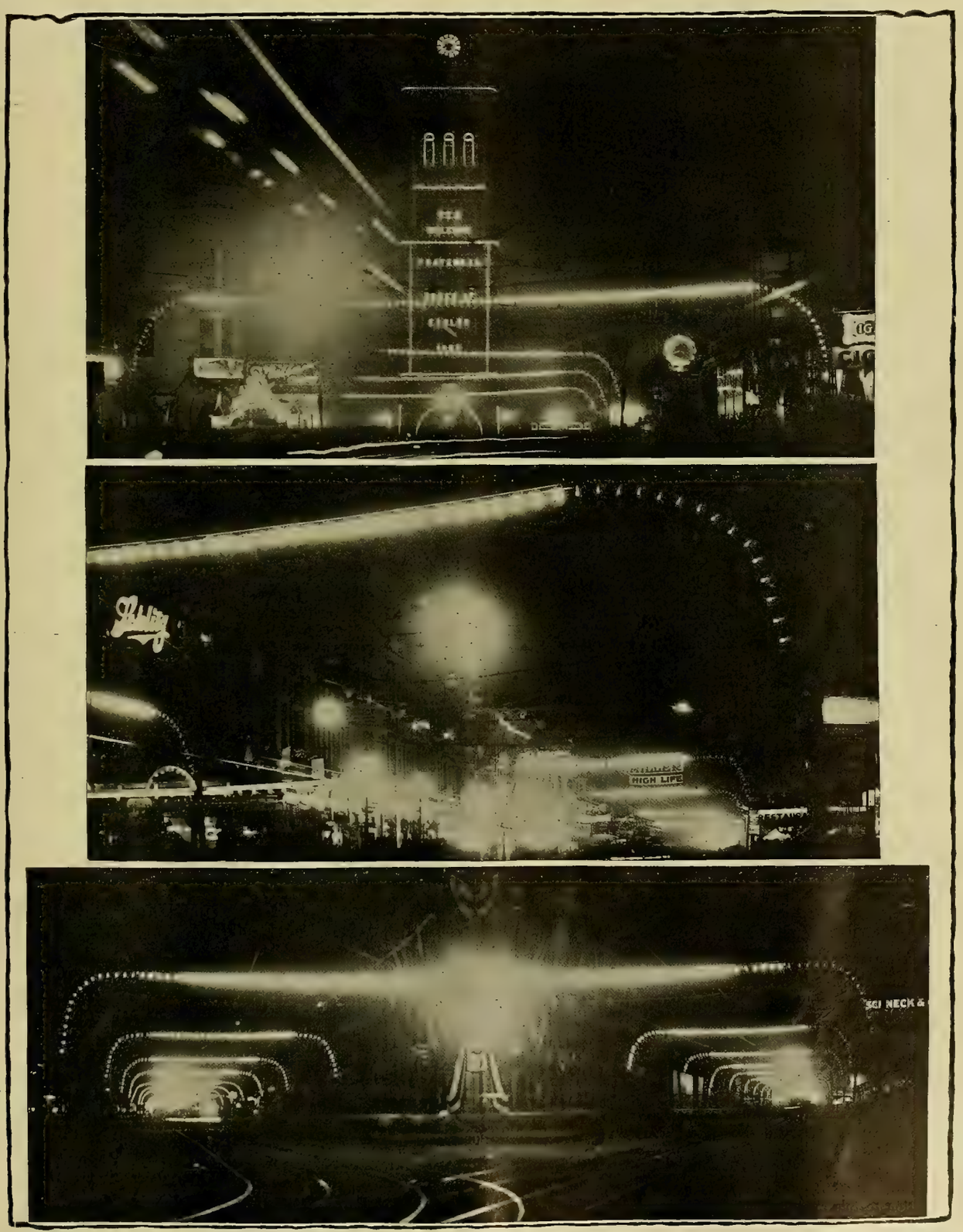
No small part of the success of the convention of the Fraternal Order of Eagles, just held in Milwaukee, was attributable to the elaborate scheme of decorative lighting which was carried out by the Milwaukee Electric Railway and Lighting Company. The effect produced was striking. It is estimated that 50,000 visitors came to the city for the week beginning August 12th, including the delegates and their friends, and all were pleased with the results accomplished by the lighting company through Mr. O. M. Rau, its chief electrician.

The decorations were ordered by the Eagles' committee, the special wiring and current, which were paid for at the regular rates, costing several thousands of dollars.

The decorative lighting of the streets was accomplished wholly by arches of incandescent lamps at the street intersections. These arches were distributed from Twelfth Street on Grand Avenue to the Milwaukee River. On the other side of the river, Wisconsin Street, which is a continuation of Grand Avenue, was similarly lighted nearly to the shore of Lake Michigan. On all the downtown streets, particularly on Third and East Water streets, the arches were constructed several blocks each way from the main thoroughfare.

In all there were 93 of these arches, each containing 60 16-candlepower incandescent lamps, making in round numbers 5,500 lights. These were burned each evening from eight o'clock to midnight.

Some interest attaches to the manner in which the decorative arches were made, and a description



Upper View.—Market Square and City Hall. Middle View.—Third Street, South of Grand Avenue. Lower View.—Looking South on Third Street and Southeast on West Water Street.

ELECTRICAL DECORATIONS FOR THE EAGLES' CONVENTION IN MILWAUKEE.

of the method used will perhaps contain a suggestion to the central-station manager who may be called upon to light the streets of his city on some similar occasion.

Wiring necessary for operating the lamps was all done beforehand in the shop. The wires were cut the proper length to span the street from the poles carrying the street-railway trolley. The sockets for the lamps were then connected along the wires at intervals of 10 inches to a foot.

Between the lamps, and a few feet apart, insulators were attached to which were fastened the wires which were to carry the arch from a horizontal wire strung from trolley pole to trolley pole. These carrying wires were also cut in the shop.

The assembled streamers were then distributed along the route to be lighted. The ends of each streamer were fastened to opposite trolley poles, and the carrying wires fastened taut to the horizontal wire and some in an oblique direction to the poles. When this was done an arch flattened on the top was formed from pole to pole, the wiring fitting perfectly.

For fastening the ends of the arches to the poles, which wires, of course, had to be insulated, a special iron clamp or collar was made for each pole, the ends held together on the inside by a bolt. On these bolts were carried ordinary strain insulators, to which the ends of the arch wires were fastened securely.

The arches thus formed were connected five in series, and derived their current from the trolley wire, one side of the circuit being grounded.

Lamps were of the railway type, 16 candlepower, in three colors—the top and flat portion of the arch white, one end red and the other blue. This distinction of colors is shown clearly in the photographs.

Where everything was made in the shop there was very little work to install the arches, the lamps being screwed in place after the wires were hung.

Some Fundamental Characteristics of Mercury-vapor Apparatus.[1]

By Percy H. Thomas.

The characteristic of the type of mercury-vacuum apparatus invented and developed by Mr. Peter Cooper Hewitt which distinguishes it most clearly from other forms of vacuum tubes is its power of passing a comparatively large continuous current with a constant and comparatively insignificant voltage loss. There are, of course, other important

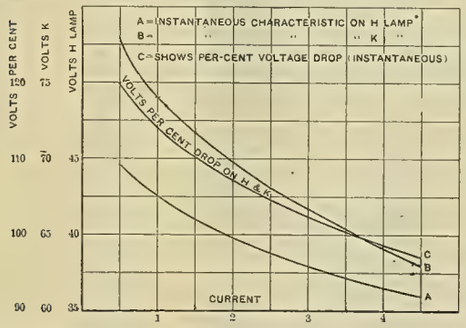


FIG. 1. CURVES OF CHANGE OF VOLTAGE IN MERCURY-VAPOR LAMPS.

features of this mercury-vapor apparatus characteristic to it, such as the negative-electrode starting resistance, the disintegrating, reconstructing negative electrode, etc.

Electrical Characteristics of the Current Path in the Vacuum.

Current passing through the vacuum space in the mercury-vapor apparatus experiences a loss of voltage, the numerical value of which tends to remain constant, independent of the current strength, except with small currents; for example, currents less than one or two amperes. Although this voltage loss or drop is practically independent of the current strength, it still is not of the nature of the counter electromotive force of a storage battery or motor, which latter are capable of delivering current in a reverse direction on the removal of the supply electromotive force. Neither is it equivalent to an ohmic resistance, for it is of an entirely different nature. It cannot be properly spoken of as a resistance at all; it is a voltage loss.

This loss is the sum of three other losses, more or less different in character; that is, the vapor loss, the positive electrode loss and negative electrode losses.

Vapor.—1. The voltage loss in the vapor increases with increase of vapor pressure, and more or less closely in proportion to this pressure; consequently, since the mercury vapor is saturated and its pressure depends directly upon the temperature of the mercury electrode, the vapor voltage loss is more or less proportional also to the temperature of the mercury electrode or electrodes.

2. The voltage loss depends upon the chemical composition of the vapor; that is, it will be different with oxygen, hydrogen and air, even at the same pressure; and all of these give a much greater loss

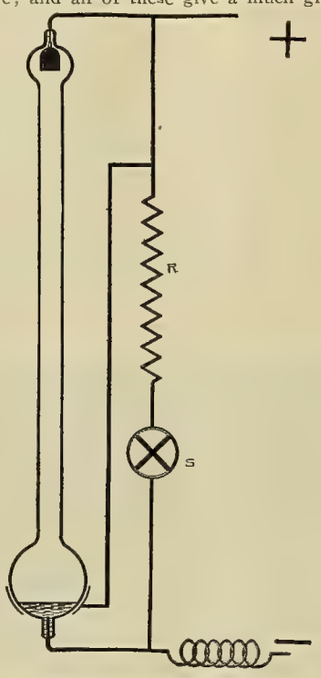


FIG. 2. CIRCUIT FOR HIGH-TENSION STARTING OF DIRECT-CURRENT MERCURY-VAPOR LAMPS.

than mercury, which is one of the great advantages in the use of the latter.

3. The voltage loss is directly proportional to the length of the vapor.

4. The voltage loss is inversely proportional to the diameter of the vapor path, but not, as might be supposed, inversely as the area of the path.

5. The voltage loss is nearly independent of the current strength, but varies slightly in a direction opposite to the current. The curves of Fig. 1 show the change of voltage with change of current and are characteristic respectively of the voltage across a 3.5-ampere commercial lamp and 30-ampere commercial converter bulb. These curves show directly the total voltage across the apparatus, but virtually represent the resistance of the vapor, plus a constant loss of perhaps 10 volts at the electrodes.

Positive Electrode.—The loss of voltage which occurs at the positive electrode is practically independent of the current strength. The energy represented by this voltage appears as heat at the surface of the electrode. The material of the solid positive electrode seems to have no appreciable direct effect on the volts lost, but a mercury positive, except when perfectly cold, has a loss some volts higher than the solid, probably because of a layer of comparatively dense vapor produced at its surface by the current. This is usually to the disadvantage of the mercury electrode. As the watts energy liberated in the form of heat at the positive electrodes in a commercial apparatus may be quite considerable, the solid positive electrodes have a further advantage over mercury in that they will become heated during operation and radiate a considerable portion of the heat developed on them, as heat is radiated from a hot coal. This puts no burden on the cooling power of the bulb itself, while mercury positive electrodes will be kept cool by the evaporation of the mercury, and additional vapor must be condensed by the bulb. The voltage loss on the positive electrodes is usually found to vary a good deal, but not on account of current variation. Its minimum value is about five volts. Apparently on account of an accumulation at this electrode of a certain amount of some foreign gas, such as air, which has already been stated to have a higher resistance than mercury vapor, the positive-electrode loss appears often more than five volts. The loss is practically independent of the temperature of a solid positive electrode.

Negative Electrodes.—During normal operation there is also a voltage loss at the negative electrode practically independent of the current. In a mercury electrode this loss is probably about four volts. It is practically independent of temperature and physical form.

This loss of voltage during operation must be distinguished from the resistance to starting, residing at the negative electrode and usually called the negative-electrode starting resistance, or, more briefly, the negative-electrode resistance.

The current enters the negative electrode through a very clearly defined small, bright area, or "spot," even on very large electrodes, which normally flits about rapidly over the whole surface when not subjected to the influence of a magnetic field. When, however, a magnet is brought into the neighborhood, the electrode spot is driven to one side as far as the edge of the electrode. By providing an amalgamated metallic body at the surface of the electrode the negative-electrode spot may be caused, under some conditions, to rest quietly on the surface at the junction of the mercury and the solid material.

The negative-electrode spot causes a violent agitation on the surface of the mercury and acts as though it exerted a pressure downward, making a depression on the surface. There is, at the same time, a very rapid evaporation of mercury at this point, which seems to be an essential part of the transfer of the current from the vacuum space to the electrode proper. At the same time that the negative spot is vaporizing mercury it is also heating the electrode itself, which finally becomes so hot as to cause further vaporization. The evaporated mercury is cooled and condensed by contact with the bulb, on the inside of which it collects in drops. The drops grow larger and finally run down into the electrode, tending to cool it.

Starting Characteristics.

A voltage considerably higher than the normal operating voltage may be required for starting the flow of current through the vacuum. For a tube of definite diameter the difference between the starting and the operating voltages is very small for short lengths of tube, perhaps up to 10 diameters. But the operating voltage increases directly as the length, while the starting voltage increases more nearly as the third power of the length, so that for long tubes there is a very considerable increase of voltage required for starting. On the other hand, the starting voltage is lessened by increasing the diameter of the tube. This high starting voltage is partly due to the necessity of establishing a path through the opposing gas and to vapor molecules initially filling the whole space. Once such a path has been established with a considerable volume of current, a much less voltage will evidently keep it clear. In many types of apparatus it is found convenient to start on an auxiliary positive electrode placed near the negative and transfer the current to the main positive electrode after starting. In this case the starting resistance of the vapor path to the main positive electrode must be overcome before normal operation can be established. In a converter bulb where the distance between the negative and the positive electrodes is comparatively short, no greatly increased voltage is required for starting the current through the vapor path proper. In a lamp tube 45 inches long and one inch in diameter, such as is used in one type of commercial lamp, several times the operating voltage may be required for starting the current through the vapor, independent of the negative-electrode starting resistance. A high resistance filament connected to the + electrode and extending into the neighborhood of the negative will reduce this vapor starting resistance by allowing the current to climb up, so to speak.

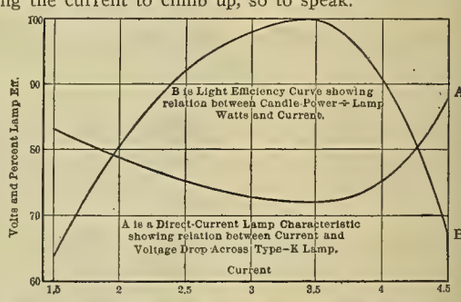


FIG. 3. NORMAL CHARACTERISTICS OF MERCURY-VAPOR LAMPS.

Positive Electrode.—There appears to be no resistance to starting at the positive electrode other than the normal operating resistance.

Negative Electrode.—The negative-electrode starting resistance is too well known to need further description. There are two well-known methods of overcoming this starting resistance:

1. By establishing a current through a complete metallic circuit within the vacuum, and breaking this circuit within the vacuum, in which case the original current will continue to flow, since the negative-electrode resistance never has a chance to assert itself. This result may be accomplished by having two mercury electrodes which may be brought into contact by tilting the container, or otherwise, or by moving suitable parts from outside by a magnet. This type of starting is one of the most commonly used at the present time.

2. The second method of starting consists in directly applying a high potential with or without the addition of various means for reducing the starting resistance.

This negative-electrode starting resistance is a very variable quantity and ranges from almost nothing to many thousand volts, according to conditions. It is very much greater with a cold electrode, especially a cold mercury electrode. It is dependent upon the form and surroundings of such an electrode, and especially upon the potential or charges on the outside and inside of the insulating walls which confine the electrode. If the negative electrode is provided with a metallic strip, called a starting band, outside the container, and this strip be charged at a potential different from the electrode, the starting resistance is weakened or may be entirely overcome. On the other hand, if this band or strip be connected to the negative electrode itself, the negative-electrode resistance is rendered more stable since it is protected from charges. This is

1. Abstract of a paper presented at the annual convention of the American Institute of Electrical Engineers, Milwaukee, Wis., May 31, 1906. See also references in the Western Electrician of June 9, 1906, page 475, and June 30, 1906, page 542.

the principle made use of by Mr. Hewitt in starting some of his lamps, and has been already fully described by him. The connections are shown in Fig. 2. In this figure the interruption of the current in the quick-break switch (S) causes a momentary high-potential impulse from the choke coil (I), which is applied both to the starting band in the neighborhood of the negative electrode and to the main positive electrode. The former serves to break down the starting resistance of the negative electrode, and the latter supplies the starting voltage for the vapor path. In this method of starting, a small spark or series of sparks can be seen jumping from the edge of the negative electrode to the inside surface of the glass opposite to the starting band, which surface forms the inside coating of a small condenser, the starting band being the outside coating. This small spark is undoubtedly what overcomes the negative-electrode resistance.

Mercury-vapor Lamp.

As a lamp, the mercury-vapor apparatus has a number of interesting characteristics. Its great efficiency, which in long tubes reaches one-third watt per candlepower (exclusive of resistance losses), is obtained only when run under the most favorable conditions; for example, only with the proper vapor pressure, current and tube diameter. Mercury vapor is a much more efficient material for light production than most other gases and vapors whether used alone or mixed. The addition of atmospheric air,

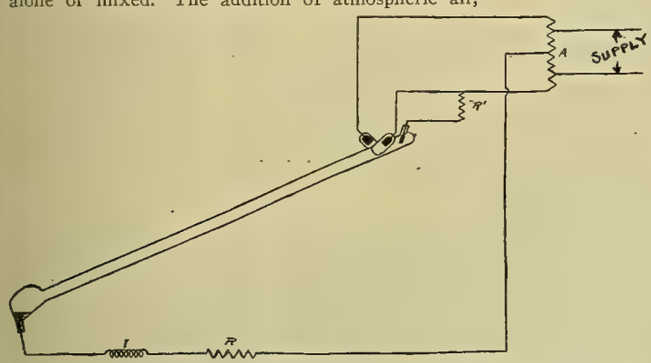


FIG. 4. STARTING AND OPERATING CIRCUITS FOR ALTERNATING-CURRENT MERCURY-VAPOR LAMP.

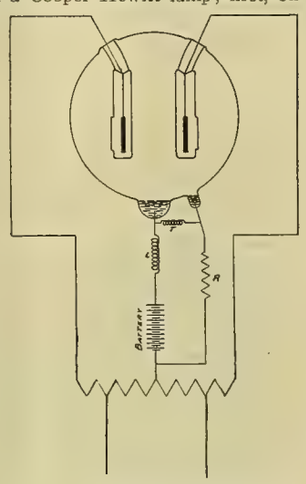


FIG. 5. BATTERY STARTING CIRCUIT FOR MERCURY-VAPOR CONVERTER.

for example, to mercury vapor, even in very small quantities, increases the voltage on the tube very much, thus increasing the energy supplied.

The spectrum of mercury vapor is, furthermore, one of the most complete and usable gas spectra; it contains a variety of colors in substantially equal proportions, chiefly an orange-yellow, a yellow, a blue and a violet, with a smaller amount of a green-blue. The only portion of the spectrum not pretty well represented is the red, which, generally speaking, is the least desirable color. The mercury spectrum has proved to be excellent physiologically and extremely well adapted to most mechanical processes. It is possible of course by the addition of other gases to add red to the spectrum, which may then be quite prominent, especially if means are taken to condense a portion of the mercury vapor. In general, however, these combinations of gases are more or less likely to deterioration and alteration, and have a considerably lower efficiency than pure mercury vapor. For most purposes the color would not be more desirable with the addition of red.

Light Efficiency.—The efficiency of mercury vapor as a source of light follows a number of laws. 1. The watts per candlepower vary with the pressure of the vapor, having a minimum at a certain pressure, as shown in Fig. 3, which is from a test on a commercial type of lamp. 2. It is nearly independent of the current strength within certain limits, in this case it being assumed that the pressure, temperature, etc., are constant. 3. Superheating the tube, and consequently that portion of the vapor emitting light, seems to have little effect.

It will be seen by the curves in Fig. 3, on which is shown the normal lamp voltage characteristic, that is, the relation between current and voltage of the operating lamp, that the most efficient light-giving point is at, or nearly at, the point of lowest voltage on this characteristic. This is fortunate, since for purposes of regulation this is a most desirable point to operate the lamp. Above this most efficient point the pressure of the mercury vapor increases rapidly, and while also increasing the candlepower it increases the voltage in the tube in still higher proportion. Below this point the voltage on the lamp rises, probably partly on account of traces of residual gas not exhausted in the pumping, which causes a great dropping off of the quantity of light and the efficiency. These residual gases are here more prominent on account of the lower mercury temperature and vapor pressure.

It is evident that the temperature of the mercury electrode and the pressure of the mercury vapor resulting from a given current will depend directly upon the air temperature surrounding the lamp. In the commercial types of lamp, however, the actual change in efficiency from change in atmospheric temperature is very slight throughout the practical working range. This results from the flat form of the lamp characteristic near the point of 3.5 amperes, as seen in Fig. 1.

Lamps may be made for various uses with different diameters of light-giving tubes. The diameter most commonly used and suited to 3.5 amperes is one inch, or a trifle less, in inside diameter. To give the same intrinsic intensity with other diameters the current should be varied in proportion to the cross-section of the tube; that is, for a two-inch tube we should require about 14 amperes. Since the voltage decreases as the diameter of the tube, and since at the same intrinsic brilliancy the quantity of light increases as the diameter on account of the larger surface, we should expect double the light and double the energy consumed with the larger tube. It is found by measurement, however, that the larger tubes are somewhat more efficient, so that there is a saving of 20 to 25 per cent. on the efficiency for two-inch over that of one-inch tubes—inversely with smaller tubes and the appropriate currents. With smaller tubes, however, the difficulty of maintaining the negative alive becomes very much greater on account of the small current which, as already explained, is subject to momentary impulses tending to stop the flow of current.

There can be no one proper method of measuring the candlepower of a Cooper Hewitt lamp; first, on account of the fact that the color of the lamp is different from the color of any accepted standard, and because it is a spectral against a continuous spectrum; and, secondly, because the light-giving tube is not a point, and the law of inverse squares does not hold except at very great distances. For commercial tests the candlepower of the lamp should not be measured at a great distance, since the lamp has a practical advantage over most other lights from its tubular form, which comparative advantage it would lose were the candlepower measured at a considerable distance. Where it is important actually to define the candlepower of these lamps, the particular method of measurement to be used must be specified.

Alternating-current Lamp.—The principle of the alternating-current lamp is generally well understood by this time, the circuits being shown in Fig. 4. Referring to this cut [in which (A) is an auto-transformer, (R') is a starting resistance, (R) a lamp resistance and (I) inductance], it is evident that during one alternation, current is supplied from one-half of the transformer secondary through the lamp tube back to the neutral point, and during the other alternation by the other half of the transformer secondary through the tube to the same point, and that the choke coil in the negative lags the current over the zero points.

The light from the alternating-current lamp is practically equivalent to that from the direct-current, since in the light-giving portion of the tube the light is substantially direct current.

On 25 cycles, by providing a larger choke coil in the negative than is necessary in the 60-cycle lamp, the natural tendency to flicker with the period of the 25 cycles is eliminated.

Starting.—The method of starting in the type C alternating-current lamp is an extension of that of the direct-current lamp and is of some interest. A small electrode or pin is placed in the head of the lamp, as shown in Fig. 4, and connected to one of the positives through a rather high ohmic resistance. In starting, the lamp is tilted so that the mercury forms a continuous stream from the negative to the positive end and is carried by its momentum up around the inside end of the tube until it touches the pin which is placed on the top side of the tube. On account of the irregularity of the flow of the mercury it here makes and breaks contact with the pin a number of times, each time causing a breakdown of the negative-electrode resistance, either on the column of mercury or the pin. In the latter case the lamp will go out at the end of the alternation. If, however, the mechanical break at the pin occurs during such an alternation that the mercury column is the negative, the lamp will start to operate upon the pin, and that main positive electrode to which the pin is not connected as positive electrodes and the mercury stream as the negative. Then, on account of the starting resistance connected with the pin, the current will be immediately transferred from it to the corresponding positive, and the lamp is started. The lamp is then returned to its normal position and all the mercury flows back to the negative. If, now, there were no resistance between the pin and its positive electrode, and assuming the lamp to have been started during tilting by one of the breaks between the mercury and the pin, it is evident that if the mercury touches the pin again, the lamp will go out, since for this instant the flow of current does not enter the vapor at all (on account of the metallic connection between negative and one positive). That is to say, if it were not for this resistance which prevents current when once transferred to both main positives from being withdrawn by a subsequent connection between the mercury and the pin, the lamp would be started and put out and started again repeatedly. Only the last break between the mercury and the pin would count in starting, and we should fail to light the lamp more often than we succeed. As an actual matter of fact, lamps have been built which started practically every tilt, though the average commercial lamp is not expected always to light at the first trial.

Mercury-vapor Converter.

The Cooper Hewitt apparatus may, as is well known, be utilized to supply direct current from an alternating-current supply by virtue of the negative-electrode resistance. No further description of the general method of accomplishing this result is necessary at this time. The converter may be run single phase, in which case a connection similar to that already described in Fig. 4, except for starting circuits, is generally used, though it may be three-phase, four-phase, etc., in which case no choke coil in the direct-current circuit is usually required.

Starting.—In a converter a very short vapor path is purposely provided, and the starting is easily accomplished by breaking a metal circuit in the vacuum as already described, for the current is here easily transferred from the starting to the main positive electrode. The method can be easily seen from Fig. 5, which shows a form of commercial bulb used for a single-phase converter, together with starting circuits. There are two electrodes of mercury, one being the main negative and the other a starting electrode. By shaking these two together, passing current through and separating them, the negative-electrode resistance is broken down and the voltage upon the main positive electrodes forces current to flow to the main negative. The supplementary positive should then be cut out of the circuit. Converters, however, can be started by starting-band and high-tension impulse, or by the direct application of sufficiently high potential.

In cases where the converter is to feed a storage battery, it will be noted that the electrical connection shown in Fig. 4 for the alternating-current lamp is not perfectly satisfactory, on account of the comparatively large direct current sent by the battery through the transformer winding when the negative and starting electrodes are connected, which is in the wrong direction to start the negative electrode as a negative. The high impedance of the sustaining coil prevents any considerable alternating current from flowing, but does not seriously limit the flow of direct current from the battery, which thus tends to make the starting positive a negative. The difficulty may be avoided by the method shown in Fig. 5. By this method the battery is made to start the supplementary electrode as a negative, whereupon the main positives start operation with the supplementary as a negative, passing current through both the resistance (R) and the battery, through the coil (T). If then a second connection is made between the

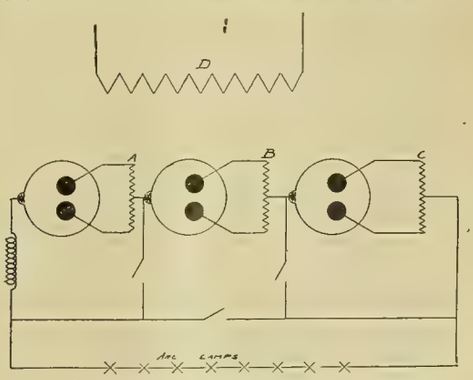


FIG. 6. SERIES CONNECTION FOR MERCURY-VAPOR CONVERTER BULBS.

starting and the main negative electrode, the current is shunted from the coil (T) through the main negative, and on the second separation the main negative starts in the proper direction, as current is now passing against the battery instead of from it. On account of the liquid character of the mercury, it is found by experience that with one tilting operation two "makes" and "breaks" are ordinarily produced between the main and starting electrode, so that the initial starting on the supplementary electrode and the transfer to the main negative occur almost together so as not to be distinguishable by the eye. The starting circuit should usually be cut out during regular operation. By making the coil (T) a magnet for tilting the bulb, the starting is automatic. This method has an advantage over

other apparatus for automatic starting, in that it is not necessary to operate any switches in the main circuit carrying the heavy current; the only cut-out that is necessary is the disconnection of the starting circuit which carries at most one or two amperes.

Series Operation.—A very interesting application of vapor converters is the operation of series directing supply. Where a moderate number of lamps is current arc lamps from a constant-current alternat- to be operated in series, a single bulb will furnish a sufficiently high direct-current voltage; where many arc lamps are to be operated, two or more converter bulbs may be used as shown in Fig. 6, by which arrangement the direct-current voltage of the various bulbs is available in series in the arc circuit. [In this cut (A), (B) and (C) are independent secondaries to the common primary (D), which is fed by a constant alternating current]. By the use of sufficiently powerful sustaining coils it is possible to utilize current obtained from 25 cycles without material flickering of the arcs. This is an extremely important gain for the users of 25-cycle systems. Bulbs in series may be started as individuals and afterwards thrown in series either on short-circuit or lamp load; or they may be started on a common short circuit or even on the arc circuit itself, the connections for accomplishing this purpose being comparatively easily devised.

Current Control.—Where a direct current of constant potential is desired through the use of a vapor converter, this can be properly accomplished by the direct connection of the work circuit through the converter and a sustaining coil, and the constancy of the direct-current potential will be directly equal to that of the alternating-current supply, since though 15 volts are absorbed by the bulb this value does not increase with increase of current.

In cases where it is desired that the direct-current potential shall be continuous, even when no direct current is drawn, it is evident that with single-phase converters auxiliary means must be supplied to keep the bulb in operation. This is accomplished in a number of ways, for instance by a shunt which is kept always running, or by providing a separate circuit with a separate source of electromotive force passing current through the bulb from separate positive electrodes and utilizing the same negative as the main circuit.

Where regulation of the current is desired, as in operating storage batteries, it is not sufficient to provide a constant-potential alternating-current supply, but some means equivalent to the adjustable resistance ordinarily used in direct-current systems for this purpose is necessary. This can be easily accomplished by the introduction of inductance, preferably adjustable in the main positives or in the supply. Since the voltage taken up by the resistance or inductance is fixed as the difference between the supply voltage and the direct-current potential by changing the ohmic value of this "resistance" or backing, we, of course, alter the current strength.

British Association at York.

[From the London correspondent of the Western Electrician.]

London, August 7.—At this period of the year there is little of importance going on, but the annual meeting of the British Association affords some matters of interest to record. This function is probably a noteworthy example of real stodgy science and holidays going hand in hand, as it were. There are many such annual meetings every year, but none, perhaps, touch such extremes as the meetings of the British Association. Of course it is impossible for me to deal fairly with the papers of electrical and allied interest; they will find publication in full, later, through the usual channels. The president this year is Professor Ray Lankester, and in the city of York there should be every encouragement and inspiration to good work. York was the birthplace of the Association three-quarters of a century ago, and the historical reminiscences clinging to the place make it a popular resort to the scientist under the auspices of such meetings as this. Further, in contrast to the last meeting held in England, the year before last at Southport, the weather this year has been all that can be wished for.

The burden of the presidential address to the association (there are also presidential addresses to the numerous sections) was the relationship of science and the government of the day. Now it is an oft-lamented fact that it is the hardest possible task in the world to induce any government here adequately to support science; i. e., a thoroughgoing, all-round support which is so essential for the well-being of the community of which science is the backbone. There are several aspects of this controversy, and Professor Lankester confined himself to the research side, so to speak—that is, the scanty support given, no matter the political denomination in power, to scientific institutions and investigations. There are notable examples in the belated progress of the National Physical Laboratory, the Kew Magnetic Observatory and other institutions not of an electrical character. It is pleasing to know, however, that there are now men in the cabinet closely identified with science who are keenly alive to the complaint made at York by Professor Lankester, to which was also added, by the way, a plea for more scientific men in public departments. G.

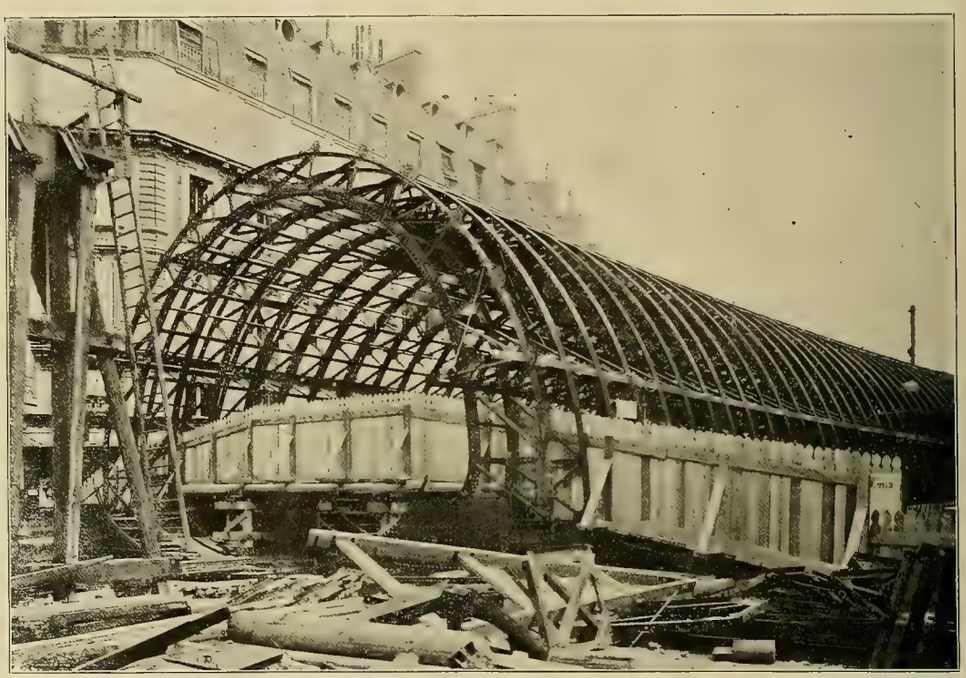
Building Large Electric-railway Subway Structure on the Surface.

By A. De Courcy.

A somewhat unusual piece of work is being carried out upon the new section of the Paris Subway. The new line is the fifth of the main sections which have been built up to the present, and it runs entirely underground, crossing the city from north to south. This is the first time that the Metropolitan road has had to cross the Seine underground, as in the two lines which now cross the river a special bridge was erected in each case. Where the line is brought across the two branches of the Seine which surround the Island a system of metallic caissons is used. In the river bed are sunk elliptical-section caissons built of structural iron, and the interior of the caisson corresponds to the general section of the tunnel, leaving room for the two tracks. Thus the tunnel is continued below the river bed at a considerable depth. A similar construction is used where the road crosses the island.

It is on the left bank of the Seine that one finds the most interesting part of the work. A mass of structural iron work more than 200 feet long is now building at the surface, and it is to be sunk to a depth of 75 feet in order to bring it in line with the part which is already laid in the river. As shown in the picture, there is an elliptical section to take the tracks, whose width is about 50 feet. The whole will be covered with steel plate so as to be watertight, and under the main structure is a portion which is open at the bottom so as to form the caisson proper. In it the workmen will excavate the ground on the compressed-air system, and the whole structure will be lowered gradually down to the proper level.

At the other end, next the river, the tunnel structure will expand out into an immense cylinder, which is to form the underground station of the Place St. Michel. Like the other part, the whole will be plated with sheet steel. This station will be one of the most important on the line, and the metallic structure had to be laid out so as to allow for two superposed lines, seeing that a second underground road is to cross at this point. The latter is the Sceaux steam railroad, which is to pass along the Seine, and it will run in a separate tunnel above the Metropolitan, with access between the two at the underground station. When completely sunk in the ground the top of the metallic structure will lie about three feet below the ground level.



LARGE PARIS SUBWAY STRUCTURE BUILT ON SURFACE, BUT TO BE SUNK AS APPROACH TO SEINE TUNNEL.

Production of Rubber.

Exports of rubber from Brazil continue to grow, and the present year promises to show a larger increase than ever, according to the report of Consul-general Anderson of Rio de Janeiro. The entries at Manaos and Para from July, 1905, to March, 1906, aggregated 32,840 tons against 31,590 tons in the corresponding period of 1904-05, and 29,080 tons in the 1903-04 period. At the two principal rubber-shipping ports of the republic during the month of May there were 60 tons more exports than in the corresponding month last year, and 760 tons more than in the corresponding month of 1904. The entries in January this year, 5,710 tons, broke the record in the history of rubber exports from Brazil or any other country. The United States has been taking considerably more than half of the entire crop, and present indications are that the proportion of the crop going to the United States this year will be larger than usual.

The Removal of Overhead Wires in Boston.

For several years the work of clearing the streets of Boston of poles and overhead wires (except, on some streets, those used for street railways) has been in progress. The work is done chiefly by the companies owning the circuits, but under the direction of the Wire Department of the city, of which Patrick J. Kennedy is commissioner. Adopting a wise policy, the city government assigns a certain reasonable area each year in which the overhead wires must be removed, and thus the work proceeds steadily, but is not unduly onerous on the companies. The annual report of the Wire Department for the year ended January 31, 1906, has just been published, and from it the following facts are taken:

The prescribed district for 1905 was Maverick Square and Meridian Street, East Boston, from Sumner Street to the Chelsea boundary line, a distance of 5,311 feet, and Main Street, Charlestown, from Water Street to Charles Street, a distance of 5,280 feet, exceeding by 31 feet the distance authorized by law, namely, two miles per year.

Standing on Maverick Square and Meridian Street were 82 poles, supporting about 143,000 feet of wire, owned by the Edison Electric Illuminating Company, New England Telephone and Telegraph Company, Fire Alarm Branch (Boston Fire Department), Police Signal Service (Boston Fire Department), and others. Wires on most of these poles were in a very crowded condition, crossing and recrossing the streets, in many places over the trolley wires of the surface railways.

On Main Street, Charlestown, in the sections prescribed for the placing of wires underground, there were 93 poles, supporting about 130,000 feet of wire, owned by the Charlestown Gas and Electric Company, New England Telephone and Telegraph Company and the Edison Electric Illuminating Company. On the west side of the street was a heavy line of chestnut poles, on which were telephone, high and low and extra high-potential wires. These wires (extra high-potential excepted) crossed over the "L" structure in a number of places.

The removal of poles and wires has been necessarily slow, owing to the failure of the Board of Aldermen to approve of pole locations selected by the companies for distribution purposes.

Much of the time of the inspectors has been given to examining new work, new installations being largely in excess of previous years, the number of inspections of this kind being 10,354.

As to the general work of the division, it has been carried on much the same as in past years, the usual attention being given to defective work

Harrison Avenue, South from Dover Street, with Overhead Wires.

Harrison Street, South from Dover Street, with No Overhead Wires except Trolley Wires.

THE REMOVAL OF OVERHEAD WIRES IN BOSTON.

and its correction, the selection of new pole locations, setting, resetting and removal of poles, erection of derricks, with the stringing of derrick guys, moving of buildings through streets where overhead wires are stretched, examining and approval of underground conduit locations, inspection of underground conduit service connection and other construction, inspection of all overhead wire installations and the investigation of all reports of exterior fires and accidents supposedly of an electrical origination, those found to be of such nature being made the subject of special reports.

That portion of the city which has been selected in accordance with the law as the underground district for 1906 is Albany Street, Hampden Street and Dudley Street, from Dover Street to Magnolia Street.

Considerable inconvenience has been experienced by the various electrical companies, owing to the changes made necessary along Washington Street and the adjacent streets on account of the subway construction. Nearly every tube and pipe has had to be changed in a more or less degree, and in consequence of this considerable temporary work has been necessary, in order that the service between the companies and their customers and subscribers might be maintained uninterrupted.

While this work is still in an unfinished state, everything is being done to hasten it, especially in those sections where the actual subway work has been finished; and all underground electrical changes in the upper portion of Washington Street should be completed within a few months.

Some idea can be had of the extensiveness of these changes when it is stated that the Edison Electric Illuminating Company alone has already laid in Washington Street and cross-sections over 53,600 feet of duct, and this simply to take the place of that previously in the ground and to provide for future customers. This company has, perhaps, had more to do and to contend with along the line of the subway than the other companies, as it early decided that as such extensive changes were necessary it would at the same time remove its solid tubes from the streets and replace them with the duct or drawing-in system. This has of course necessitated much more work than otherwise would have been the case.

In some cases manholes have been built in the streets and the covers located in the cross-walks—a thing avoided as much as possible, but which in some cases was unavoidable, owing to the fact that at these points the underground construction has been so crowded that almost every available inch of space has been occupied.

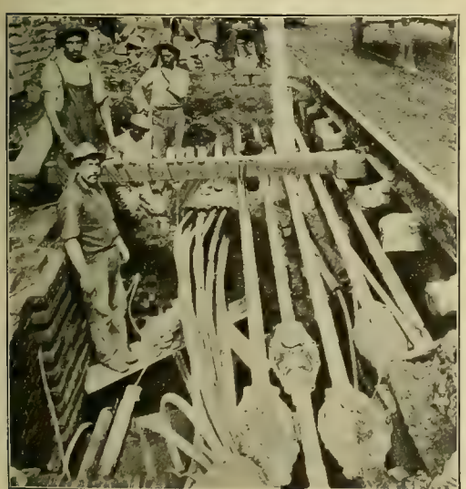
In a number of instances two covers, marked Edison Electric Illuminating Company, have been placed side by side, only a few feet apart. It does not, however, follow that there are two manholes, as this is done in cases where what is called an "accessible distribution box" has been installed in a manhole. This accessible distribution box differs from the old distribution or catch-box, inasmuch that, while the old box was practically the same as to the top, cover and general inside construction, it was placed directly in the ground and there connected to the feeders and mains, and so was only accessible from the top unless the ground around the box was opened; but in the case of the new-style box it is placed in the top of one side of a manhole, and so is accessible from the bottom via the manhole, so that not only the catches are within easy reach without opening the street, but the connections and cables can be reached at any time simply by entering the other opening of the manhole. About 20 of these boxes have been installed during the year along Washington Street.

From February 1, 1905, to January 31, 1906, the amount of wire removed by the Wire Department was 268,915 feet. The amount of wire removed by owners was 1,818,859 feet.

The following table shows the character of cables used by the various companies in Boston:

METHOD EMPLOYED IN DRAWING CABLE IN 1894.

METHOD EMPLOYED IN DRAWING CABLE IN 1906, WITH AUTO TRUCK.



BOYLSTON STREET, NEAR WASHINGTON STREET, BOSTON, SHOWING CONDITIONS PREVIOUS TO SUBWAY CONSTRUCTION.

CHARACTER OF CABLES USED BY THE VARIOUS COMPANIES IN BOSTON.

Company.	Kind of Insulation.	Sizes.
American District Telegraph Co.	Rubber	20 conductor.
Boston Automatic Fire Alarm...	Rubber	15 conductor.
Boston Auxiliary Fire Alarm....	Rubber	4 conductor.
Boston District Messenger Co...	Rubber	2 conductor.
Boston Elevated Railway Co....	Rubber and paper	From No. 6 to 1,000,000 C. M.
Boston Consolidated Gas Co.....	Rubber	No. 6.
Charlestown Gas and Electric Co.	Rubber and paper	No. 6 to 0000.
Edison Electric Illuminating Co.	Rubber and paper	No. 6 to 500,000 C. M.
Fire Alarm Branch (B. F. D.)....	Rubber	4 to 19 conductor.
Holmes Electric Protective Co..	Rubber	10 conductor to 13 pair.
Massachusetts Tel. and Tel. Co.	Paper.....	25 to 100 pair.
Mutual District Messenger Co...	Rubber	10 and 20 conductor.
New England Tel. and Tel. Co..	Paper.....	30 to 480 pair.
Postal Telegraph-cable Co.....	Paper.....	12 conductor.
Police Signal Service (B. P. D.).	Rubber	7 conductor.
Western Union Telegraph Co...	Rubber and paper	15 to 125 conductor.

TABLE SHOWING THE UNDERGROUND ELECTRICAL SERVICE OF BOSTON.

	To 1905.	1905.	Jan. 31, 1906.
Feet of conduit.....	1,346,403	62,095	1,408,498
Feet of single duct.....	8,697,645	423,699	9,121,354
Feet of cable.....	10,802,832	597,766	11,400,598
Number of manholes.....	6,106	282	6,388
Number of service connections....	12,597	794	13,391
Feet of solid tubing (Edison).....	534,283	14,129	548,412
Distribution boxes (Edison).....	482	7	489
Park boxes.....	145	.....	145

Electric Freight Service Begun in Chicago Tunnels.

Underground freight service was begun in Chicago on August 15th through the tunnels of the Illinois Tunnel Company. The first consignment was from the freight sheds of the Chicago and Erie Railroad, Clark and Fourteenth streets, to the Monarch Company, across the river. The trip, two miles, was made in 16 minutes. From the same yards the next two cars started for the freight yards of the Chicago, Milwaukee and St. Paul road, and two more went to the storage warehouse of Marshall Field & Co. on the West Side. The former trip was made in 24 minutes and the latter in 12.

At the beginning of business there were present, besides officials of the tunnel company, a number of steam-railroad men interested and several city officials.

About 45 miles of the tunnel is now completed, several branches extending well beyond the river on the North and West sides. The tunnel company now is equipped with 67 electric locomotves and 400 freight trucks. There are being built an additional complement of 15 locomotives and 250 trucks. The company has 40 receiving stations and is connected with nine regular railroads. The roads now ready for service are the Erie, Alton, Rock Island, Wabash, Santa Fe, Great Western, Monon, Baltimore and Ohio, Milwaukee and St. Paul, and contracts have just been entered into between the tunnel company and the Chicago and Eastern Illinois and the Illinois Central.

The Chattanooga (Tenn.) Railway Company will expend $20,000 for improvements.

WESTERN ELECTRICIAN

EVERY SATURDAY.

PUBLICATION OFFICES:
507 Marquette Building, - CHICAGO.
TELEPHONE, MAIN 1746.

Eastern Office, 150 Nassau Street, New York.
Telephone, 5220 Beekman.

Trade Supplied by Western News Co.

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DATES AHEAD.

Colorado Electric Light, Power and Railway Association (annual convention), Denver, September 18th to 20th.
Illinois State Electric Association (annual convention), Springfield, Ill., September 19th and 20th.
Central Electric Railway Association (outing), Robinson Park, near Fort Wayne, Ind., September 26th.
Old Time Telegraphers and Historical Association, and United States Military Telegraphers (annual meeting), Arlington Hotel, Washington, D. C., October 9th, 10th and 11th.
American Street and Interurban Railway Association (annual convention), Columbus, O., October 15th to 19th.

ONE INTERESTING and recondite investigation which formed the subject of an evening lecture at the recent meeting of the British Association was "The Electrical Signs of Life and Their Abolition by Chloroform." The lecturer was Dr. A. D. Waller, and he illustrated his address by lantern-slide pictures and diagrams. According to the London Times, the speaker began by stating that all the mechanical and chemical changes manifested in living organisms were accompanied by electrical changes, and, since these were capable of most delicate measurement, the intensity or amount of life in any living fiber or substance could be measured most accurately by ascertaining the magnitude of the electrical changes to which it gave rise on stimulus from some outside source. The methods by which this measurement of electrical change in living nerve fibers had been made and recorded photographically were then described in detail, and photographic records of the electrical changes obtained by stimulus from an outside source, with the living matter from the crystalline lens of the eye, from the chlorophyll in green leaves, from vegetable seeds, from a flower, and from a hen's egg, were exhibited. The effects of gases and anesthetics upon these phenomena were then dealt with. Chloroform was the most effective of the anesthetics experimented with, all electrical signs of life being totally abolished by its use. Ether was less effective, and therefore much more safe for use as an anesthetic, since the suppression of the electrical response to stimulus was only temporary and not permanent, as in the case of chloroform. The action of alcohol and of carbonic-acid gas upon nerve fibers was also described. The electrical result of stimulus was called by the lecturer "blaze" current; this, in his opinion, was a universal sign of life, in all tissues and organs, from both the animal and vegetable worlds.

This investigation, which is most interesting, is along lines similar to the researches of Loeb and others at the University of Chicago. Gradually the fact seems to be established that there is some connection between electricity and life. If electricity is bound up in some mysterious way with the life principle, and if matter in the last analysis is simply electric charges, then indeed is the province of electricity in the universe one of overwhelming importance.

COTTON MILLS are employing electric drive in increasing number in the South, and the newer method of transmitting power about the factory is proving popular. Each year the percentage of electrically driven mills is greater, and in no case has a factory discarded electricity after having installed it. Usually current developed from waterpower is employed, and the existence of a number of enterprising hydro-electric power companies has a direct bearing on the situation. In many cases these transmission companies offer to supply power cheaper than the consumer can make it himself by burning coal under steam boilers. Sometimes this saving is shown to be as high as 40 per cent. in the power and lighting bill, and of course this economic advantage makes the position of electric power unassailable where cheap current from waterpower is available. One thing favoring waterpower development in the Southeastern States is that the rainfall of the Appalachian region is said to be greater than that of any other area of equal size in the country. Thus the power is more constant and reliable than is sometimes the case in waterpower utilization. A pretty sure head of water may be assumed, and it is said that only once in the last six years have the hydro-electric companies suffered any inconvenience from scarcity of water.

Showing the far-reaching effect of this latter-day development, it has been asserted within the last four weeks that a great railroad building from the coal fields of West Virginia to the Atlantic coast, passing through the mill section, has decided to change its route on account of the fact that electric power for sale to the mills promises to reduce the consumption of coal to a non-paying basis. This report may not be true, but the mere fact that it is widely circulated shows the importance now attached to the use of electric power in southern cotton mills.

But not only is the electric power cheaper; it is better. It is more easily controlled and apportioned where it is needed, and it has the great advantage of cleanliness, particularly appreciated in a cotton mill. Drippings from the long lines of overhead shafting heretofore characteristic of the mills are happily a thing of the past when the electric drive is introduced. When, therefore, this superior method of driving the mill machinery can be had at less cost than steam power, it is no wonder that electric drive is becoming increasingly popular among the mill-owners of the South.

IT IS INSTRUCTIVE to observe the rather unexpected and diverse uses made of electrical apparatus in scientific work. Thus Director George E. Hale of the Solar Observatory on Mount Wilson in Southern California, in his report to the Carnegie Institution, says that, in photography of the sun with the spectroheliograph, it was found that the heating of the mirrors by the sun produced marked changes of focal length, together with such evidences of astigmatism as would be expected to follow from the distortion of the plane mirrors. For a time it seemed probable that the use of the telescope would be seriously handicapped by these changes of focal length, not only because of the poor definition caused by astigmatism, but also because the long exposures required with the spectroheliograph would be impracticable under such conditions. But here is where the little electric fan came into play. The experiment was tried of cooling the mirrors with a blast of air after they had been exposed for some time to the sun. The good effect of this treatment was shown by a considerable change of focus toward the normal position. Electric fans were accordingly installed to blow each of the three mirrors while they are exposed to the sun during the adjustment of the spectroheliograph, and between exposures, when the mirrors are also shielded by a canvas screen. The success attained in decreasing the exposure time with the spectroheliograph was marked.

Again, in the endeavor to produce fused-quartz mirrors the electric furnace was used for fusing the quartz crystals, and this method proved more successful than others, in that the disks thus produced contain fewer bubbles. Nevertheless the bubbles still remaining are too numerous to permit a satisfactory optical surface to be given the quartz disks, and experiments in remelting the surface by the electric arc have not succeeded, as was hoped, in removing the bubbles from a superficial layer of sufficient thickness for figuring.

Further, in the work with the spectroheliograph, we are told that the solar image and plate are fixed, and the spectroheliograph is moved across them by means of a small electric motor. This is belted to a large wooden pulley on a screw supported by the wooden base and running in a nut attached to the moving platform.

In making photographs of the spectra of certain bright stars there is also some interesting electrical work. The spectrograph used in the work with the Snow telescope has collimating and camera lenses of five inches aperture and 13 feet focal length, mounted rigidly, with the slit, grating-mount and plate-holder on a single massive stone pier. The large plane grating was ruled on Rowland's engine many years ago. It is mounted in the front of a cubical brass box, and its rear surface is bathed by water, which is constantly stirred by paddles revolved at slow speed by a small electric motor, supported on the wall of the room. Special precautions are taken to prevent vibration of the grating from the motor or its connections. A bulb containing saturated ether vapor is immersed in the water, which is heated by two small incandescent lamps controlled through a relay. If the temperature rises too high, the current is cut off by the expansion of the ether vapor, which moves a column of mercury, and thus breaks contact in the relay circuit.

It will thus be seen that electricity plays a useful part in a modern astronomical observatory. But those who remember Dr. Hale's old Kenwood Observatory in Chicago, with its ingenious adaptations, described several years ago in the Western Electrician, will not be surprised. At Mount Wilson there is a power house, with gasoline engine and dynamo. Storage batteries of 30 and 60 cells are placed in a separate underground building of concrete. The smaller battery is used for special purposes, such as supplying power for the spectroheliograph motors, where great constancy of voltage is necessary to give photographs free from lines or bands due to irregular motion.

International Association of Municipal Electricians.

The eleventh annual convention of the International Association of Municipal Electricians was opened in New Haven, Conn., on August 15th and continued through three days. The sessions were held in the aldermanic chamber of the City Hall, which was tastefully decorated. Louis M. Ullman, president of the board of police commissioners of New Haven, presided at the opening at 10 o'clock on Wednesday morning. About 200 delegates were present, many of them accompanied by their families.

T. C. O'HEARN,
President International Association of Municipal Electricians.

Governor Henry Roberts was present and welcomed the delegates to the state. He said that the spirit of invention was widespread throughout Connecticut, and that this had been the means of building up many thriving towns. Mayor John P. Studley of New Haven welcomed the electricians to the city, and he promised to prove to the visitors that New Haven is one of the beauty spots of the East. He said that New Haven was a city of peculiar interest to the electricians as the home of the telephone, and also that there have been many important parts of the fire alarm invented there.

Jerry Murphy of Cleveland, Ohio, president of the association, read a short address. Before speaking President Murphy was presented a handsome gavel made by the members of the New Haven fire department. It was constructed of red cedar and native elm.

The first report called for was that of the electric-light and power department. A. S. Hatch of Detroit, Mich., presented the report, from which the following is taken:

REPORT OF THE ELECTRICAL DEPARTMENT.

The progress during the last year in lighting and power has been in the line of high-tension distribution, particularly for the purpose of connecting neighboring towns into a single network with the system of a large city, and with it the building of larger stations and larger generating units. The work of the association during the last four years with respect to line construction has been taken up by these companies so that with the installing of the heavy telephone leads in conduits and distribution, particularly for the purpose of connect- has been a tendency to use the high-tension poles of the power companies, keeping the low-tension wires below the high.

Railway work shows much progress, particularly in suburban lines, which are adopting alternating current, and instead of using 550 volts between trolley and rail are using 3,300, and in some cases 6,600. The greatest economy is with roads having a light service, since the car equipments cost materially more for alternating than for direct current, and also the power consumed is more; but the investment costs for line and sub-stations as well as their operation is less. Steam roads are also adopting electricity, but it is for their most severe work, such as on long grades and in tunnels. They are using both alternating and direct current under very similar circumstances.

Probably the greatest progress has been made in electrochemical industries, and waterpower privileges have increased in value accordingly. The key of this industry is in the ability of electricity to separate the elements of chemical compounds so they may be reunited in any desired manner. Thus, what have been considered waste products in other chemical works are being made into useful ones. One illustration is in common salt. This is being separated into chlorine and sodium, which are again united with other elements to produce several compounds, and undoubtedly many more uses will be found for it.

The problem today is to have enough light where needed and still not too much—that is, lamps of different wattages burning on the same circuit. There are places in a city where 450 watt lamps are required and others where a 250-watt lamp or even less would be sufficient. Flame lamps giving a high candlepower have been tried, but have not proved satisfactory on account of their bright light being more than desired. An attempt to decrease the watts per lamp has resulted in an irregularly burning lamp.

The greatest fault with the magnetite lamp is outages due to a slag forming on the magnetite pencils. The secret of the flame lamp is in the carbons used being impregnated with such salts as produce a high radiating power, principally calcium salts. The arc is more a flame than an arc due to the extreme length of arc permitted by the vapor being a better conductor than air. The light is of a golden tint rather than the violet light of the ordinary arc, and, using 300 to 350 watts, give about five times the light of a 480-watt lamp with common carbons.

The small arc lamp consuming about 280 watts and using a 5-16-inch carbon is meeting with success for interior lighting. It is the result of a demand for a substitute for the gas mantle and points to smaller arcs for street purposes. There seems to be no reason why the flame arc should not be made smaller except that the carbons will have to be made small and the voltage across the arc low, and their limit may prevent a lamp being built for less than 200 watts. The latest arc lamp is a combination of a Nernst glower and arc lamp so that the refractory material bridges the carbon pencils.

The improvement in incandescent lamps is in the use of metallic filaments giving from 1½ to 2½ watts per candle. A graphitized filament lamp has been installed at Lowell, Mass., to take the place of gas lamps, and is claimed to be adapted to series circuits giving a whiter light than the ordinary lamp.

On account of the use of alternating current for central stations, the problem of rectifying it for direct-current apparatus, such as vacuum tubes and magnetite lamps, has been attempted for several years in an endeavor to get a more efficient apparatus than the motor generator. The chemical rectifier gave much promise, but the most efficient device seems to be the mercury arc. This rectifier can be used on alternating systems of as low as 25 cycles without motor generators. Its efficiency is as high as 88 per cent. on full load, while the motor generator is only 62 per cent. The rectifier tubes are claimed to have a life of 500 hours. The principle of the rectifier is that of the Cooper-Hewitt lamp. The terminals of an autotransformer form the positive electrodes, and the negative is at the bottom of the tube and connected with the middle point of the transformer by the work to be done whether charging storage batteries or running arc-light circuits. Thus all the positive alternations pass from one electrode to the neutral point and all negative alternations from the other, so the rectifier not only provides a unidirectional current but also one of constant strength. However, in order to get a direct current of a given voltage the alternating must be about three times as much.

Mr. Hatch added a list of representative cities to show the price being paid in different cities for street lighting. He also presented a summary of a report made to the National Electric Light Association comparing private and municipal plants.

OTHER BUSINESS.

The protection of municipal electricians by the civil-service laws was a topic which consumed much time on the first day. President Murphy read a paper in favor of placing municipal electricians under civil-service rules. Will Y. Ellett of Elmira, N. Y., opened the discussion by saying that he hoped to see the day when the superintendent of fire-alarm and his assistants would not be under the whim of politicians. Others who took part in the discussion were Walter M. Petty of Rutherford, N. J.; J. B. Yeakle of Baltimore, Md.; H. C. Bundy of Watertown, N. Y.; William A. Barnet of Bridgeport, Conn., and A. S. Hatch of Detroit, Mich. Several of these speakers were opposed to the association interfering with the civil-service laws. It was finally voted that a committee take charge of the matter and report at the next annual meeting on the condition of the civil-service rules. This committee is composed of Messrs. Hatch, Petty and Yeakle.

A number of other good papers of interest to the electricians were read, including the following: "History of the Fire and Police Telegraph," by Adam Bosch of Newark, N. J.; "Camparison of Underground and Overhead Wiring, and the Relative Values of Single Rubber-covered Wire and Lead Incased Cable," by W. H. Thompson of Richmond, Va.; "Conditions Surrounding the Inspection of Wires in the Southwest (with special reference to the advisability of one inspector completing each inspection instead of several inspectors each doing a part of it)," by Clarence R. George of Houston, Texas; "Question Box," by Walter M. Petty of Rutherford, N. J.

The paper of Mr. George led to a lively discussion among the members. Captain William Brophy of Boston called particular attention to the danger of discarded or dead wires being left in the streets, citing instances of fatal results from this practice.

Upon reassembling at two o'clock W. Y. Ellett, chairman of the aerial construction department, presented an oral report.

Louis Gascoigne of Detroit, Mich., chairman of the underground construction department, said that he had no detailed report to make, but called on W. H. Thompson of Richmond, Va., to read his paper, "Comparison of Underground and Overhead Construction, and of the Relative Values of Single Rubber-covered Wire and Lead Incased Cable." The discussion of this paper took up the remainder of the time of the afternoon session.

The convention reassembled at eight o'clock for an evening session, the first business being taken up being the presentation of the paper by J. B. Yeakle of Baltimore, Md., "Details of Certain Auxiliaries to Fire-alarm Apparatus." After the discussion of this paper Mr. Petty of Rutherford, N. J., presented some of the questions from the "Question Box." This closed the evening session.

The ladies were given a trolley ride in the afternoon, and in the evening while the delegates attended the session of the convention the ladies enjoyed a band concert on the green.

The session on Thursday morning was given up to the discussion of Mr. Thompson's paper, several members having arrived during the night who were interested in the subject and wished to take part in the discussion. A sightseeing trip to Yale campus was enjoyed by some of the visitors on Thursday forenoon. In the afternoon a party was taken to the plant of the National Steel and Wire Corporation, where the visitors witnessed the drawing of wire from large steel billets. This industry is one of the largest and most important in New Haven. From the steel mills the steamer Hastings took the visitors down the sound as far as Trimble Islands, the trip offering an opportunity to see the operations on Connecticut oyster farms.

At the closing session on Friday the association considered invitations from Dallas, Tex., Atlantic City, N. J., Niagara Falls, N. Y., and Norfolk, Va., for the meeting place next year. It was decided to meet at Norfolk at the Jamestown Exposition.

The nominating committee reported the following list of officers for the coming year, and the report was confirmed:

President—T. C. O'Hearn, Cambridge, Mass.

First Vice-president—James Grant, New Haven, Conn.

Second Vice-president—Clarence R. George, Houston, Tex.

Third Vice-president—John Berry, Indianapolis, Ind.

Fourth Vice-president—W. H. Brodt, Troy, N. Y.

Secretary—Frank P. Foster, Corning, N. Y.

Treasurer—C. E. Diehl, Harrisburg, Pa.

Executive Committee—J. B. Yeakle, Baltimore, Md.; R. A. Smith, Norfolk, Va.; William Crane, Erie, Pa.; Jerry Murphy, Cleveland, Ohio; W. M. Petty, Rutherford, N. J.; T. F. Almon, St. Louis, Mo.; A. S. Hatch, Detroit, Mich.; W. H. Thompson, Richmond, Va.; G. F. McDonald, Ottawa, Canada.

Winnipeg to Build a Hydro-electric Plant.

Taxpayers of Winnipeg, Man., have passed a by-law to expend $3,500,000 on a power plant to supply all the wants of the city, and have engaged Cecil B. Smith of Toronto to report on the best methods to be adopted to get the best results for the expenditure. Mr. Smith made a proposal covering engineering, superintendence and inspection in connection with the power plant on the Winnipeg River, and transmission and transformation in connection therewith. It was agreed to appoint Mr. Smith at a salary of $10,000 a year on a contract for 2½ years. It was also agreed that Mr. Smith should be allowed to act as consulting engineer for the Ontario Power Commission if he did not devote more than three weeks in any year to this purpose. The engineer will be superintendent of construction, and the work is to be done by day labor. The power committee was also authorized by the council to make an offer to the Winnipeg General Power Company for its plant at Lac du Bonnet. Mr. Smith will take charge of the work on September 1st. The city of Winnipeg has taken the first tangible step toward the development of the power on the Winnipeg River. J. Wilson and 17 men have left for Lac du Bonnet for the purpose of surveying a right-of-way for a tramway to Pointe du Bois Falls. Mr. Wilson will have charge of the survey.

The Chilean Earthquake.

In the terrible earthquake in Chile on August 16th, by which and the consequent conflagration Valparaiso suffered most severely, electrical properties appear to have been severely damaged, although the reports are meager and conflicting. It is reported that electric and gas lights in Valparaiso were extinguished at the first shock, which came in the evening, and that the people groped their way about amid ruin and desolation in a pouring rainstorm. The electric-light plant is said to be ruined. On August 20th it was said that telephone communication with Santiago was resumed, but that the telegraph wires were still down.

A Berlin dispatch says that directors of the electric street railway of Valparaiso have cabled to the German Oversea Electrical Company, owner of the majority of the stock of the Chilean concern, that its power plants, machinery, equipment, tracks, cars and car sheds at Valparaiso have not been injured by the earthquake or fire. The dispatch adds that the workshops of the concern, the reserve power buildings, the storage-battery station and the arc lamps and wires have been considerably damaged. All the officials of the company escaped injury.

THE SMALL CENTRAL STATION.

Practical Hints on Its Construction and Operation.

CHAPTER VII. (*Continued*).

Steam Turbines.

The Allis-Chalmers Turbine.—This turbine is also of the Parsons type with improvements in detail of construction. It also usually has three drums of blading, with the corresponding balancing pistons. The details of construction of the spindle vary with the size of the turbine, being designed to give the necessary strength and stiffness, combined with minimum weight in order to reduce the load on the bearings. In the larger diameters the rings that carry the blades are made separate from the body of the spindle, as also are the balance pistons. These parts are provided with tapered fits and are assembled by pressing. Each of the separate parts is carefully balanced before assembling. After the final assembling the complete spindle is carefully and accurately balanced so as to prevent even the slightest vibration when running.

The arrangement of balancing piston in the larger sizes is one of the special features of the design. The large low-pressure piston is omitted and a smaller piston substituted at the opposite end, receiving steam at a higher pressure, as shown diagrammatically in Fig. 16. In this design the large balance piston has been replaced by the smaller piston (Z) at the low-pressure end of the turbine; this latter balance piston working inside the supplementary cylinder (W).

The blading is of peculiar and interesting construction. The roots of the blades are formed by special machinery and are then dovetailed into slots cut in a securing ring. These rings are semi-circular in form and are placed into dovetailed grooves cut in the surface of the spindle and cylinder, being held in place after insertion by key pieces, which are in turn upset into undercut grooves in the side of the holding grooves. In forming the blades a projection is left on the tip, and these, after the blades are secured at the roots, are inserted in suitable slots cut in a shroud ring, the projections being then riveted over, securing the shrouds to the blades. These slots are accurately spaced by special machinery. The shrouds are of channel section with the flanges projecting outwards, and after being put in place are turned to the proper diameter.

The Rateau Turbine.—This turbine is styled by its builder a "multicellular" turbine, from the fact that each moving row of blades is mounted on a ring which revolves in a separate cell or chamber, in the walls of which are the nozzles or stationary blades. The walls of each cell are of course pierced at the center for the passage of the shaft of the turbine, to which are riveted the various rings. This shaft is comparatively small in diameter, so that any leakage of steam from one cell to another along this shaft, this being the only place where there can be such leakage, is of necessity very small.

The moving rings are of pressed steel and to their rims are riveted the blades of sheet or wrought iron, and to the ends of these shroud rings. The walls of the cells are also of pressed steel, but are made in halves and fit into grooves cut in the cylinder or enclosing casing, making a steam-tight joint. There are only a few of the stationary blades or nozzles in the first cell, more of the same size in the next, and so on to allow for the expansion of the steam, until the entire circumference is taken up with blades, when the diameter of the cell is enlarged and the height of the blades increased. The moving wheels are of course fully bladed on the whole circumference.

There is one main admission valve of the double-seated poppet type, controlled by a differential valve gear and the usual spring-loaded fly-ball governor.

The bearing at the high-pressure end is supported by a pedestal fastened to the cylinder, while the others are on pedestals independent of the casing. They are babbitt lined with flooded lubrication. These turbines are often made with two cylinders, the exhaust from one passing the inlet passage of the other.

The Zoelly Turbine.—This, in principle and construction, is very similar to the Rateau turbine, and differs from it only in certain details. It has fewer sets of blades and has the entire periphery of the stationary rows filled with blades, allowing for the expansion by increasing the height of the blades. The moving wheels are of solid steel castings, highly polished, a row of blades being inserted in a dovetailed groove cut in the rim of each wheel. One side of this groove is formed by a steel ring riveted to the disk after the placing of the blades.

The bearings are similar to those used in other turbines of this type and are supplied with a continuous stream of oil circulated by a centrifugal pump driven from the turbine shaft. A thrust block at the low-pressure end holds the spindle in the proper position. The steam is controlled by a throttling governing system with a piston form of admission valve. This valve is operated by a powerful oil relay system directly controlled by the governor.

The Hamilton-Holtzworth Turbine.—Following very closely the lines of the Rateau and the Zoelly turbines, it differs merely in the construction of certain parts. The blading on the moving wheels are riveted, one row per wheel, between the two steel plates which form the wheel, these plates in turn being riveted to a steel hub mounted on the shaft of the Rateau type.

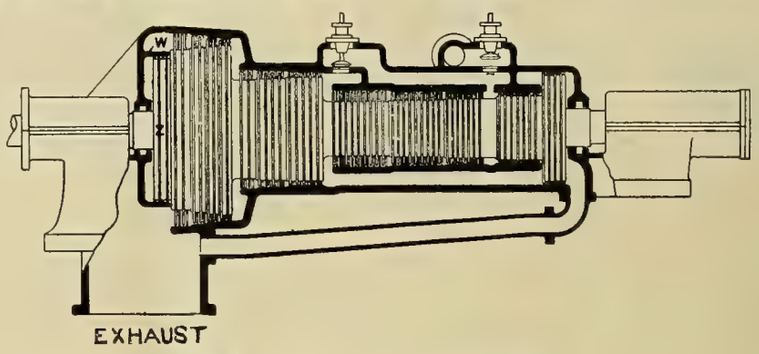


FIG. 16. ALLIS-CHALMERS STEAM TURBINE.

A double-seated poppet valve is used to admit the steam, and is controlled by a simple governing mechanism operated by the usual type of governor.

The number of the stages is about the same as in the Rateau, but expansion is allowed for by increasing the height of each row of blades as in the Zoelly.

Concluding Remarks.—Other turbines, to a considerable number, have been designed and suggested, differing from one or the other of the above but little, although details of construction are being constantly improved.

This chapter may well be concluded by the following quotation from the report of the National Electric Light Association's committee for the investigation of the steam turbine, presented June 8, 1906:

"The turbine situation has very materially changed since our first report [1904]. Today the steam turbine is recognized as a standard piece of apparatus, and turbines of some type are being installed in nearly all of the newer power houses. Turbines have been installed in a number of steamships built in Europe, and, we are informed, have been approved by the commission appointed by the British Navy for use in its battleships and cruisers. Although steam turbines for marine use are outside of the scope of this committee's investigation, it is interesting to note, however, that after a trial on merchant vessels of the Cunard Line, they are being introduced into new ships of the same line. This would indicate that confidence is placed in this type of prime mover by the engineers. During the discussion at the meetings of the committee it was decided that it was unnecessary to continue any further tests on economy, as there were now so many turbines installed in regular operation giving satisfactory results; and the most important matters receiving attention were the various details which go to make up reliability and insure continuity of service."

CHAPTER VIII.

Belting and Shafting.

Belting.—"There is nothing like leather" is an old saying, and it applies particularly to belting when giving the hard service required in electric-lighting stations. A belt made from pure oak-tanned leather, cut from short laps of the solid part of the hide, when not "filled" or "buffed," gives the best results, its smoothness of running and staying power being dependent on the quality and firmness of the leather used. Where the belt speed is high, it is desirable to increase the width and decrease the weight. A 14-inch light double belt will run smoother than a 10-inch heavy double belt. In all cases it is economy to order belts one inch wider than necessary, if the face of the pulley will permit; otherwise order the full width of pulley and increase the weight. Endless belts are always employed, and where the distance is too great to send a man to put them on, they can be ordered with opened ends and laps prepared and accompanied by the necessary cement and instructions for making clamps and putting together properly. The cleaner any belt is kept the longer its life.

Belts should be kept free from machine oil. When they are not pliable enough to hug the pulley closely, use a good quality of dressing made by any of the leading belt makers. Many good belts are ruined from the use of some inferior dressing or stuffing, caused usually by too much oil, which, by softening, stretches the belt out of shape.

The following is about the average price of belting:

Double-ply Endless Leather Belting.

Width, Inches.	Price, Per Foot.	Width, Inches.	Price, Per Foot.
3	$0.38	24	$3.17
4	.52	26	3.43
5	.65	28	3.70
6	.79	30	3.96
7	.92	32	4.22
8	1.05	34	4.49
9	1.19	36	4.75
10	1.32	40	5.28
11	1.45	44	5.81
12	1.58	48	6.34
13	1.72	52	6.86
14	1.85	56	7.39
16	2.12	60	7.92
18	2.38	64	8.45
20	2.64	68	8.98
22	2.90	72	9.50

Where restricted space or small diameter in the driven pulley requires the use of leather link belting, it should only be applied where the "pulling" side of the belt is the lower; otherwise regular endless belting and idlers are the more desirable. The life of the link belt is less than the ordinary endless.

The following rule will apply to finding the length of belt required where the dynamo engine or shafting is not set up, and it is desired to order the belt so as to put on as soon as the machinery is placed.

Add together the diameter in inches of the two pulleys and multiply the sum by 3.1416. Divide this result by two, reduce to feet, and add twice the distance in feet from center of dynamo pulley to center of driving pulley. The result is the number of feet of belting required. For instance, the dynamo pulley is 16 inches, the engine pulley 60 inches and distance between centers 16 feet four inches.

$16 + 60 = 76$ inches.
$76 \times 3.1416 = 238.75$ inches.
$238.75 \div 2 = 119.38$ inches.
$119.38 \div 12 = 9.95$ feet.
$9.95 + 32.8 = 42.75$ feet.
Length belt = 42 feet 9 inches.

The dynamo pulley should, in measuring for belt, be placed as near the driving pulley as the sliding base frame will permit, so that the maximum amount of adjustment may be had for taking up the slack due to the belt's stretching. In ordinary belting, if the exact measurement thus made is given, the belt manufacturer will make all the allowances for stretch and lap. Also give as nearly as possible the speed in feet per minute at which the belt will run.

Shafting.—Tests made to find the power used in shafting, pulleys and belting show that the amount lost in transmitting the load from the engine to the dynamos varies from six to 40 per cent. of the total horsepower of the engine, the average amount consumed being 12 per cent.

Accuracy in lining up shafting and pulleys is no less important than firm foundations, and adjustable pillow blocks are imperative, so that the slightest settling of the foundation may be immediately remedied by adjusting the pillow blocks.

An automatic oil-feed pipe line may be run,

through gravitation, from an elevated receiving tank to the bearings, the drip pipes conveying the oil after its passage through the bearings to the oil filter, and from thence elevated by a small steam pump to the receiving tank. The valves are so arranged as to regulate the flow of oil at a uniform rate to all bearings, or to any one bearing, at any required speed.

Following is the formula for prime or "head shaft" with driving pulley located not more than one foot from a main bearing:

$$\frac{\text{Dia.}^3 \times \text{R. P. M.}}{100} = \text{H. P.}$$

For second mover or "line shaft" the following is the formula:

$$\frac{\text{Dia.}^3 \times \text{R. P. M.}}{80} = \text{H. P.}$$

Rules for Determining Size and Speed of Pulleys.—In the following formulas, it will be understood that the term "driver" indicates that diameter of driving pulley is to be taken, and that

FIG. 17. CONSTANT-CURRENT TRANSFORMER.

the term "driven" indicates that diameter of driven pulley is to be taken.

First—To determine diameter of driving pulley, multiply diameter of driven pulley by its number of revolutions per minute and divide this product by revolutions per minute of driver.

Second—To determine diameter of driven pulley, multiply diameter of driver by its revolutions per minute and divide this product by revolutions per minute of driven.

Third—To determine speed of driving pulley, multiply diameter of driven pulley by its revolutions per minute and divide this product by diameter of driver.

Fourth—To determine speed of driven pulley, multiply diameter of driving pulley by its revolutions per minute and divide the product by diameter of driven pulley.

Driving and other extra heavy pulleys should always be located as near bearings as possible.

CHAPTER IX.

Electrical Equipment—Generators—Switchboard.

Selection of Apparatus.—In the foregoing chapters the reader has been given an introduction to the steam equipment required for the successful operation of an electric-lighting plant. The chapters that follow will be devoted in a similar manner to the electrical equipment and construction. No attempt will be made to give any particular style or make of apparatus a preference, nor will any given system of lighting be prescribed. Conditions differ so widely that any attempt at an absolute recommendation would be ridiculous. Different lighting systems will be described, and the interesting points in each system brought out.

The selection of a particular system of lighting for any given set of conditions and requirements should be left to the judgment of a thoroughly competent engineer who has been fully informed as to what the needs of the situation are and what amount of money is to be spent.

Lighting Systems.—The comparatively recent introduction of the series alternating system of electric lighting and the even more recent appearance of the Nernst lamp put a somewhat difficult problem before the engineer of today when he is called upon to recommend a lighting system. The Cooper Hewitt mercury-vapor lamp, the Moore tube lighting system as well as the new metallic-filament incandescent lamps give some ground for the belief that the future will see a system of electric lighting, both for outside and interior work, quite different from anything now in commercial use. At the present writing, however, we have only to deal with what is the established practice of the present day.

The methods of electric lighting now employed or which have been in vogue in the past are principally as follows:

Direct-current series arc system.
Direct-current multiple-arc system.
Alternating-current series arc system.
Alternating-current multiple-arc system.
Alternating-current series arc and incandescent system.

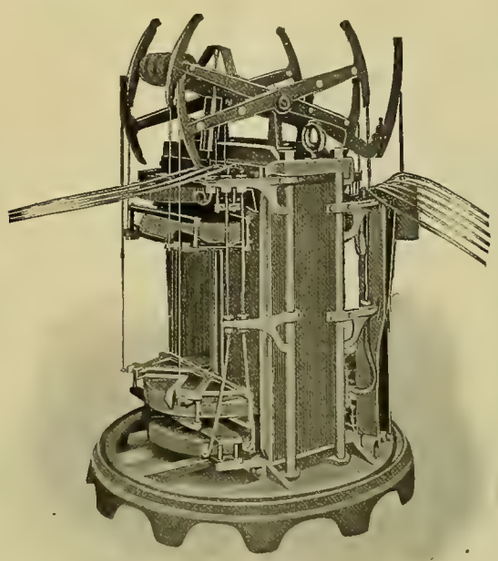


FIG. 18. CONSTANT-CURRENT TRANSFORMER WITH COVER REMOVED.

Alternating-current series incandescent system.
Nernst alternating-current multiple system.

Of the above systems, several will be described, with an attempt to determine for the purchaser the best and most economical system to be employed under different conditions and surroundings.

Series Alternating System.—The system best suited to average conditions where the amount of money to be invested is a limiting factor and the ends to be reached with this amount are somewhat extensive is the series alternating system. This system requires an alternating-current generator, constant-current transformer, the necessary line wire and lamps, and the other accessories customary with all electric-light installations. Although the alternating-current arc lamp takes a greater machine capacity to operate it than the direct-current arc, still it requires, on the other hand, less attention and fewer carbons in a year's run. The cost of operating this system, figured from the viewpoint of the wattage output per lamp, is greater for a given number of lamps than that of any of the other systems, but a counterbalancing gain is realized through fewer outages, lower repair bills and a considerably less first cost.

Another feature of this system of lighting which will particularly appeal to the prospective purchaser in heavily treed towns of 4,000 inhabitants and less is the possibility of operating both arc and incandescent lamps on the same circuit. We refer here to lamps used for outside illumination only. Towns of the size mentioned never require more than 60 arc lamps on the street circuit. From all arc lamps down to no arc lamps and all incandescents the series alternating-current system operates equally well.

In a town where the shade trees on the side streets are so numerous as to make the use of arc lamps in the residential parts next to impossible, the outside incandescent lamp is most serviceable. The business section of such a town will of course be suited to the operation of arcs, and this condition can be met satisfactorily and economically, both styles of lamps being operated from the same generator. The series circuit or circuits can be strung from the constant-current transformer installed in the station, and all lamps, both arc and incandescent, which will be connected in series, will be taken care of.

The constant-current transformer before mentioned will keep the current at the proper amperage. The regulation of the well-built constant-current transformer is such as to insure a perfect working system with a minimum number of attendants and extremely small repair bills.

Commercial circuits for house and store lighting may be strung on the same poles as the street-lighting circuits, thereby doing away with the additional cost of a special line. Although this construction will answer in a great many cases, yet occasions will arise where it will become necessary to build short sections of pole line in addition for the use of the commercial circuits alone. These will of course merely be extensions of the street-lighting pole line.

The line transformers should be installed on poles so situated as to be easily reached with feeders from a number of consumers' houses without requiring the run to any one house to be extremely long while another to the same transformer is very short. By distributing the transformers properly, customers can be supplied with a practically equal voltage or pressure, and long feeder wires done away with. Again, properly locating the line transformers will materially decrease the first cost of the plant. The installation described is commonly called the tub system, the name originating with this particular constant-current transformer, which is frequently called a tub transformer. (See Figs. 17 and 18.)

When the demand for current becomes so great as to require the addition of a second generator, the street-lighting circuit should be operated from one machine and the commercial circuit from another.

[*To be continued.*]

Work on the Philadelphia Subway and Elevated.

The Rapid Transit Company of Philadelphia has awarded a contract for the construction of eight passenger stations along the line of the Market Street elevated road. The stations will be constructed of steel framework, covered with sheet copper. The interior work will be of red oak. Each building will be supplied with waiting rooms for men and women and ticket offices. The platforms will be 300 feet in length. It is the desire of the traction company to place the section of the subway west of City Hall and the elevated line in operation as early in November next as possible. While the elevated stations are under construction, the Smith Contracting Company will vigorously push the subway station work at Fifteenth and Market streets. This will be one of the largest underground stations in the world. It extends from the east side of Sixteenth Street to City Hall on both sides of Market Street, and entrances are being made from Broad Street Station and the Arcade Building. This station will be occupied within the next 60 days.

The temporary loop of the subway being made west of City Hall will be ready for use within 60 days. Until the elevated stations are completed the surface line now operating in the subway will use the temporary loop. As soon as the elevated section is opened to the public many cars will be added to the service.

Municipal Street Railways Proposed in Seattle.

A dispatch from Seattle, Wash., says that the City Council in a special session has accepted plans for a municipal street-railway system and fixed September 12th as the date on which the question will be submitted to a vote of the people. The plans, drafted by City Engineer Thomson, provide for a system covering the city, with the exception of streets on which the Seattle Electric Company has franchises extending until 1939. The cost will be $7,569,000. Of this sum it is proposed to vote bonds in the sum of $1,272,000 against the general credit of the city to begin construction work. The remainder, according to the plan, will be secured on bonds backed by the earnings of the system. As viewed by opponents of municipal ownership the service outlined in the plans adopted covers only the outlying districts of the city, leaving the richer section to the local company.

The Pittsburg Reduction Company is said to have obtained absolute control of the extensive electric power facilities at Massena, N. Y. The company bought the controlling stock of the St. Lawrence County Electric and Water Company, capital $100,000; the St. Lawrence Water Company, capital $100,000, and the Massena Electric Light and Power Company, capital $50,000. The company recently purchased the St. Lawrence River Power Company, which owns the canal between the St. Lawrence and Grasse rivers.

The Spokane and Inland Railway.

In the Western Electrician of October 14, 1905, announcement was made of a new single-phase railway which was projected to run between Spokane, Wash., and several neighboring cities, and since that time the general plans of the system have been completed, contracts for the equipment let, and the construction work is now practically finished. As this road embodies a number of new features in electric-railway work, an outline of some of its important characteristics will be of interest.

The railway was originally incorporated under the name of the Spokane Interurban System, with a capital of $3,500,000, the incorporators being well-known local capitalists. The principal terminal of the road is Spokane, from which the line runs south through Waverly, Rosalia, Thornton and Colfax, which is the southern terminus at present, although the road has been surveyed, and will be eventually extended to Penawawa, Wash., or Lewiston, Idaho. A branch leaves the main road approximately midway between Spokane and Colfax, and extends to Palouse City. The Y-connected system between Spokane, Colfax and Palouse City is about 106 miles in length. The roadway and overheady construction have already been completed.

In addition to its railway business, the company proposes to transmit and distribute electric current for lighting and power, both in the city of Spokane and in the towns through which its lines pass. The country traversed by this road produces large quantities of wheat and fruit and is not provided with any railroad transportation. This insures a large freight business for the new road, as the long wagon haul to the steam railroads will be avoided. For this reason the electric road is receiving the hearty support of the farming interests along its route.

There are three classes of service to be maintained—passenger, mail and express, and carload freight; and after a careful consideration of the various systems had been made, the Westinghouse single-phase alternating-current system was adopted as being economical in first cost as well as in operating expense, besides permitting the use of locomotives for a system of heavy traction which would have been impracticable with a direct-current system. The cars of the Spokane and Inland enter Spokane over the tracks of the Spokane Traction Company, which operates a 600-volt direct-current system, and this requires the use of both direct and alternating current on the interurban cars.

Power purchased from the Washington Water-power Company is used for the operation of this road. It is delivered as 4,000-volt three-phase current of 7,200 alternations to a frequency-changing station about 10 miles south of Spokane. This station will contain four motor-generator or frequency-changing sets, each of a normal rating of 1,000 kolowatts, consisting of a 1,000-horsepower 60-cycle three-phase 4,000-volt induction motor, a 1,000-kilowatt 25-cycle 2,200-volt single-phase alternator of the revolving-field type, and a 750-horsepower 550-volt direct-current generator, which is to float on a storage battery acting alternately as a motor and as a generator. These three machines will be mounted upon a single bed-plate and will be provided with ample bearings. There are three exciter sets for the alternators, each consisting of a 75-horsepower three-phase 4,000-volt induction motor and a 50-kilowatt direct-current generator. A 20-panel switchboard, electrically operated oil circuit-breakers and lightning protective apparatus complete the equipment of the frequency-changing station.

The 2,200-volt 25-cycle current is stepped up to 45,000 volts by means of four 1,250-kilowatt oil-insulated water-cooled transformers, and at this pressure is transmitted to 15 static transformer sub-stations. Each sub-station is equipped with two 375-kilowatt transformers of the oil-insulated self-cooling type, which step down the current from 45,000 volts to 6,600 volts, which is the trolley-line voltage. The cars and locomotives operate under three different potentials—6,600 volts alternating current in the country, 700 volts alternating current in the small towns, and 600 volts direct current in the city of Spokane.

The trolley line is of the Westinghouse standard catenary construction, with a No. 000 wire carrying 6,600-volt alternating current. The high-tension transmission lines are No. 2 copper wires.

The electrical equipment of both the passenger and the express cars is identical and consists of four Westinghouse 100-horsepower alternating-current railway motors per car, which will maintain a schedule speed of from 35 to 40 miles per hour. The locomotives are equipped with the same type of motors, but the latter are each 150-horsepower capacity. Both the motor cars and the locomotives are operated on the Westinghouse multiple-unit control system.

These locomotives are designed to handle a general carload freight business and are capable of hauling seven standard freight cars fully loaded at about 30 miles per hour on a level track. They will operate on the 6,600-volt and 700-volt alternating-current lines and on the 600-volt direct-current line. Both pantagraph and wheel trolleys are used, as shown in the accompanying illustrations, the pantagraph trolley being for operation on the 6,600-volt circuit and the wheel trolley for the 700-volt alternating and the 600-volt direct-current circuits.

The cab of the locomotive serves to enclose the auxiliary apparatus and is constructed entirely of steel. Its total weight is 49 tons and its length over bumpers is 29 feet. It has two swivel trucks with 38-inch driving wheels, and two motors are mounted on each truck and are geared to the axles.

Both straight and automatic air brakes are used, the compressed air for which is supplied by two Westinghouse Air Brake Company compressors, each driven by a five-horsepower Westinghouse single-phase motor.

The motors are arranged in two groups, each group consisting of two motors connected permanently in series; so for the purpose of control these groups may be considered as single units in a two-motor equipment. Two auto-transformers are used on the locomotives, and an automatic overload and no-voltage circuit-breaker is placed between the trolley and the transformers, which operates on either overload or no-voltage by breaking the current supply to the control magnets, thus automatically opening all the switches. This circuit-breaker must always be closed by hand, and it will not stay closed unless the trolley is up and current is on the line.

When the circuit-breaker is thrown in, the circuit is completed through the auto-transformers to ground. A commutating switch is automatically shifted to the alternating-current position, and the small transformer furnishing current to the control system is cut into circuit, leaving the locomotive ready to start.

The unit switches are essentially similar to those used on direct-current systems. The control magnets are of the alternating-current type, wound for 200 volts, and operate on about 80 volts direct current, but in both cases will operate down to about one-half voltage. These magnets serve to admit air under heavy pressure to the cylinders which operate the unit switches.

These switches are assembled into a compact unit, known as a switch group, and the group is protected by an iron case in which it is mounted from the severe exposure to which a locomotive or a street-car equipment is subject.

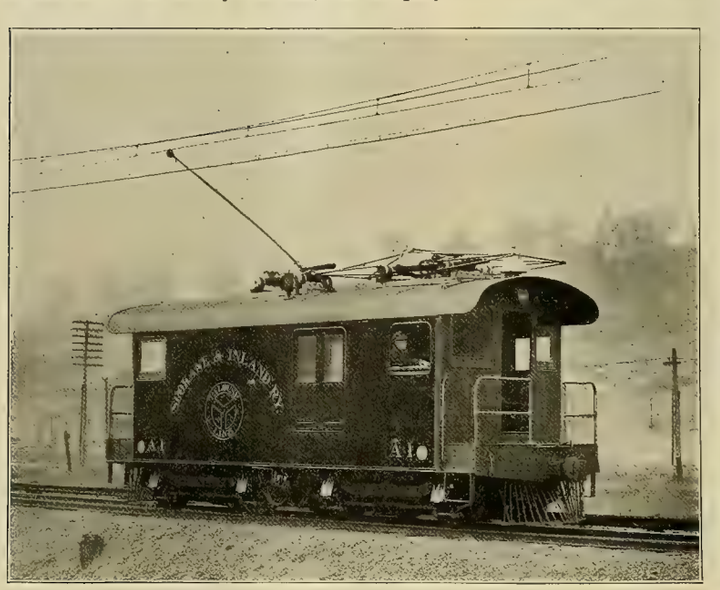
Interlock contact blocks are provided, which make it impossible for a switch to close or remain closed unless all the other switches operate according to their predetermined cycle. This insures the proper order of switch operation.

The alternating current for the operation of the magnets by the master controller is obtained from the secondary of a small transformer, which is connected to the 500-volt point of the main auto-transformer. When operating on direct current a resistance is placed in series with this auxiliary transformer across the 600-volt mains, and direct current is taken from a suitable tap on this resistance. This dispenses with the use of a storage battery for direct-current operation.

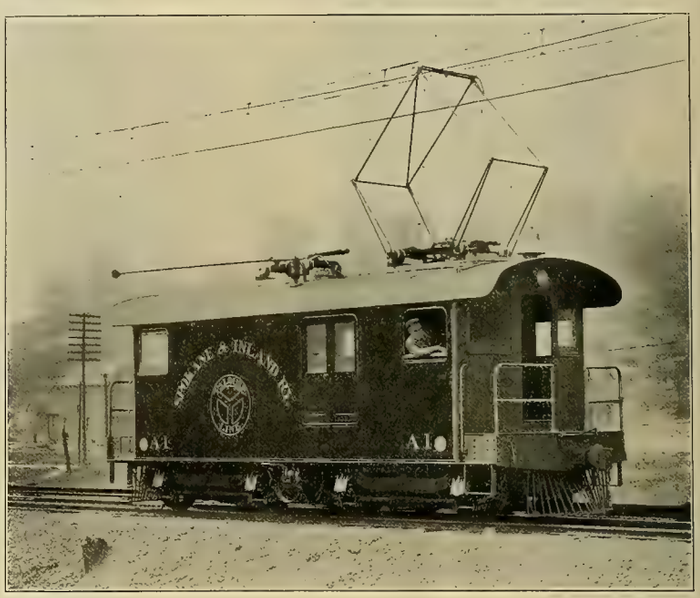
The only mechanical operation in changing from alternating current to direct current is to change the trolleys; the control is changed automatically by the commutating switch, which is a small pneumatically operated drum for shifting the control circuits. This drum is operated by a magnet connected directly to a 200-volt tap on the main auto-transformer, and has no direct-current connection. The switch has one position for direct-current operation and another for alternating-current operation, and it cannot be thrown to the alternating-current position unless alternating current is flowing through the magnet coil. If it should remain in the direct-current position no harm would be done.

The reversing switch is similar to the commutating switch in its operation, but is furnished with two magnets and air cylinders, one for each position.

The preliminary order on this contract specified 15 passenger cars, six express cars and six locomotives.



Electric Locomotive Operating on Direct Current.



Electric Locomotive Operating on Alternating Current.

THE SPOKANE AND INLAND RAILWAY.

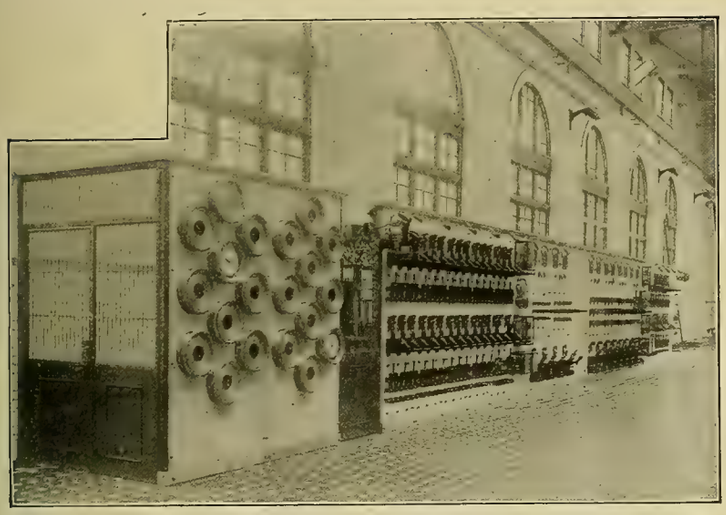
The Lighting of the New Pennsylvania Passenger Station in New York City.

One of the problems connected with the new passenger station of the New York, Pennsylvania and Long Island Railroad Company (described in the Western Electrician of May 26th last) was the choice of an economical lighting service. The unusual proportions of the rooms to be lighted, the long hours of burning and the continuity of the service made it necessary to investigate all systems thoroughly and impartially, to tabulate the results and then select the system that approached nearest to the specific requirements.

After a careful and exhaustive study of all commercial systems, the engineers have decided to use the Nernst lamp. The characteristics of this lamp are admirably adapted to fill the requirements of illuminating such a building, on account of the graded units of the lamp, giving uniformity of color; the color quality of the light; its steadiness; its distribution and its economy in maintenance and operation. The last two items are very carefully scrutinized by a railroad corporation, and, other things being equal, they usually decide the question.

Financial considerations, however, did not govern entirely in this case, and the conception of the architect was given due consideration, as the choice of an unsuitable lighting scheme would have seriously marred the interior architectural beauty of such a magnificent building. Here again the Nernst lamp had the advantage, and by using the inverted lamp the rays will be thrown upward, giving a perfectly diffused and steady light, of pleasing color and low intensity, so desirable in lighting high interiors.

It is doubtful if there is another room in the country that has the proportions of this main waiting room, which is approximately 100 feet wide, 300 feet long and 167 feet high. The building itself is approximately 450 feet wide, 800 feet long and 100 feet high, and is divided into waiting rooms, dining rooms, arcades with shops, offices for railroad officials, baggage rooms, driveways, a concourse, train platforms, etc. There are also to be lighted several miles of tunnels and approaches and large terminal yards, for which the Nernst series lamps are admirably adapted.



Gauge Panels Separated from Rest of Board by Ornamental Door.

It will be seen, from the above list, that every variety of lighting service is called for. On account of the economy of the Nernst lamp, the plant required will be remarkably small, about 20,000 glower units being specified.

On account of the great variation in the architectural features of each room, no uniform arrangement of lamps was permissible, each room being a problem in itself. The spaces thus treated, with their approximate dimensions, are as follows:

	Width, Feet.	Length, Feet.	Height, Feet.
General waiting room	100	300	167
Seventh Avenue arcade	50	220	64
Men's waiting room	60	100	60
Women's waiting room	60	100	60
Restaurant	60	120	33
Lunch room	60	120	33
Concourse	60	450	90
Thirty-first Street carriage drive	50	530	65
Thirty-third Street carriage drive	50	530	65

The remainder of the building offers nothing unusual in the lighting problem. In the offices and corridors the lamps will be located on the ceiling, no drop lights being used. A provision has been made for desk lamps where required.

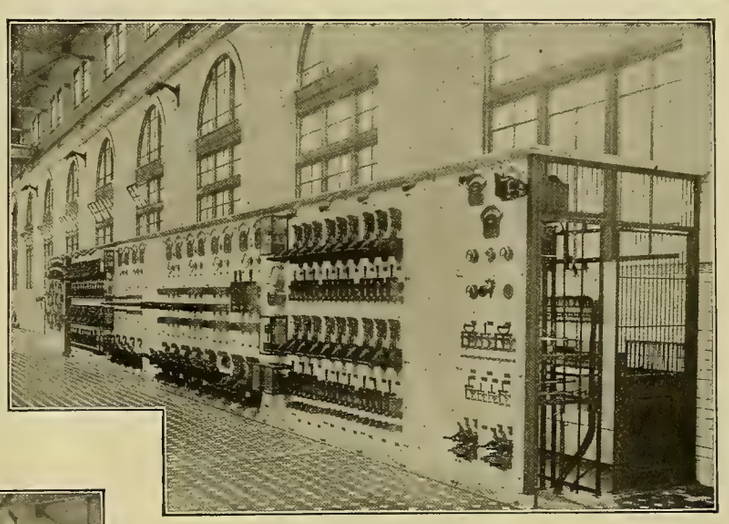
The shop lighting in the arcade will be a feature of this installation, and Nernst lamps will be used, with a standard mirror reflector for the shop-window lighting.

The Minneapolis correspondent of the Western Electrician, writing under date of August 11th, calls attention to the report that the municipal electric-light plant at Boscobel, Wis., is offered free to anyone who will obligate himself to operate it, the city having found it too big a burden.

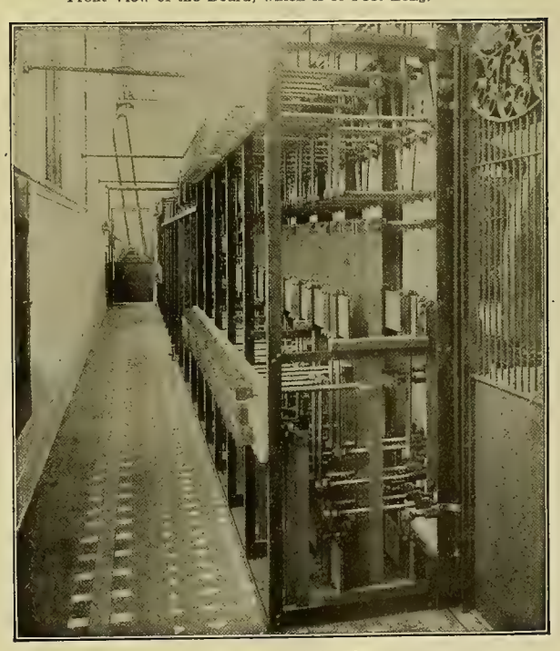
Switchboard in the Sears-Roebuck Plant.

In the large private electric power plant of Sears, Roebuck & Co., Chicago, the switchboard is a conspicuous feature. This board was designed and built by the Western Electric Company of Chicago, according to plans and specifications drawn by Adams & Schwab of Chicago and Baltimore, consulting engineers.

The board is approximately 66 feet long and consists of 21 panels of the finest white Italian marble, highly polished on both surfaces and all edges, 2½ inches thick and 96 inches high, supported on a blue Vermont marble sub-base four inches high. An ornamental cornice of white Italian marble is also provided, extending across the entire board and back to the wall over the ornamental grillework, which encloses the switchboard.



Front View of the Board, which is 66 Feet Long.



Rear View of Board.

SWITCHBOARD IN SEARS-ROEBUCK PLANT.

There are two gauge panels, separated from the rest of the board by an ornamental door; seven generator panels, one of which is for future use; two totalizing panels; nine feeder panels, and one motor-generator panel.

The generator panels are located in the center of the board and are each equipped with a Weston station-type illuminated-dial voltmeter and ammeter, three Western Electric "F" single-pole double-throw draw-file-finish knife switches and two I-T-E single-pole overload and reverse-current circuit-breakers.

The totalizing panels are placed at either side of the generator panels and are each equipped with a Bristol recording ammeter and four integrating wattmeters.

Next to the wattmeter panels are mounted five feeder panels on the left-hand side and four (one of which is blank) on the right-hand side. Each of these panels is equipped for the control of six feeder circuits. Each circuit has a double-pole switch and a single-pole circuit-breaker of the I-T-E Autoite type, which cannot be closed while an overload exists. The circuits are further protected by National Code fuses, mounted on the rear of the board.

The extreme panel on the right-hand side controls two small motor-generator sets and a storage battery, which furnish current for the fire-alarm system and for the graphophone motors in the stenographic department.

It will be noticed that the generator switches and the lower row of feeder switches are double-throw. This, in connection with a double set of bus-bars, renders it possible to isolate a heavy fluctuating load caused by electric locomotives, and which might disturb the lighting system.

The marble panels are mounted on the front of a double steel angle framework, the rear of which carries the marble fuse panels, making a very substantial support for the 16,000 pounds of copper used in the construction of the bus-bars.

The rear of the board presents almost as fine an appearance as the front, owing to the fact that the marble is highly polished. All current-carrying parts are draw-file finished and lacquered, iron parts japanned, etc. Long studs are used for the switches, etc., to avoid the necessity of bends in the copper.

No feeder or generator cables are carried on the board, straight copper bars being brought from the studs, through square openings in the floor slates, to the pull box under the floor. All the small potential wiring on the rear of the board is carried in iron-armored conduit, suitable outlet boxes being provided on each panel.

All switches used on the board are Western Electric type F. These switches are very heavy and substantial, have a fine draw-file finish and are built entirely of the highest grade of pure Lake copper. These switches are being specified by exacting engineers, and the company making them says that they are rapidly becoming standard for high-grade switchboards.

Glow Lamps and the Grading of Voltages.[1]

By William Henry Preece, K. C. B., F. R. S.

Life.—The life of a glow [incandescent electric] lamp is dependent entirely upon the voltage that maintains it alight. If a lamp be specified to give 16 candlepower with 110 volts at an efficiency of 3.5 watts per candle it may give this result at starting, but surely and certainly will give less and less light, however constant the voltage may be. It will deteriorate more rapidly if the voltage be variable, especially if it exceeds the standard 110-volt pressure. I mention particularly the 110-volt. The other standard pressure is 220 volts, but manufacturers have not yet introduced a 220 as good as the 110-volt lamp. The latter requires quite 20 per cent. more energy for the same light than the former, and it would be decidedly economical to fix 110-volt lamps—two in series—on 220-volt circuits. I am doing this on my own installation in Wimbledon. In fact, it has been proved in America that the 110-volt lamp has three times the useful life of the American 220-volt lamp, and that 110-volt lamps at 3.1 watts per candle and 220-volt lamps of 3.8 watts per candle have equally useful lives. The former will absorb 30.4, the latter 24.6 units [kilowatt-hours], the difference being 5.8. If we take the mean price per unit at 3½d. [7 cents], it indicates that the 220-volt lamp costs 10d. more every 500 hours than does the 110-volt lamp, which is more than the cost of the lamp. The reason for the difference between the two lamps is the impossibility of "flashing" the fine filament of the 220-volt lamp. The consequence is that the lamps have to be worked at a lower temperature.

Lamps may last alight for many hundred hours. I have known lamps that have endured through 6,000 hours, but it is quite certain and easily proved that after a lamp has dropped from 16 candlepower to 12.8 candlepower it is wiser and cheaper to remove and replace it with a new lamp. The useful life of a glow lamp is defined as the time taken for the mean horizontal candlepower to drop 20 per cent. from the standard value.

Blackening.—This loss of light is due as much to the blackening of the bulb as to the increase of the resistance of the lamp. The blackening is so regular in its growth through age, when the voltage is maintained constant, that Dr. Clayton Sharp proposes to classify used lamps by comparison with a scale of standard lamps artificially aged. This simplifies the assortment of played-out lamps immensely. It is quite easy to determine the point when the lamp has reached the end of its useful life. Indeed, the bulb blackening gives directly the percentage of its useful life. It is a test independent of candlepower and of efficiency and very quick. The lamp tells its own story.

The useful life of a lamp, as already mentioned, is defined as the number of hours it takes for the candlepower to fall 20 per cent. from its standard intensity. The absolute life is the period in hours it takes to expire by rupture of the filament. These hours may be continuous or intermittent. My experiments of 1894-95 showed that interruptions in lighting made no difference if the voltage remained constant. Messrs. Ayrton and Perry proved that it made no difference whether the currents were continuous or alternating, but subsequent experience has shown that on both systems variation of voltage has a deleterious influence.

Standards.—The following candlepowers are recognized as standards: 8, 16, 32. It is proposed to add to them 12 candlepower and 25 candlepower. The continental standards are 10, 20, 30 candlepower.

It is impossible to tell how few lamps comply with specified standards unless they are tested on purchase and tested periodically during life. It is impractical to expect that any users other than the very large ones would undertake this duty. Hence, if testing is to be done effectually it must be done by the authorized distributors.

Voltage Variation.—The most serious disturbance in our systems of distribution of electrical energy and a prolific source of decay and destruction of our glow lamps is the variation of voltage, not only from our specified standard pressures, but in any one system, from the individual pressure adopted in the network of that system. This latter variation is an evil, not only in the feeders, but in the service lines, and frequently in the internal circuits of lamp installations. No serious attemtp has yet been made to secure uniform pressure throughout the network of distribution systems by introducing voltage regulators.

The departure from the standard pressures of 110 volts and 220 volts adopted by the Engineering Standards Committee is shown by the following table:

Voltage of circuit.	Lighting in kilowatts.	Number of generating stations.
100	72,701	54
102	463	1
103	160	1
104	2,824	1
105	7,308	6
107	3,567	8
110	7,523	11
115	5,103	3
120	120	1
150	2,379	3
200	129,690	81
204	16,603	2
205	3,112	1
210	21,361	26
214	3,568	1
215	479	1
220	66,935	82
225	144	6
230	104,720	122
235	88	1
240	45,389	57
250	18,249	10
	512,516	472

In 472 systems only 11 adopt 110 and 82 220 volts, while 122 employ 230. Most of these, however, were established before the standards committee was formed, but many have been established since. The whole object of a standardized system of pressures is to secure uniformity of lamps and a reduction of the very numerous processes in factories, so as to reduce their prime cost. Standardization thoroughly carried out, means economy, cheaper manufacture to the maker, lower price to the user.

There is a great deal too much technical individualism about, and the time has come for the Incorporated Municipal Electrical Association and the chairmen of electric-light committees to take some steps to secure uniformity of practice. This is necessary for the benefit of the public; for greater uniformity tends to greater economy. The ruling force is £, s. d., and not mere fad. The great and rapid growth of the power demand adduces an additional reason why standardization should be enforced. It is of even more consequence with motors than with lamps.

The variation of pressure in the network of a system is therefore a serious evil, for it affects not only the life but the efficiency and candlepower of the lamps, and especially of the high efficiency lamps which we hope standardization will secure in the future. Mr. Wilkinson of Harrogate says: "Many lighting circuits are unfit to supply any lamps of higher efficiency than 'traction' lamps, while numbers of supply networks are badly laid out and so stinted of copper that it is necessary to maintain abnormal pressure at the feeding centers during heavy loads in order to produce a satisfactory light in the remote districts" (Inst. of E. E., February, 1906).

Voltage Regulation.—Voltage regulation makes for increased and greater uniformity of light. There are several excellent systems of voltage regulators which automatically maintain the pressure constant to within a small percentage for both continuous and alternating systems, but the main difficulty is in the original design of the network when fear of financial failure demanded low estimates of cost to secure the support of timid councils.

Batteries are most effective regulators for continuous-current systems, especially at sub-stations, but a good, practical method is to regulate the current in the field-exciter circuits of large dynamos, while small dynamos, if not compounded, are regulated by resistance thrown in or out by relays.

Alternating-current systems are also regulated by varying the exciter current and by varying the induction ratio of static transformers.

Grading Voltages.—One of the most serious evils brought out by the inquiries of the standardization committee has been the very faulty rating of the lamps by the majority of the British makers. I know of a case where a householder could not get his servants to use eight-candle lamps because they gave "so poor a light." He got the manufacturer to mark them as 16-candle lamps and all grumbling ceased, though the light remained the same. A large number of 220-volt and 110-volt 16-candlepower lamps were purchased in the open British market and sent over to New York to be compared with the American-made lamp. They were tested. Their performance was extremely wretched. They agreed neither with their marked voltage candlepower nor efficiency. They showed a miserable absence of uniformity. They averaged out 13.2 candlepower and 4.51 watts per candle. The American lamps averaged 16.2 candles and 3.83 watts per candle with great uniformity.

Both sets of lamps were subjected to the American rapid life test. They were set up at 3.1 watts per candle. The English lamps averaged a life of 82 hours, the American 156 hours—a superiority nearly twice as good!

But this result was also obtained—that the American 220-volt lamp has five times the useful life of the English-made lamp of similar voltage!

This experiment was repeated at home. Lamps were purchased in the open market in London and sent to the National Physical Laboratory. The results confirm in many respects the American figures.

The standard adopted in this country for pressures allows a variation of 10 per cent. on either side. This means a wide margin of from 99 to 121 volts in the one class and from 208 to 242 volts in the other. Hence lamps may be made and supplied of any voltage within these wide limits. Since the pressures are so ill selected and manufacturers can find a market for virtually all that they make, owing to the callousness of users, no care is taken to select and stock lamps in their various grades, or to make them of uniform structure. Moreover, the absence of specification and of tests has encouraged great looseness of practice in the users who buy as well as in the tradesmen who sell. The result has been faulty rating, poor efficiency, nasty lamps and great waste. The rejected cheap lamps of the Continent have been dumped down in this country and their marking neglected. Experience shows that the cheap lamp proves to be a swallower of energy, and a costly agent. I have heard of a case where Continental made lamps absorbed 9.14 watts per candle. The user gives attention to his quarterly bill only, and when he finds his bill increasing per lamp, as it invariably does with time, he does not attribute it, as he should, to the inefficiency, gradual and natural deterioration of the lamp with use, the diminution of light and the waste of energy, but to the wiles of the authorized distributor. He often blames the system and returns to gas. The persistent use of an inefficient lamp is senseless and extravagant. Many a user is paying for twice as much energy as he needs. No wonder that the gas interest rejoices. There is distinct room for the expert illuminating engineer who can test pressure candlepower differences in situ and who can advise the user on novelties and economies.

The chief remedy is to make the correct rating of lamps imperative. Specification and testing will be beneficial and will tend to secure more care in selection and better efficiency. Greater regulation of pressure would facilitate the grading of lamps into groups and enforce the similar grading of our networks into zones of pressure. But falsification of brands must be made illegal. Lamps should be grouped in classes to meet this point somewhat in the following way:

110 volt lamps	100	105	110	115	120	
200 " "	200	210	220	230	240	

No others should be sold, and authorized distributors should district their systems and regulate their pressures so as to maintain pressure constant in each district. There is no fear of disturbing the price. In fact, manufacturers assure me that such a grading would so improve their own output of lamps and reduce their cost of manufacture that with a good specification they would be able not only to supply better lamps but cheaper ones. This is found to be the case in America, where voltages are graded to suit the output of the makers, and users find their lamps much more uniform in performance.

Tests.—Testing is thus the climax of all that has been said, and it is the only means that we possess to secure efficiency and prevent fraud. Moreover, it gives the right to any public body to possess a trademark under the Trades Mark Act and to prosecute infringements as ordinary cases of fraud. With great care, much consideration and a mass of evidence and experience the Engineering Standards Committee has prepared but has not finally settled a specification which will run the risk of becoming a dead letter unless some arrangements are made for branding the lamps purporting to be to standard specification. Local authorities are already inspectors of weights and measures, and they can all become so for electric lamps if they establish a testing laboratory—a by no means expensive undertaking.

If the actual standards are left in the care and under the control of the National Physical Laboratory they will be reliable, and manufacturers and consumers will have confidence in their readings. If, moreover, the local inspectors maintain their secondary standards in good order by periodical examinations and renewed certificates they will be equally satisfactory, but it must be clearly understood that pentane standard lamps and secondary glow lamps can only retain confidence if they are controlled and calibrated in properly equipped laboratories under the management of statutory authorities. Consumers cannot do their own testing effectively legally. The duty must be relegated to a properly legalized testing institution. Nothing can surpass the engineering of our central stations in England, for the quality and design of our plant remains a pattern to the world, but nothing can equal our internal commercial management and the financial conduct of the business, for as a rule management and control are lamentably wanting. The lamp—the aim of the capital sunk—is outside their business, and the light for which payment is made is beyond their jurisdiction. Lamps must be renewed at proper intervals. It is barbaric to let them break. Lamp control is almost universal in the United States.

The gas people in the United Kingdom are wiser. They are now undertaking the supervision and maintenance of mantles for a small annual charge. It is done in York for 3d. per burner per month; in Ipswich for 3d. per burner per quarter.

It is somewhat humiliating and certainly should excite earnest thought that nearly all the recent advances in developing the electric and gas light in this country have emanated from Germany or America. The Nernst lamp, the Welsbach mantle, tantalum, osmium, zircon glow lamps, flaming arcs, etc., are all importations. Is the Lion asleep? Are we wasting our energies in religious discussions? Is the spirit of enterprise abroad? Is our abundant money poured into less profitable undertakings? Are we checked by grandmotherly legislation? Something is wrong somewhere. The one thing I wish this paper to expose is the shocking technical ignorance of the ordinary householder,

1. Part of a paper read before the British Association (Section G) at York, England, August 6, 1906. It is especially interesting as showing British practice and its variation from American practice.

the absence of any legal power to protect the user in the quality of his electrical apparatus purchased on the open market, and the apparent growing decay of honor amongst our manufacturers. "Made in England" is becoming a reproach to us.

DISCUSSION.

Prof. S. P. Thompson said that the newer types of lamps with tantalum and osmium filaments had reduced the consumption per candlepower to about 1.5 watts. He preferred, when considering the question, to compare the candles per watt, which was the real figure of efficiency. The question was, how can the efficiency of light production be increased? The two ruling factors were the temperature of the source of light and its specific emission. With materials now to hand, one candle per watt was being approached. The Langley curves connecting the sensitiveness of the eye to the light rays from various parts of the spectrum were shown, and the maximum occurred with green light with a wave-length of about one-fiftieth millionth of a centimeter. With other curves connecting the energy given off by rays in different parts of the spectrum, Prof. Thompson showed that less than one-hundredth of the total energy was represented by the luminous rays from ordinary incandescent lamps. The similar curves for arc light, sun light, etc., showed that as the temperature rose the proportion of light to heat increased, and that the wave-length of maximum energy moved toward the green part of the spectrum. In the extreme case of the firefly the whole of the energy was in the form of light, and there were no heat rays. The series of curves shown were for black bodies, which were the best radiators. When metallic filaments were used, as osmium and tantalum, although the bright surfaces were not so good for radiating, it was proved that the peak in the energy curve was nearer the luminous part of the spectrum. Thus while radiating less energy, the rays given off contain more light rays than those from a black body at the same temperature. This was the reason for the higher economy of these types of lamps. He differed from the author on the question of lamp grading. Any difficulties on this score would disappear when metallic filaments were used.

Colonel R. E. Crompton said that the grading of lamps to meet with the present conditions of supply was quite necessary even with the newer forms of filaments. The supply of light as was given in America had certain advantages. Thus the company controlled the supply of lamps as well as of electrical energy, and secured better lamps for their consumers. The conditions of supply were different from those in this country, where private lighting was responsible for the bulk of the output. The clause in the Electric Lighting Act of 1882 which prohibited the undertaker controlling the supply of lamps was introduced at the suggestion of Sir J. W. Swan, who wished to further research by giving all makes of lamps an equal chance. The many different voltages of supply shown in the table were due to the endeavor of undertakers to keep down capital cost to the lowest possible limits. This accounted for what might be termed experimental voltages. When fixing standard voltages of 110 and 220, the supply of power as well as light had to be considered, and variations were allowed accordingly. Thus a motor designed for 110 volts would work at either 100 or 120 volts. The higher standard of 220 volts was also a mean figure, and only some six per cent. of the voltages of supply came outside these standards and their suggested ranges of variation. From many points of view zones of slightly different voltages of supply would be convenient, but this was only practical when the bulk of the load was for power. In this respect America had an advantage, as the proportion of power load to lighting was higher than in this country. As regards Prof. Thompson's explanations, the full truth had not been given. Thus the flame arc lamp gave increased light for a diminution of temperature. This appeared to be due to the formation of a luminous cloud round the arc. Prof. Blondel had recently shown him some experiments which promised an efficiency of one-sixth of a watt per candle. The essence of the idea was the use of small carbons and a large surface of cloud.

Robert Hammond referred to the lighting of two miles of streets in York 25 years ago with arc lamps which he had carried out. He believed there would be great advances in the immediate future, and that lamps should be supplied to a strict specification. All lamps should be marked with their voltage, candlepower, and watts per candle under the Weights and Measures Act to protect the users.

Leon Gaster showed some interesting specimens of most recent forms of metallic-filament lamps. He deprecated the formation of a lamp-testing station by each local authority, as it would lead to much amateur work and conflicting testimony. One large laboratory supported by a number of undertakers would be better and much less expensive. With the co-operation of the Standards Committee and the manufacturers, good and reliable work could be done.

Another speaker said that the comparison of English and American lamps referred to in the paper was not fair. In the test the best type of American lamp had been tested against five or six typical English lamps, some of which he knew to be of low efficiency. This resulted in low results for the average. Manufacturers were handicapped by the range of voltages in this country and could do better under American conditions.

Sir William Preece, in reply, said his object was attained if his paper received the attention of local authorities and the managers of electric lighting plants. Prof. Thompson had omitted one fact in his argument. This was that the rise of temperature in incandescent lamps was limited by the material employed. The new type of carbon he described allowed the 2,000-degree limit to be approached. He indorsed the suggestion that authorities should combine in testing lamps.

Indiana Telephone Items.

The Williams Telephone Company of Park County has incorporated for the purpose of building and operating a system of telephones and exchanges in Florida Township, with principal office in Rosedale. James A. Taylor, James H. Adams, G. H. Salmon and George L. Laney are the directors.

The Dunlap Mutual Telephone Union is the name of a new company organized in Elkhart County. An exchange will be maintained in Dunlap, and the lines extended into the rural district. The officers of the new company are Alvin Huber, president; William Besecker, secretary, and Harvey Miller, treasurer.

At a recent meeting of the directors and officers of the Van Buren Telephone Company it was decided to rebuild the system and install some new equipments.

Concerning a recent rumor that the Delaware and Madison Counties Telephone Company's local plant at Anderson would soon be merged with the Central Union system, C. R. Kelly, local manager of the Delaware and Madison Counties exchange, said that all talk of a merger or consolidation of the two local telephone exchanges is without foundation.

The final session of the State Tax Board was held during the past week to consider appeals from the assessments that it made at its first session against the New Long-distance Telephone Company, the Indianapolis Telephone Company, South Bend Home Telephone Company and a number of smaller companies. It will not be known for a week at least what the action of the board will be.

For the purpose of resisting the assessment of property made recently by the State Board of Tax Commissioners, the Western Union Telegraph Company has filed suit in the United States court to enjoin the board from certifying to the county auditors of the state the amount of assessment recently fixed by the board on the property of the corporation in Indiana. The property of the Western Union Telegraph Company was assessed this year at $69 a mile. This assessment was fixed after the officers and attorneys of the company had urged the board to fix a valuation of $32 per mile. The company contends that the value of its tangible property does not exceed $18 per mile of wire, and insists that this, together with franchises and business, will not exceed $40 per mile. The complaint shows that the net earnings of the company in Indiana in 1905 amounted to $24,529.71, which was only nine per cent. of the net earnings per pole-mile of the entire telegraph system.

S.

Ohio Telephone Notes.

United States Telephone bonds are being picked up on the stock exchange and otherwise at 82½. This has been done quietly and for the account of a St. Louis brokerage house, it is said. The Ohio syndicate has been rather inactive for some time, owing to the dull market.

Many improvements have been made in the plant of the Cuyahoga Telephone Company, and it is now in better physical condition than ever before. It is said that the company has reached a position where a large natural increase in the number of subscribers is made without the active campaign that has characterized the past. This has resulted in a decrease in the expenses.

Opposition of some of the councilmen to allowing the Cincinnati and Suburban Bell Telephone Company to build a conduit in Main Avenue, Norwood, will probably defeat the purpose of the company to secure better cable service and at the same time improve the appearance of the street by doing away with the poles.

A report from Akron is to the effect that the Akron People's Telephone Company will in a few weeks install an automatic system. Independent and four-party lines will be used. In the latter, when one subscriber is talking, all the others will be automatically locked out. It is expected that the plant will be ready for use by January 1st.

The Central Union Telephone Company's exchange at Pomeroy was damaged by a fire which occurred in the Ewing Block, where it is located.

G. W. Anderson, representing the Bell interests, was in Cleveland a few days ago investigating the conditions produced by rival telephone companies. He said that upon conditions found would depend the future action of the company in places that have but one system.

C.

CORRESPONDENCE.

Continental Europe.

Paris, August 8.—The first part of the new St. Denis lighting and power plant, which lies in the northern suburbs of Paris, has been almost finished, and some of the machines are now running. When fully equipped the plant will have a total capacity of 150,000 horsepower in turbine-alternator units, and will be undoubtedly the largest plant in Europe. The principal units, consisting of 12,000-horsepower Brown-Boveri steam turbines and three-phase alternators, are to be 12 in number, according to the present design. Four of these groups have now been installed. The station is arranged so that the main dynamo room can be extended indefinitely, and it is proposed to build it to 600 feet length. For the new part the workmen are now engaged in digging the foundations. In the completed building are placed the four 12,000-horsepower sets, besides a smaller 300-kilowatt turbine group for direct current. The main groups furnish 10,500 volts and 25 cycles. One of the most recent groups to be erected is a "polymorphic" group, consisting of two generators and two alternators mounted on the same shaft. One of the alternators gives current at 42 cycles. Either the alternator or one of the generators can be run as a motor so as to furnish different kinds of current. This machine is in erection, but has not yet been started. The complete plant will have three boiler rooms, one of which is now built, while the foundations for the other two are under way.

One of the most recent electrical enterprises in the North Italian region is the large hydro-electric plant which has been installed not long ago in the district of Milan. This plant has been erected in order to supply current throughout an extensive district, including the cities of Milan, Pavia and Novara. It is situated on the Tessin River and utilizes a net head of water of 60 feet, corresponding to 4,700 horsepower available. The house now contains an outfit of waterwheel-generator groups having a capacity of 1,400 horsepower each. Five groups of this size have been installed. The turbines operate at 315 revolutions per minute. Besides the main groups there are two small turbine sets for the exciters. Single-phase current is produced in the plant, and the alternators which are coupled to the wheels are designed to work at 2,700 volts and 42 cycles. A set of step-up transformers raises the machine voltage to 25,000 for the line. Each of the transformers has a capacity of 540 kilowatts. From the station a set of 18 main-line wires at high tension branch out in different directions toward Milan, Vigevano, Novara and Pavia. A double line is used for carrying the current to Milan over a distance of 18 miles. Where the high-tension line passes across the Tessin River a long span of 700 feet is used, consisting of phosphor-bronze cables. Two large pylons of steel 50 feet high are mounted to stretch the wire at this point.

Space telegraphy has been used, and successfully, it is reported, in Germany for sending signals to moving trains. The new system was tried some time ago upon the trains of the Prussian and the Bavarian state railroads. In the engineer's cabin is installed a set of apparatus which is connected to a short mast wire so as to receive the messages or the given signals for stopping or reversing the engine. The apparatus has been constructed by the Allgemeine company. On the recent trials the signals could be received very well, and the railroad authorities are taking measures to use the system on a number of roads, especially on the single-track lines.

At the last annual meeting of the Triphase Company, which operates one of the largest electric stations in the suburbs of Paris, the report for the sixth year showed favorably for the running of the plant. Even though the four years' contract with the Subway had expired, which thus deprived the company of the sale of a large amount of current, the balance is still in excess of last year's showing. The running expenses were lower for the present year. According to the report, the receipts are $430,000 and expenses $174,400. The company decided to pay a dividend of four per cent. this year.

Among the new projects for lighting, power or traction on the Continent, several may be mentioned.

In France the town of Bourg is to have an electric station, as well as the town of Ariane, in the Maritime Alps region. At Bergerac bids are asked for electric lighting, power and gas supply.

A number of projects are under way in Spain, and there is considerable activity there. A Madrid company proposes to erect a new plant. This is a hydraulic station, which will utilize a fall in the Salamanca province for supplying the towns of Salamanca and Porto. In the region of Madrid a new tramway line will soon be running from Zumarraga to Ascoita, while the East Tramways Company has obtained a concession for a new line of considerable length.

Electrical enterprises are also active in Turkey, and it is stated that a large hydraulic plant is to be erected near Damascus by the Ottoman Company for lighting and tramways in the city.

A. DEC.

Great Britain.

London, August 7.—The question of electrical legislation in Great Britain is important, and as the parliamentary session is to all intents and purposes ended, now is an opportune moment for discussing it. Concerning tramways, a general act was passed in 1870 (prior to the era of electric tramways, of course) and has since not been amended or brought up to date. In connection with electric lighting, the original acts of 1882 and 1888 have not been amended. In both branches of the industry, of course, the most altered circumstances exist, of which the public departments concerned are fully cognizant, but the cry of the government has always been that there are other matters of greater importance to be attended to. Four years ago a deputation from the Institution of Electrical Engineers waited upon the then president of the Board of Trade to urge the importance of these matters. In the following year and the two years after that a government bill, amending the electric-lighting acts and ridding the industry of many of the anomalies which admittedly exist, was introduced, but was somehow crowded out and never passed. This year the new government has not had time even to consider the position, and nothing whatever has been done. The industry, of course, continues to progress, but the natural result is that electric supply and other authorities have to be continually promoting special legislation for their own particular cases, at great expense to themselves, when, by some general act, all such expense could be avoided, to the consequent benefit of the industry, naturally. Frequent instances are occurring, yet the years pass by and things go along in the old way. If our legislators could only realize the close connection between these things and the prosperity of the nation, the state of affairs would quickly be altered. Just at present, however, the tendency of the majority of individual members of Parliament seems to be to prevent any progress except at the hands of municipalities—a policy for which we have suffered in the past and shall, apparently, continue to do so.

In consequence of the recent fatal electric-tramway accident at Highgate, London, the cable tramway service on Highgate Hill and adjoining thoroughfare was stopped by the police in anticipation of similar accidents there. This was rather hard on the cable people, for in spite of the hill in question having a gradient of 1 in 4 in parts, the only blemish on its clean bill of health is one accident, and that not a fatal one. Upon representations being made, however, the police authorities have agreed to the running of the cars again, a guarantee being given that the old cars shall be gradually replaced by a newer type. Meanwhile there is a suggestion that the London County Council shall purchase the line and electrify it.

Talking of London County Council tramways, it is gratifying to note that the lines authorized this year over Blackfriars and Westminster bridges, after so many efforts to get permission, are to be put into hand at once, and will, it is hoped, be working before Christmas.

Our American and Continental friends, when they were touring Great Britain a short while since, may probably have been struck by the somewhat inconsistent use of electricity for public street lighting. This is due to a variety of causes, the main one being that in many instances the gas works are the property of the local authority, the electrical and gas departments being controlled by separate committees. It is somewhat surprising, for instance, that a place like Sheffield should have not a single public electric lamp, while the proportion of electric lamps to gas lamps in the streets of Liverpool is exceedingly small. In Scotland a true spirit of rivalry is engendered between the gas and electrical departments, with the result that in Glasgow, for instance, electric street lighting predominates. In Edinburgh the committee takes the commercial view that street arcs are the finest advertisement possible, hence we find here probably the best example of public lighting in the United Kingdom.

G.

Dominion of Canada.

Winnipeg, Man., August 18.—Winnipeg, in consequence of the arrival of power from the Lac du Bonnet works of the street-railway company, has received a big reduction in the price of light, it having been reduced to one-half of the present gross rates, which are as follows: Freight elevators, 20 cents per kilowatt-hour; motors, 12 cents, and lighting, 20 cents. The new rates are: Elevators, six cents per kilowatt-hour; motors up to 50 horsepower, six cents; motors up to 100 horsepower, four cents; motors over 100 horsepower, three cents, with discounts of 10 per cent. up to $20; over $20, 15 per cent. The city has also arranged a contract with the company for 2,000 horsepower for civic purposes, including waterworks and street lighting, at the rate of $30 per horsepower, making a great saving on the present cost of power.

The city of Winnipeg is putting up 300 new arc lights in districts where there is inadequate lighting.

Messrs. Thorald and Paradis of Calgary are at work preparing plans and specifications for the erection of a municipal electric-light plant for the town of High River, Alta. The cost is estimated at $17,000.

The village of Port Stanley has installed an electric-light plant.

The business men of Russell, Man., have decided to install an electric-light system, and are now seeking for information as to the best system to adopt. The mayor of Russell is E. M. Williams.

The Delhi (Ont.) Light and Power Company is about to build a new dam.

Port Hope has passed a by-law to establish a municipal electric-light system at a cost of $7,400. J. W. Sanders is mayor.

The City Council of Fort William, Ont., has instructed the town solicitor to prepare a by-law to be submitted to the people to build an electric street railway through the town, to be operated by the city or leased to a company. The latter course will no doubt be decided on. This will give the people two street-railway companies.

The Ottawa Electric Company has asked to be heard by the Ontario Hydro-electric Power Commission on the application of the city for the supply of power for the civic lighting plant. The company will continue before the commission the opposition to the city plant, which has been prosecuted in court.

The Selkirk Electric Light and Power Company has sold its plant to a new company composed of the Messrs. Flavelle of Lindsay, Ont., and several Winnipeg capitalists. The amount involved in the transaction is $40,000. The plant is to be remodeled. James Stuart is to be the secretary of the company.

A 15-pair paper-covered lead and iron-armored cable of the latest pattern is destined for service in connection with the new copper telephone line between Vancouver and Seattle, which was completed two weeks ago, as far as the land lines are concerned. With the successful laying of this cable under the Fraser River the British Columbia Telephone Company has two cables running under the river between Westminster and Brownsville. The old cable was laid in 1894, and has seen uninterrupted service ever since. When the work of connecting the land ends of this cable is completed the company will have two through copper lines between Vancouver and Seattle.

The Eastern Telephone Company, which controls telephones on the Island of Cape Breton, has decided to sell out to the Nova Scotia Telephone Company of Halifax.

The Bell Telephone Company is making connections on Wolfe Island with a new cable, to run under the St. Lawrence River from Cape Vincent, laid by the Central New York Telephone and Telegraph Company. The cable, one mile long and weighing 18 tons, is one of the longest the company has ever handled.

H.

New England.

Boston, August 18.—The New York, New Haven and Hartford Railroad Company and its subsidiary, the Consolidated Railway Company, are planning high-power interurban electric lines between New Haven and Meriden and New Haven and Middletown, Conn. The steam and electric tracks will be connected in the cities and T rails will be used. The Consolidated Company's lines in New Haven have already been equipped with that style of rail, which has been substituted for the grooved rail whenever the latter wore out. The T rail is also in use in Meriden and Middletown. Cars will be run over the steam railroad tracks between the cities and to the hearts of the cities over the electric lines. The companies planned a similar service connecting Hartford, Bristol and Waterbury, but there was so much opposition to the T rail in the streets of Hartford that the scheme has been abandoned.

The Pittsfield (Mass.) city authorities have issued an order that electric cars shall not exceed a speed of four miles an hour while crossing the Dalton Road Bridge over the Boston and Albany Railroad. The order also states that no car shall cross the bridge while another car, a steam roller, or any especially heavy load is on the bridge.

A conductor of the Boston and Northern Street Railway Company has been found guilty of the larceny of car fares and sentenced to 30 days in jail. The cases of two other conductors for the same company have been continued until August 24th. The company employed regular city policemen to collect the evidence.

"Organized labor" held a convention in Boston, August 14th, at which a platform and a declaration of principles were adopted. The platform contained the following: "Restoration to cities and towns of their rights which legislative action has taken from them by the corrupt influence of railroad and railway, gas and electric-light corporations. Public ownership of those utilities which in their nature are monopolies. The protection of legitimate capital."

The Consolidated Railway Company has started a force of engineers surveying a route for an electric railway between Great Barrington, Mass., and Canaan, Conn.

The Connecticut Railroad Commission has just issued a report covering the bond issues made by electric railway companies of that state. The outstanding bonds amount to $36,536,592, which is over $6,000,000 more than the companies' aggregate capital.

The Boston Elevated Railway Company has petitioned for a location for its proposed elevated structure between the North Station and the Charles River on its Boston and Cambridge elevated road, and the Boston aldermen will give a public hearing on it on August 20th. The company's plan does not follow the line specified in the act passed by the last Legislature. To avoid curves the company wants to build its structure over land now occupied by six or seven blocks of brick tenements.

The Boston aldermanic committee on municipal lighting was to have held a meeting last Monday, but only six of the 15 members appeared—two less than a quorum—and the chairman announced an adjournment subject to the call of the chair. It is known that a large majority of the committee is against municipal ownership, and the committee is looked upon as a huge joke. So far its deliberations have resulted in nothing of value.

The Interstate Consolidated Street Railway Company has petitioned for the Massachusetts Railroad Commission's certificate allowing it to act as a common carrier for freight and express in North Attleboro. It wishes to establish a freight and express service between that town and Providence, R. I.

B.

New York.

New York, August 18.—For more than a week there has been trouble on the Brooklyn Rapid Transit line to Coney Island concerning the legal fare which may be charged for the ride. The company asks two five-cent fares, and most of the passengers object to paying more than one. The result has been many clashes between the company's employes and passengers and policemen. The whole question was laid before the attorney-general of the state to-day, and it was agreed that the company should operate its line as in the past but give all protesting passengers a receipt on payment of the second fare. If the courts decide that the second fare is illegal, the company will refund the money paid for it on presentation of the receipt.

Charles Dean, for more than 40 years in charge of the Western Union telegraph line work in Somerville, N. J., was instantly killed on Tuesday morning while at work on a pole at Raritan, a mile west of Somerville. An electric light wire touched the telegraph wire he was working on and he received the full current. Children saw him suspended head downward and summoned help.

The American Institute of Social Service will hold in New York city, in January next, an exposition of devices for safeguarding the lives and limbs of working men and women, and for preventing accidents under the ordinary conditions of life and labor to which the general public is exposed. This will be the first exposition of the kind in this country. As far back as 1889 there was a German exposition for the prevention of accidents. In 1893 an exposition of this nature was held in Amsterdam, and since then there have been several similar expositions in continental Europe and in Canada. The interest of manufacturers generally is solicited, as well as that of organizations whose special function is to improve the conditions of labor, and a widespread response is looked for to this request for representation in the nature of photographs, descriptive drawings, models and, as far as possible, the devices themselves in actual operation. Requests for information regarding space should be made to Dr. William H. Tolman, director, 287 Fourth Avenue, New York.

Mayor McClellan of this city, who is in Europe, is quoted in a Berlin dispatch to the New York Herald as follows: "I have been looking into municipal government in Europe and I must say I fail to find the boasted superiority in Germany of which we are accustomed to hear so much in America, particularly where the virtues of municipal operation of street tramways are so regularly held up as a lesson. The few examples I have seen are wholly bad. The Frankfort and Dresden municipally owned lines not only handle a traffic judged inconsiderable by American standards, but do so inefficiently and inadequately. I am more than ever convinced that municipal operation is the last desperate resort, to be invoked only when private enterprise has been tried and failed."

New York consumers are given gas at 80 cents a thousand feet by a decision of Judge Giegerich of the Supreme Court. A peremptory writ of mandamus was granted by the judge compelling the Consolidated Gas Company to supply its customers at the 80-cent rate as provided by the law passed at the last session of the State Legislature.

The quarterly statement of the Interborough Rapid Transit Company, filed at Albany yesterday, shows gross earnings of $5,290,164 for the three months ended on June 30 last. This includes both the Manhattan and Subway divisions. The figures show an increase of $741,321 over the corresponding quarter in 1905. The net earnings, including other income, were $3,288,621, and the surplus, after charges, including the 7 per cent. guaranteed on Manhattan Elevated stock, was $986,650.

C. I. C.

Southeastern States.

Charlotte, N. C., August 18.—The amount of energy to be developed by Col. M. P. Thornton for his city lighting plant at Hickory, N. C., will be 6,300 horsepower. The dam is 2½ miles from the city, and it is expected that sufficient power will be developed to supply the entire town with current for manufacturing.

The $500,000 power plant and canal of the Virginia Passenger and Power Company of Richmond, located near Petersburg, the western terminus of the lines, is now in readiness to begin operations. The plant has been under construction for many months, and it is said that the $500,000 outlay is only the beginning of the plans of the Gould interests in developing their properties in that part of Virginia.

The possibility of building an electric railway from Petersburg to Claremont, Va., for which a legislative charter was secured, and which for a while seemed to have been dropped, is again being agitated, and it is rumored that the Virginia Passenger and Power Company may become interested in the scheme, also taking a wider scope of plans.

The Spartanburg (S. C.) Electric Power Company, recently launched, has secured rights at several important waterpowers and will put into the work $1,000,000 in a very short time to develop powers in Cherokee County, South Carolina, and in Cleveland County, North Carolina. R. C. Crawford, J. Slack and F. H. Dravo of Pittsburg are the principal stockholders. Several Spartanburg capitalists are also in the company, and extensive developments of power are now well mapped out. This company will come into competition with the Southern Power Company, but, as far as is known, these two are entirely independent.

Morehead, N. C., has just completed a $7,500 electric plant for the illumination of the city.

W. G. Wylie of the Southern Power Company of Charlotte is quoted as saying that the transmission lines from Great Falls to Spartanburg, S. C., will be carried on to Greenville, 30 miles, and also to Columbia, forming a triangle, with two sides 100 miles in length.

The Southern Electric Construction Company has the contract for building the Charleston-Summerville (S. C.) electric railway, work on which, it is said, will soon be started. The president of the electric line is Ogden Edwards of Troy, Ohio, who will locate in Summerville.

George W. Deem of Waycross, Ga., and associates, have applied for an electric street-railway franchise in Waycross. The company agrees to have the line completed within two years if the franchise is granted.

The United Electric Company of Birmingham, Ala., has been awarded the contract for the electrical work in the new hotel, New Florence, in Birmingham.

The proposition for a municipal plant in Richmond, Va., has been voted down by the lower council, and appears finally to be dead for the time. Agitation in the matter has covered a long period of time.

The interurban electric-railway question about Atlanta becomes more interesting, and it is now stated that two more companies will ask for franchises, making four in all entering the city. The two last reported are a line to Augusta and another to Columbus, Ga. The company building the line to Macon will ask for a franchise in a few days, while the Atlanta and Carolina has already been chartered and will likely be at work soon. This will make Atlanta one of the greatest electrical centers in the South Atlantic states.

The Fork Shoals (S. C.) cotton mills has added $50,000 capital to its stock for the purpose of installing electrical mill machinery.

A movement has been started and is being urged on the City Council of Atlanta to compel the Georgia Electric and Street Railway Company to sell tickets at the rate of six for 25 cents when desired. It is claimed that such is the case in most other cities of like size in the country.

Three bids were submitted for the construction of the central power station for the United States naval yards at Charleston, S. C., as follows: Pennsylvania Bridge Company, $214,887; Continental Jewel Filtration Company, $289,162; Symonds-Mayrant Company of Charleston, $223,000. The lowest bidder has headquarters in Washington, D. C. L.

Ohio.

Cleveland, August 18.—The discussion of the street-railway situation in Cleveland has continued unabated through the past week. The Forest City Railway Company proposed to the Cleveland Electric that it would co-operate in the exchange of transfers to prevent charging a double fare, when passengers were compelled to use both lines to reach a given point. While the Cleveland Electric has shown a willingness to make all possible concessions that will not amount to destroying all profit, there is little probability that it will agree to do this, as the new company may be a long time in securing even a small system of lines. Councilman Hitchins, who introduced the first ordinance for the Cleveland Electric, is now contending for the Detroit plan of 10 tickets for a quarter morning and evening and six the remainder of the day. Another councilman says he will introduce an ordinance providing for the extension of the franchises of the company in return for 12 tickets for a quarter, all rides to end at the Public Square or near there. Matters are getting into a muddled condition. The company will probably have another ordinance introduced, providing for seven tickets for a quarter and extension of franchises for 25 years, but with some other modifications that have been suggested by councilmen.

The North Avenue power house of the Mahoning and Shenango Railway and Light Company at Youngstown will be doubled in capacity, according to a report coming from there this week. Something like $1,000,000 will be spent in improving the various lines of the system, it is said. President E. M. Sanderson was in Youngstown a few days ago in connection with these matters.

Col. C. V. Hard, representing the Cleveland, Ashland and Mansfield Traction Company, has been granted a franchise for the road through Ashland County for 25 years. The company will be allowed to charge three cents a mile for passengers.

Stockholders of the Western Ohio Railway Company have ratified the purchase of the Lima, Findlay and Toledo, and voted to increase the capital $400,000 in six per cent. cumulative stock, to take care of a like amount of stock of the purchased road. The Western Ohio owns the common stock of the company.

The Navarre Electric Light Company of Navarre has been incorporated with a capital stock of $10,000 by John W. Zinsmaster, G. A. Myers and others.

An increase of capital stock from $10,000 to $2,000,000 has been made by the Sandusky, Fremont and Southern. This is a branch of the Lake Shore Electric.

A new sale of the Springfield and Western, one of the Appleyard roads, has been ordered unless the company pays the New York Trust Company $155,000, the amount of bonds that were issued with that company as trustee. George H. Warrington bid the road in for the Schoepf people when the others were sold, but the courts have held that the trust company has a prior lien on the road, because of the issue of a mortgage in its favor before the property was leased by the Dayton, Springfield and Urbana road.

The Forest City Railway Company of Cleveland is making a fight to secure a route to the Public Square.

Attorney T. L. Childs of Akron has planned an almost straight trolley road from his city to Youngstown, and is endeavoring to secure an entrance to the latter place now. The road will have no grade crossings, and the run can be made in an hour, Mr. Childs says.

Plans for the reorganization of the Eastern Ohio Traction Company are again being talked over. For a time it seemed that they had been abandoned.

The incorporation of the Canton-Akron Consolidated Railway Company of Akron is said to foreshadow the merger of the electric lines in that section. Andrew Squire, W. B. Sanders and J. H. Dempsey are among the incorporators. A meeting of the stockholders of the Northern Ohio Traction and Light Company is to be held on September 18th to ratify the action of the directors in taking over the Canton-Akron, Canton-New Philadelphia and Tuscarawas traction lines.

The Dayton Citizens' Electric Light Company has purchased property at Third and Webster streets, Dayton, on which a $200,000 plant will be erected. O. M. C.

Indiana.

Indianapolis, August 18.—The Way Railway Company has filed articles of incorporation with a capital stock of $50,000. The company proposes to build an electric railway from Michigan City to Gary, through Laporte and Lake counties, and an extension from Michigan City north through Porter and Laporte counties to the Michigan state line. The length of the entire system will be 26 miles. G. Emile Kaltenback is president, and Homer Potwin, secretary.

The Lafayette and Hoopeston Interurban Railway Company has filed articles of incorporation with a capital stock of $10,000. This company proposes to construct and operate an interurban line from West Lafayette to Hoopeston, Ill. Isaac E. Switzer, William Walsh and John H. Benkson are among the directors. The company's home office will be Otterbein.

The St. Clair Air Brake Company of Indianapolis, incorporated with a capital stock of $100,000, proposes to establish a plant for the manufacture of railroad supplies, railroad attachments and other articles used in connection with interurban railroads. Chief among these is the St. Clair air brake, patented by A. A. St. Clair. The directors of the company are John A. Shoemaker, Oren T. Owen and A. A. St. Clair.

Actual work by a large force of men and 100 teams has begun on the construction of the Indianapolis, Newcastle and Toledo electric railway. Work has also begun on the power station near Newcastle. The engineering features will include, in addition to the main building equipment, 10 permanent and one portable sub-station. The officers of the company say that the contemplated use of a portable sub-station is in keeping with recent practice in general electric-railway service. Electric railways are liable at times to exceptionally heavy loads, and the portable station can be readily shifted in such cases to a point where additional power is required.

The roadbed and track of the Toledo and Chicago interurban railway between Auburn and Garrett in Northern Indiana, has sunk out of sight, necessitating the transfer of passengers and express matter at this point. The tracks cross an old peat bed, and while special cars were carrying crowds of people to a recent picnic, the tracks began to sink and were soon covered with 38 feet of water. Engineers are now planning to bridge the chasm until it can be filled with some kind of solid material. S. S.

Illinois.

Peoria, August 18.—The Casey Water, Power and Mineral Company has been incorporated, with principal office at Casey; capital, $2,500. The incorporators are J. T. Turner, F. Hammond and R. A. Young. It is intended to build and equip utility plants.

The Kinloch and Bell telephone companies are contending for the business in Edgar County, the city of Paris being the center of activity.

The McKinley syndicate will accept the franchise recently granted it by the city of Streator for the construction of the Peoria, Streator and Ottawa Railway, and will deposit a check for $5,000 if the council will extend the time for completion from January 1, 1908, to October 1, 1908.

Robert F. Merkle, manager of the electric-light plant at Havana, Ill., has made application to the City Council for a franchise to build a gas plant at that place.

The Peoria and Bloomington Railway will build an express depot, to be finished by the time the line is completed into Peoria. It will be built on property now owned by the company adjoining the approach to the new bridge.

The electric railway between Springfield and Lincoln will be completed in two weeks. The line will not run over the present street-car tracks in Lincoln, as the street-car company demands more than the interurban will pay. The present plan is to run parallel to the Chicago and Alton, as is practically the case all the distance to Springfield.

The chief electrician of the Illinois Traction Company, G. J. Chester, has moved his headquarters from Springfield to Decatur. This centralizes the offices of the general superintendent, chief engineer and claim agent with the chief electrician. The company now has two portable sub-stations and one more new one is on the road from the East, while two more are being built at St. Louis. V.

Northwestern States.

Minneapolis, August 18.—The Virginia (Minn.) Light and Water Company has applied for a franchise at Eveleth, Minn., and promises an all-day service at reasonable rates. The Eveleth Electric Lighting Company will oppose the application.

The Chippewa Valley Electric Railroad Company has begun the survey for a trolley line from Eau Claire to Menomonie, Wis. There is also some talk of extending the line south as far as La Crosse.

The Eveleth Electric Company of Eveleth, Minn., has applied for an electric-light franchise at Aurora, Minn.

The $3,000,000 bond issue of the La Crosse (Wis.) Waterpower Company has been purchased by the State Bank of Chicago.

The municipal electric-light and water plant at Marshfield, Wis., is to be remodeled. Electrically driven pumps will be installed. A $35,000 bond issue is proposed to defray the expense.

The Berggren Electric Light Company of St. Paul has opened an office at Grand Forks, N. D.

The Ladysmith (Wis.) light and power plant has been sold to the Menasha Paper Company.

The Mesaba Range Traction Company has disposed of its bonds, and the construction of a line connecting Eveleth and Virginia, Minn., is now assured.

Representatives of various construction and equipment companies are at La Crosse, Wis., figuring on the proposed power dam to be erected near Black River Falls by the La Crosse Waterpower Company.

There is talk of Southern Minnesota capitalists leasing the Chicago Great Western line, between Rochester and Winona, Minn., and transforming it into a trolley line.

The American Electric Company of St. Paul has received the contract for generators for the state reform school at Red Wing, Minn., and at the state institutions at Faribault.

Patrick Scherlock has been given a 15-year franchise for an electric-light system at Belle Plaine, Minn.

John and D. Regan of the Regan Construction

Company of Des Moines and others have incorporated as the Boone-Webster City (Iowa) Interurban Railway Company, with a capital of $500,000, for the purpose of building a trolley line from Boone to Webster City. E. E. Hughes is president and J. S. Crooks secretary.

The Fox River Valley Electric Railway Company will move its headquarters to Sheboygan, Wis., about the first of September. R.

Pacific Slope.

San Francisco, August 16.—The United Railroads of San Francisco is accomplishing quite a work, although laboring under great difficulties with seven different unions, in which its employes are enrolled, planning to combine to enforce various demands as to the operation of the company's system. The union track laborers are out on strike, as are also the power-house oilers, firemen and some of the engineers. The men in the two electric power stations quit work without warning at 5:10 p. m., but their places were promptly supplied by men who were held in readiness, and there was little interruption of the service. The company's McAllister Street cable line has been converted into an electric road and put into operation from the ferry to the power house.

The Southern Pacific Railroad is once more considering estimates for the speedy reconstruction of its local steam lines in Oakland, Alameda and Berkeley as electric-railway lines. This work has been in view for some years past and numerous estimates have been made, but in the past the cost has been considered excessive or some engineering difficulties have prevented decisive action being taken. It is thought that it will be a go this time.

The Sunset Telephone Company has been granted a five years' lease of a building to be erected for it at once on the lot next to the Arthur Building at Auburn, Cal. Manager Johnson of this company has been engaged in the launching of a movement among the residents of the rural districts of Sonoma County, Cal., for the establishment of a complete rural system. The company is preparing to take down the poles and wires of its system in Sacramento and placing them underground.

The Pacific States Telephone and Telegraph Company has stated that an extension of the service will be made from Truckee to Loyalton at once.

Messrs. G. and O. Braniff & Co., of the Westinghouse Electric and Manufacturing Company, have been awarded the contract for supplying the generating equipment for the electrical installation of Molino La Union of Toluca, Mexico. The order consists of generating apparatus having the capacity of 1,200 horsepower.

The Gold Bullion Company, near Golden, N. M., will install a complete light plant for night work.

F. R. Schnack of the firm of Copeland & Schnack of Los Angeles has signed a contract with the city for installation of the proposed new electric-light and water plants.

The Institute Electric Company has been granted a new franchise by the board of county commissioners, and it will construct a plant for the generation of electric energy and light throughout the county of Salt Lake.

It is reported that work will be begun at once in Dark Canyon, Big Bend, Cal., on a 40,000-horsepower plant for the Western Power Company.

J. C. Taylor of Los Angeles, Cal., is preparing to build a plant in Lost Man's Valley, near Bear Creek, to generate electrical energy for San Bernardino, Los Angeles, Orange and Santa Barbara counties. It is reported that Mr. Taylor is acting for promoters who contemplate a consolidation of all power interests in Southern California.

The plans of the Stave Lake Power Company of Vancouver, B. C., now building a dam on the Stave River for the conservation of the water of that stream for use in the generation of electrical energy, have been amplified, so that instead of having a maximum of 30,000 horsepower, there will be available 40,000 during the dry season.

Sealed proposals in triplicate are being received at the office of the constructing quartermaster, Port Worden, Wash., for the furnishing of labor and material for the installation of fixtures, wiring buildings, making changes in present wiring, making service connections, furnishing and installing wattmeters in buildings for electric lighting at Port Worden, Wash.

Manager Porter of the Telephone and Telegraph Company of Baker City, Ore., has received word from headquarters that the Pacific States Telephone and Telegraph Company has decided to make many improvements in Baker City. The work will be completed in September.

It is stated that the route of the Traction Company of San Bernardino, Cal., from Eighth Street to the city limits has been decided upon, and the City Council will be asked for a franchise over the selected streets.

D. Johnston has applied to the Board of City Trustees of San Bernardino, Cal., for a franchise for a double or single-track electric railroad over a number of streets. A.

PERSONAL.

Prof. Amos E. Dolbear, the well-known electrical expert, is in poor health. He is 71 years old and is at his summer home in Munsonville, N. H., under the care of a physician.

James D. Safford of Springfield, Mass., a director of the American Speaking Telephone Company of New York and a number of other corporations, died of paralysis on August 13th. He was 64 years old.

Bion J. Arnold, past-president of the American Institute of Electrical Engineers and president of the Western Society of Engineers, is recovering nicely from a recent painful illness, and is expected at his office within a day or two.

Joseph Ramsey, Jr., former president of the Wabash Railroad, is reported to be associated with the project of a $150,000,000 air-line electric railroad between Chicago and New York, mentioned in the Western Electrician of July 14th, and which has been regarded as chimerical.

The New Haven Evening Register of August 15th says that William Marconi, the space-telegraph inventor, has joined the experimental staff of the Columbia Phonograph Company, and that his inventions in the talking-machine art will be the property of the phonograph company.

Mr. Ralph W. Pope, secretary of the American Institute of Electrical Engineers, arrived in Montreal on August 11th, on the turbine steamer Victoria of the Allan Line. He has resumed his duties at 95 Liberty Street, New York, after an absence of two months in England and Scotland.

Captain E. B. C. Hambley, manager of the Whitney Company, which is developing the waterpower at Whitney, N. C., died at Salisbury, N. C., on August 13th of typhoid fever. He was an Englishman by birth and 48 years old, and had lived in the South for 25 years. Captain Hambley was known to mining engineers all over the world.

William J. Mills, for so long superintendent of the Eastern Carbon Works of Jersey City, has again entered the carbon business. Mr. Mills is now superintendent of the Stackpole Battery Company of St. Marys, Pa., in which he is financially interested. Mr. Mills has many friends, who will extend their best wishes for success in his new venture.

A statue of the late John W. Mackay is to be unveiled about the middle of November on the campus of the Nevada State University at Reno. The statue, which was modeled by Gutzon Borglum, and is now being cast, is a gift to the university by Mr. John W. Mackay and Clarence H. Mackay. The latter also donated a mining building, in front of which the statue will be placed.

John Barry, chief electrician of the Indianapolis police and fire departments, and F. H. Moore, electrical inspector for the Indianapolis fire inspection bureau, are examining the electrical wires of that city. Particular attention is given to high-voltage wires. Chief Coots of the fire department has recommended that a separate inspector be appointed to supervise all electrical work, both in streets and buildings.

Hon. Horace D. Curtiss of Woodbury, Conn., president of the Woodbury Automatic Telephone Company and Woodbury Water Company, died August 14th. He was senior member of the woolen manufacturing firm of Daniel Curtiss Sons and a director of the Woodbury Electric Company and the Woodbury Savings Bank. He had been a member of both branchises of the Connecticut Legislature, and his only son was a member of the lower house of the last Legislature.

Hon. James S. Neville, mayor of Bloomington, Ill., and chairman of the Illinois Railroad and Warehouse Commission, died suddenly on August 17th, at West Baden, Ind., where he had gone for the benefit of his health. He had been suffering for some time from stomach trouble. He was prominent in business and politics, and as mayor of Bloomington had made several improvements in the public utilities, the latest being the rebuilding of the city electric light plant, contracts for which are practically made.

ELECTRIC LIGHTING.

Jacob Hiash proposes to establish a private electric-light plant at De Kalb, Ill.

The Huntsville (Mo.) Light and Power Company has been incorporated with a capital stock of $75,000.

The citizens of McComb City, Miss., have voted in favor of issuing $30,000 in bonds for the establishment of an electric-light plant.

At Frankfort, Ind., an ordinance providing for the bonding of electrical contractors and the inspection of all wiring by the superintendent of the municipal plant has been adopted by the City Council. Formal applications and permits are now required previous to the starting of any new work or alterations or repairs in the old work. The ordinance is modeled largely after one submitted some time ago by the Underwriters' electrical bureau.

The DeKalbe Fuel, Light and Power Company of Fort Wayne, Ind., has been incorporated with a capital stock of $100,000. John Roce McCullough, Olaf N. Guildlin and Charles H Printz are the incorporators.

Lawrence Jones of Louisville, Ky., has purchased the privilege of furnishing electric lights, heat and power in that city, paying therefor $100,150. E. G. Cowdery of St. Louis, vice-president of the Laclede Gas and Electric Company, bid in opposition to Mr. Jones. The ordinance providing for the sale of a franchise for this purpose was created by the General Council, and the authorities expected to get not more than $50,000 for it. The company which Mr. Jones will head is going into business in opposition to the Louisville Gas Company, which has been furnishing electric lights. He says he will at once proceed with the erection of the plant. The Louisville Gas Company asserts that the ordinance is invalid, and has a suit pending now to sustain this stand, the ground being taken that this company should have been allowed to bid.

At Elgin, Ill., the ordinance regulating electric wiring is now being enforced. The inspector is preparing a set of suitable blanks, and when printed, formal applications and permits will be required of contractors before doing work. The standard for wiring is being constantly improved and will soon be in full compliance with the National Electrical Code. The lighting company is preparing for a vigorous campaign in behalf of additional consumers through a substantial reduction in rates, and it is expected that considerable new wiring will be installed soon. The lighting company is maintaining a direct-current three-wire system, with a maximum difference of potential of 220 volts. One of the outside wires of this system is grounded instead of the neutral, but the underwriters object to this, owing to the fact that cut-outs in service will not operate well under all circumstances where the condition prevails.

ELECTRIC RAILWAYS.

The Weatherford Interurban Railway and Light Company of Weatherford, Okla., has been incorporated with a capital stock of $250,000.

The Chicago and Milwaukee Electric Railroad Company has petitioned for a franchise to build its lines on the city streets of Racine, Wis.

Passengers on electric cars are sometimes startled by a loud report coming from beneath the floor of the car. The noise is no reason for alarm, for it is only evidence that a safety device has worked properly. Too heavy current having come down the trolley, a fuse to protect the motor has "blown," breaking the circuit between the trolley wires and rails.

The stockholders of the Philadelphia Company have ratified the proposition to increase the capital stock of the corporation from $36,000,000 to $42,000,000. It was explained that the increase had been arranged to give the company revenue to make contemplated improvements to the lines of the Pittsburg Railways Company, the Allegheny Light Company, and other subsidiary companies.

An increase of $3,000,000 in the preferred stock of the Northwestern Elevated Railroad Company of Chicago has been certified. The authorized amount of this stock is $25,000,000, and this increase brings the amount issued up to a total of $8,000,000. The reason for the increase is that the company proposes to issue bonds in an amount not to exceed $3,000,000 for the building of the Ravenswood extension and for other betterments and improvements, and the bonds are convertible into preferred stock. The stock increase provides for the conversion.

A dispatch from Boston says that the New York, New Haven and Hartford Railroad Company has disposed of all its trolley companies in Massachusetts, Rhode Island and Connecticut, to several individuals who have formed an association which is to be known as the New England Security and Investment Company. This action, it is said, was taken as a result of Governor Guild's message to the last Legislature urging legislation which would prevent the transfer of Massachusetts transportation companies to aliens. The transaction involves the sale of 75 per cent. of the street railways of Connecticut, together with lines running into New York and Rhode Island and numerous lines into Massachusetts.

The committee on standard rules submitted a report to the American Street and Interurban Railway Association at the St. Louis convention in 1904, in which was embraced a code of general rules for the government of trainmen of electric roads and also some additional rules, applicable to interurban roads, to be used in connection with those contained in the Standard Code of Rules. These rules have been issued in pamphlet form and sent to the various street-railway companies of the country. The committee now desires to know if the rules contained in the report have been universally

adopted, and, if not, to ascertain the reasons for their non-use. Companies are requested to advise B. V. Swenson, secretary, 60 Wall Street, New York city, whether these rules have been adopted.

PUBLICATIONS.

A booklet from the Gould Storage Battery Company, New York city, deals with Gould storage batteries for telephone exchanges. Several types of Gould cells are suitable for telephone service, the most popular of which are illustrated in the book.

The latest handbook, No. XVII., of the Standard Underground Cable Company of Pittsburg, has just been issued and is ready for distribution. In its 228 pages it contains price-lists, telegraph code and useful information relating to bare and insulated wires and cables for conducting electric currents. It was compiled by Joseph W. Marsh, vice-president and general manager of the company. While the book is primarily a trade publication and devoted to some extent to the exploiting of the products of the Standard Underground Cable Company, it embodies in convenient form for ready reference a wide range of information which will be interesting and valuable to all engineers, managers and owners of electrical properties. The information is up-to-date and is based on the results of years of practical experience. There are six general divisions in the new book—price-lists, telegraph code, description of products, working directions, testing, general information and electrical information. The last three are especially interesting. There are numerous illustrations, including 24 pages of half-tones. Gratuitous distribution of the book is being limited to one copy to each of the company's customers, but in order that anyone interested may secure a copy the company has put it on sale at a nominal figure, in three grades. The book shows careful work and is a credit to the company and to its author.

TRADE NEWS.

Articles of incorporation have been filed for the Stanley-G. I. Electrical Manufacturing Company of Massachusetts at Olympia, Wash. W. H. Hendry of Seattle has been appointed agent and attorney for Washington.

Sealed bids will be received at the office of the town clerk of Eagle River, Wis., until August 25th for the construction of a municipal electric power plant, a dam across the Wisconsin River, four miles of transmission line from the dam to Eagle River, and waterworks pumping equipment, all complete. The board will not consider bids for separate parts of the construction. The contract will be let for the entire construction and equipment. Frank Beardsley is clerk of the Town Board.

T. J. Cope has just disposed of his conduit threading machine to a syndicate from Stockholm, Sweden. This includes his new machine and improvements recently patented and covers all countries excepting Canada and the United States, which he has retained.

Tenders will be received by the deputy postmaster-general, Adelaide, Australia, until September 12th for a quantity of telephone material. Inquiry may be made of the Bureau of Manufactures, Washington, D. C., by referring to file No. 264 of foreign trade inquiries.

The production of wire (all kinds) in the United States in 1905 was 1,808,688 tons, a new high mark and considerably more than twice as much as was produced 10 years earlier. Exports last year were 367,926,500 pounds, as compared with 282,666,500 pounds in the preceding year, and 255,036,500 in 1904.

In Trenton, N. J., on August 15th, Vice Chancellor Pitney appointed J. K. Louckel and Robert A. Messler receivers of the Reeves Engine Company of Trenton. The complainant is Elwood W. Wilson of Langhorne, Pa. It is said that the liabilities of the company are $311,000 and the assets $258,000.

Trade of the United States with its non-contiguous territories amounted in the fiscal year ended June 30th to $119,304,511, this growth of about 20 per cent. over 1905 occurring in the shipments to Alaska, Hawaii and Porto Rico, but especially Porto Rico; while to the Philippine Islands there was a reduction of about three-quarters of a million dollars.

After September 1st the San Francisco representatives of the Gould Storage Battery Company will open permanent offices in the newly restored Monadnock Building. Previous to the earthquake and fire the Gould company had offices in the Crossley Building, which was destroyed, while for the last four months temporary offices at 1701 Geary Street have been occupied.

The Stackpole Battery Company of St. Marys, Pa., now has nearing completion in St. Marys a fine factory on which no expense has been spared. It is felt that the plant will be one of the finest in the world for the manufacture of batteries. The Stackpole Battery Company is a Pennsylvania corporation and is backed by some of the most powerful people, financially speaking, of that section of the state. This strong financial position of the Stackpole company, coupled with Superintendent W. J. Mills' skill as a carbon manufacturer, to say nothing of his high standing in the general electrical trade as a man that "knows the business" in every detail, seems to insure the permanency of this new industry.

BUSINESS.

The Automatic Electric Company announces the sale of a complete automatic telephone exchange of 2,600 lines immediate installation to the Richmond Home Telephone Company of Richmond, Ind. This automatic equipment will replace the manual apparatus now in use by the Richmond Home Telephone Company.

The Stromberg-Carlson Telephone Manufacturing Company of Rochester, N. Y., reports having closed contracts for switchboards for the following places: Port Byron, N. Y.; Shickshinny, Pa.; Packwaukee, Wis.; Knoxville, Tenn.; Port Williams, Wash.; Waterport, N. Y.; Sioux City, Iowa; St. Marys, W. Va.; Shell Mound, Tenn; Bridgeport, Minn.; Kentwood, La.; Palouse, Wash.

The general application of electricity to power work and the facility with which electrical energy may be transmitted over long distances has furnished the necessary incentive toward the development of the hydraulic turbine, bringing the so-called "waste" waterpowers of the country to their proper recognition. Allis-Chalmers electrical machinery had been, for some years, installed in many of the hydro-electric plants of North America before the name Allis-Chalmers Company came to be associated with hydraulic turbines and the building of hydraulic machinery. Since its entrance into the hydraulic field, however, the record for Allis-Chalmers water turbines has been remarkable, while the aggregate horsepower of the hydro-electric plants of North America in which Allis-Chalmers apparatus is installed has reached nearly 900,000. This aggregate is partly composed of installations or orders for turbines alone, amounting to over 200,000 horsepower. The Allis-Chalmers Company lays stress on the fact that it is the only designer and builder of complete hydro-electric installations in the United States.

ILLUSTRATED ELECTRICAL PATENT RECORD.

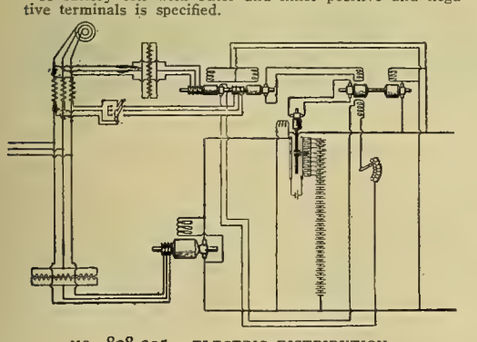
Issued (United States Patent Office) August 14, 1906.

828,315. Electrical System of Distribution. Albert S. Hubbard, Greenwich, Conn. Application filed April 10, 1905.

One claim is for the combination of a alternating-current generator and a circuit therefrom, a direct-current circuit, a rectifying device between the two circuits, a storage battery across the direct-current circuit, a motor controlling the number of cells in the battery circuit, and means dependent upon the condition of the alternating-current circuit for starting the motor in either direction. (See cut.)

828,319. Galvanic Cell. Baroukh Jonas, Toledo, Ohio. Application filed April 2, 1904.

A battery cell with outer and inner positive and negative terminals is specified.



NO. 828,315.—ELECTRIC DISTRIBUTION.

828,322. Electric Railway. Charles J. Kintner, New York, N. Y. Application filed December 5, 1903. Renewed January 11, 1906.

The system embraces a series of sectional conductors or third rails, normally open branch feeders and switches for closing the circuit between the current-feeder and the sectional conductors. These are combined with switch-controlling electromagnets included in circuit with local electrical generators beside the track, together with track-circuit-closing devices controlled by the wheels of a car or train upon the track.

828,335. Dry-battery Cell. Angelica E. Post, Boston, Mass. Application filed May 17, 1905.

One of the electrodes is a cup electrode, partially filled with the active material.

828,356. Fire Alarm. Alfred E. Watts, Wattsburg, Canada. Application filed July 13, 1905.

A number of expansible rods and disks are in electrical connection with an annunciator.

828,368. Electric Signaling Device. Henry M. Bascom, Brooklyn, N. Y., assignor of one-half to John F. Hemenway, New York, N. Y. Application filed September 21, 1904.

The instrument has an electromagnet, two coils and an armature normally held against the pole of one coil of the electromagnet and adapted to be attracted to the other coil upon cessation of current in the first coil.

828,371. Electricity Meter. Adrian Baumann, Zurich, Switzerland. Application filed October 27, 1903.

Two or more wheels are operatively connected with the meter, and a wheel fully toothed at its periphery is rigidly connected with these wheels. A counter is provided to which always one of the wheels is operatively connected on a portion or on the totality of this periphery and there are means for selecting always one of the wheels for the action upon the counter.

828,373. Electrical Switch. Harry A. Beynon, Chicago, Ill. Application filed July 12, 1905.

Hinged top and bottom boards adapted to fold together have a spring engaged therebetween and holding the same separated. Contacts are adapted for engagement when the spring is compressed, and a switch is positioned to break the circuit and to be actuated by the foot of the operator when standing on the top board.

828,386. Automatic Train Stop for Block-signal Systems. Fred B. Corey, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed March 10, 1904.

A stop arm is controlled by a signal and adapted to engage a brake-controlling device when the signal is at danger, the stop arm being adapted to move the device to apply the brakes if the car is moving fast and to be moved by the device if the car is moving slowly.

828,388. Controller. Abe L. Cushman, Concord, N. H. Application filed May 3, 1905.

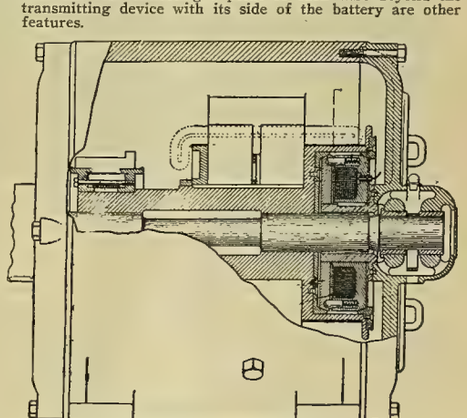
The armature-control mechanism requires to be placed in position to cut out the armature resistances before the field-control mechanism can be placed in position to cut in the field resistances. There are means electrically actuated by the motor circuit for automatically locking the armature-control mechanism in its cut-out position.

828,419. Register Signal for Measured-service Telephone-exchange Systems. Frank R. McBerty, Evanston, Ill., assignor to the Western Electric Company, Chicago, Ill. Application filed October 7, 1905.

A signal lamp is controlled by a relay having two coils, whereby the operator is notified by the continuous glowing of the lamp of the making of a tally at the meter.

828,420. Fire-alarm System. Judson McFell, Chicago, Ill. Application filed August 7, 1905.

A main circuit comprises two wires extending from opposite sides of the battery and each normally connected at one end only with its side of the battery. A signal-receiving device, a signal-transmitting device bridged between the main wires, and means comprising a switch for connecting a point of each wire beyond the transmitting device with its side of the battery are other features.



NO. 828,528.—ELECTRIC MOTOR AND BRAKE.

828,446. Electric Signaling Apparatus. George W. Watkins and Walter C. Bethel, Seattle, Wash.; said Watkins assignor to John T. Bethel, Seattle, Wash. Application filed May 28, 1903. Renewed January 22, 1906.

In electric signaling apparatus for electric railways one claim covers the combination of the line circuit, a number of normally open signal circuits having stationary circuit terminals formed of resilient metallic strips arranged in close proximity to the roadway, and circuit terminals adjustably mounted on the rolling stock relatively to the stationary terminals and electrically connected with the line circuit.

828,489. Trolley-pole Controller. Milner Lidster and Joseph Hoellig, Los Angeles, Cal. Application filed December 4, 1905.

A pressure spring is connected to the trolley pole base by a shiftable connection and there are means to

shift the connection betwen the pressure spring and the base of the trolley pole to above or below the pivotal connection between the trolley-pole base and its support.

828,518. Signaling System for Electric Railways. Charles E. Scribner, Jericho, Vt., assignor to the Western Electric Company, Chicago, Ill. Application filed December 1, 1905.

There is a semaphore at each sub-station and a selector at the central station having a number of signal-setting positions corresponding to the sub-stations. A number of testing positions follow the setting positions in inverse order thereto, a selector-arm being adapted to travel over the positions to set a semaphore and to test the operation thereof. A test circuit is adapted for connection to one of the sub-stations by the operation of the semaphore at the station, and a local circuit at the central office is adapted to be closed by current from the test circuit to operate the test signal only when the selector arm is in the testing position corresponding to the sub-station at which a signal has been set.

828,528. Electric Motor and Brake. Herbert A. Balcome, Boston, Mass., assignor to the B. F. Sturtevant Company, Boston, Mass. Application filed November 30, 1904.

An electric motor has in combination an armature, its shaft, two opposed friction-brake members secured to the armature shaft, two movable rotatively stationary friction-brake members located between the opposed brake members, a spring for forcing the last-named brake members into contact with the armature brake members, and electromagnetic means for collapsing the movable brake members. (See cut on preceding page.)

828,544. Electrode for Arc Lights. Frederic J. Gerard, London, England, assignor of one-half to Lothar Fiedler, London, England. Application filed June 9, 1903.

An electrode for arc lights comprises an intimate mixture of carbon with an alloy consisting of magnesium and another metal.

828,570. Electrically Operated Indicator. Michael C. Regan, U. S. Army. Application filed January 12, 1906.

The principal feature of this indicator is a shoe comprising a pair of contact plates insulated from each other.

828,582. Adapter. Alfred Swan, New York, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed February 6, 1905.

An improved adapter for incandescent lamps is described.

828,585. Circuit Closer for Trolley Signals. Horace Thurston, Providence, R. I. Application filed January 2, 1906.

In a circuit closer are a pair of contacts, a pair of contact arms, means whereby the arms may be actuated to close the circuit by a passing car, means including a piston working in a cylinder for automatically prolonging the period of contact, means in the cylinder for causing a quick break in the connection, and means for preventing a back contact.

828,629. Overhead Trolley. William H. Schneider, South Bellingham, Mass., and Thomas Holland, Woonsocket, R. I. Application filed February 10, 1906.

A body has a forked upper portion receiving and carrying fore and aft wheels and also having the arms of the fork extended well above the axes of the wheels.

828,637. Motor Controller. Samuel D. Black, Sherwood, Baltimore County, Maryland, assignor to the Manufacturers' Engineering Company, Baltimore, Md. Application filed February 5, 1906.

A controller for electric motor comprises a switch arm and contacts, an electromagnet, means co-operating with the switch arm and contacts to connect the coils of the magnet across the motor-supply circuit when the arm is in an operating position and to disconnect the coils therefrom when the arm is in the "off" position, and circuit-breaker contacts connected in circuit with the coils of the magnet and operative by the magnet to remain normally closed during the operation of the motor.

828,647. Magnetic Clutch. Lucius T. Gibbs, Hempstead, N. Y. Application filed August 2, 1905.

One or more friction disks are arranged transversely about a power-driven shaft and connected with a load to be driven. A number of radial armature levers are arranged to swing longitudinally of the shaft, and adapted to press the friction-disks together, electromagnetic means being provided for actuating the armature levers. (See cut.)

828,648. Reversible Driving Gear. Lucius T. Gibbs, Hempstead, N. Y. Application filed August 2, 1905.

A pair of gears mounted to rotate on a shaft have means intermediate to the gears and movable longitudinally of the shaft for connecting one or the other with the shaft, and there are electromagnets adjacent to and on opposite sides of the connecting means to act directly upon the same. There are means for energizing either magnet independently, whereby the shaft may be driven in either direction. (See cut.)

828,655. Indicating and Warning Attachment for Grain Bins. David H. Houston, Hunter, N. D. Application filed September 18, 1905.

An electrical device arranged within a grain bin indicates by the pressure of grain the amount of grain in the bin.

828,678. Electric Telpher Postal System. Roberto T. Piscicelli, Naples, Italy. Application filed September 5, 1902.

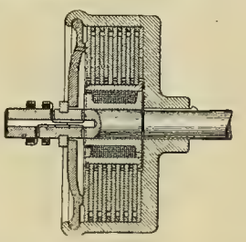
The combination consists of a collecting pole, a posting box, a frame to which the box is pivoted near the bottom, rollers on the box and vertical guides on the collecting pole in which the rollers run, which guides widen out at their highest points and compel the box to turn over on reaching the top of the pole. Conductor wires and a motor are included.

828,683. Telephone Exchange System. Harry O. Rugh, Chicago, Ill. Application filed November 17, 1902.

A section of a signaling circuit at the exchange includes a source of current and the coils of a transformer. A switching appliance is adapted to connect the signaling section with the telephone line and there are means included in the signaling section for establishing transformer relation between the coils of the transformer upon the connection of the signaling section with the telephone line.

828,687. Automatic Circuit-controlling Device. Richard F. Spamer, Chicago, Ill., assignor to the Consolidated Fire Alarm Company, New York, N. Y. Application filed January 25, 1905.

The combination consists in part of a cup-shaped body member having interior threads, a cap member engaging the threads for closing the body member and a partition member engaging the threads to divide the cup member into two compartments, the lower wall of the partition member being dished.



NO. 828,647.—MAGNETIC CLUTCH.

828,691. Electrical Signal Circuit. Eugene W. Vogel, Chicago, Ill., assignor to the Railroad Supply Company of Illinois. Application filed July 10, 1901.

In a railroad signaling system are an electrical circuit, a signaling device and a main and an auxiliary battery therein, automatic means for controlling the circuit and producing and discontinuing the signal and electrically actuated means connected in the circuit adapted to be manually controlled for cutting the main battery and signal out of the circuit, the automatic means automatically cutting the main battery and the signal in.

828,693. Telephone System. Harry G. Webster, Chicago, Ill., assignor to the Kellogg Switchboard and Supply Company, Chicago, Ill. Application filed December 15, 1902.

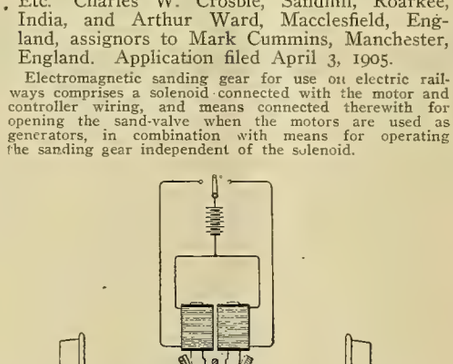
A line relay is connected with one side of the line, a cut-off relay with the other side of the line, and a supervisory relay connected in parallel with the line relay when a connection is established.

828,709. Adjustable Incandescent-light Holder. Amos B. Buckland, Rochester, N. Y. Application filed January 22, 1906.

An adjustable bracket for changing the position of incandescent electric lamps is described.

828,717. Automatic Electromagnetic Sanding Gear for Use on Electric Railways and Tramways, Etc. Charles W. Crosbie, Sandhill, Roarkee, India, and Arthur Ward, Macclesfield, England, assignors to Mark Cummins, Manchester, England. Application filed April 3, 1905.

Electromagnetic sanding gear for use on electric railways comprises a solenoid connected with the motor and controller wiring, and means connected therewith for opening the sand-valve when the motors are used as generators, in combination with means for operating the sanding gear independent of the solenoid.



NO. 828,648.—REVERSIBLE DRIVING GEAR.

828,739. Electric Switch. Gerald W. Hart, Hartford, Conn., assignor to the Hart Manufacturing Company, Hartford, Conn. Application filed November 10, 1905.

A flush push-button switch is described.

828,746. Elevator Bell Signal. Jerry King, St. Paul, Minn. Application filed May 23, 1905.

A contact device for elevator signals is covered by the patent.

828,747. Sectional Third-rail System of Electric Railways. Charles J. Kintner, New York, N. Y. Application filed October 13, 1903. Renewed January 24, 1906.

Claim 1 reads: An electric railway system embracing a current feeder or main; a series of sectional third rails or conductors; a line of sectional tram or track rails and an electrically-continuous tram or track rail; in combination with switching devices having electrical connections with electrical generators located at intervals along the route, the sectional tram or track rails the continuous tram or track rail and the wheels and axles of a car, whereby the presence of a car upon any section maintains the corresponding sectional conductor in electrical connection with the feeder through the agency of currents flowing through the switch-controlling devices, the tram or track rails and the wheels and axles of the car.

828,775. Telegraph Transmitter. Harlie O. Putt, Millbury, Oho. Application filed January 16, 1906.

A type-writing machine has a bank of keys provided with key levers and a telegraph transmitter has a number of key stems each located directly under one of the key levers. A transmitting device is carried by each key stem and there are means for rotating each key stem when moved longitudinally in one direction, and means for regulating the movement of the key stem.

828,788. Electric Crossing Signal for Railways. Eugene W. Vogel, Chicago, Ill., assignor to the Railroad Supply Company of Illinois. Application filed May 20, 1901.

The patent covers an electric railway crossing signal which is actuated by the approach of a car.

828,814. Apparatus for Electroplating. Frank R. Cunningham, Medford, Mass. Application filed September 1, 1905.

The apparatus comprises a receptacle provided with a brush and adapted to contain the plating solution, an anode contained within the receptacle and adapted to contact with the plating solution therein, and means for drawing the solution into the receptacle and discharging it therefrom.

828,834. Burglar Alarm. Burton S. Bell, Ree Heights, S. D. Application filed February 6, 1906.

A contact device for ringing an alarm bell actuated by a battery is described.

828,835. Wall Set. Jules A. Birsfield, Rochester, N. Y., assignor to the Stromberg-Carlson Telephone Manufacturing Company, Rochester, N. Y. Application filed February 13, 1905.

The patent covers a telephone wall set.

828,848. Telephone Switchboard. Alexander M. Haubrich, Chicago, Ill., assignor to the Stromberg-Carlson Telephone Manufacturing Company, Rochester, N. Y. Application filed April 1, 1904.

The claim covers strips interposed between the jack banks, jack openings in the jack banks, a set of four apertures above each jack opening in the strip, each aperture corresponding to one of the sub-stations connected with the line leading to the jack springs to the rear of the corresponding jack opening, and pins adapted for interchangeable insertion in apertures.

828,855. Railway Signaling Apparatus. Otto A. Kindlund, Chicago, Ill. Application filed December 27, 1905.

A telephone and an alarm signal are carried on a cab or car mounted on the rails.

828,864. Receiver for Wireless Telegraphy. Wilhelm Schloemilch, Berlin, Germany, assignor to Gesellschaft für Drahtlose Telegraphie M. B. H., Berlin, Germany. Application filed June 27, 1905.

A receiver circuit acts together with two detectors of different degrees of sensitiveness, and there are means operated by the less sensitive detector for protecting the more sensitive detector against too high intensities.

828,866. Party-line Telephone Exchange System. Alfred O. Stigberg, Chicago, Ill., assignor to the Stromberg-Carlson Telephone Manufacturing Company, Rochester, N. Y. Application filed May 6, 1904.

An alternating-current relay at each sub-station is connected between one line-limb and a common conductor. A polarized relay is adapted for connection between the other line limb and the common conductor, the alternating-current relay controlling the circuit through the polarized relay. A signal bell is adapted to be connected in bridge with the alternating-current relay upon actuation of the polarized relay. Means at the central exchange are provided for simultaneously sending alternating current into one line limb and direct current into the other line limb to actuate the relays and the signal bell at one of the sub-stations.

PATENTS THAT HAVE EXPIRED.

Following is a list of electrical patents (issued by the United States Patent Office) that expired on August 20, 1906:

409,170. Electric Valve. M. C. Wheeler and A. M. Clark, Marshalltown, Iowa.
409,178. Secondary Battery. C. A. Faure, New York, N. Y.
409,181. Conductor for Conveying Electricity. S. Z. De Ferranti, Hampstead, County of Middlesex, England.
409,182. Distribution of Electrical Energy. S. Z. De Ferranti, Hampstead, England.
409,183. Joint for Electric Mains. S. Z. De Ferranti, Hampstead, England.
409,207. Electrical Indicator. E. R. Knowles, Brooklyn, N. Y.
409,237. Electrical Railway System. E. E. Ries, Baltimore, Md.
409,259. Galvanic Battery. G. C. Ward, Boston, Mass.
409,291. Process of Making Solution Compaunds for Galvanic Batteries. W. P. Kookogy, Brooklyn, N. Y.
409,316. Thermostat. A. M. Butz, Minneapolis, Minn.
409,349. Dynamo Electric Machine. S. Z. De Ferranti, Hampstead, England.
409,364. Automatic Electrical Fluid Releaser. B. S. Molynfux, Minneapolis, Minn.
409,365. Gas Battery. L. Mond, Northwich, County of Chester, and C. Langer, London, County of Middlesex, England.
409,366. Process of Obtaining Electricity from Gas Batteries. L. Mond, Northwich, and C. Langer, London, England.
409,448. Secondary Battery. C. S. Bradley, Yonkers, N. Y.
409,449, 409,450. System of Electrical Distribution. C. S. Bradley, Yonkers, N. Y.
409,460. Electrical Circuit Closer for Water Indicators. F. M. Dunn, A. Petticord and J. H. King, Baltimore, Md.
409,463. Armature Core for Dynamos. D. Higham, Philadelphia, Pa.
409,470. Apparatus for Treating Animals by Electricity. G. M. Laerance, London, England.
409,498. Combined Gas and Electric Light Fixture. T. J. Pierce, Philadelphia, Pa.
409,598. Electrical Lock. P. Schwenke, Zerbst, Anhalt, Germany.
409,565, 409,566. Distribution of Electrical Energy. S. Z. De Ferranti, Hampstead, England.
409,574. Telephone Switch System. C. C. Gould, Batavia, N. Y.
409,603. Trolley for Electric Railways. J. G. Dickson, R. Dickson and P. Snyder, Pittsburg, Pa.
409,628. Safety Fuse for Electric Conductors. W. S. Bishop, New Haven, Conn.

WESTERN ELECTRICIAN

EVERY SATURDAY

Vol. XXXIX. CHICAGO, SEPTEMBER 1, 1906 No. 9

Oil Engines Driving Electric Generators in Lighthouses and Wireless Stations.

By Frank C. Perkins.

The regulation, reliability and economy of the modern oil engine are generally acknowledged; and it speaks well for this form of prime mover that it is so extensively used in lighthouses, wireless-telegraph stations and government fortifications, where hundreds of lives might be sacrificed by a momentary failure of power.

On the score of economy of operation as well as the reliability, the internal-combustion engine is well known to compare favorably with other forms of power. In the United States Navy Department's wireless-telegraph stations the acceptance tests require the greatest economy. A number of the oil engines operating in these plants ran in recent trials on an oil consumption of less than three-fourths of a pound of kerosene oil per actual horsepower developed per hour.

The accompanying illustration, Fig. 2, shows the wireless station at Cape Cod, Mass., the towers being noted in the background and the station equipped with oil engines in the foreground. Oil engines are said to be best adapted to the exacting requirements of the wireless-telegraph station work. It may be interesting to note that this station of the Marconi Wireless Telegraph Company is the plant from which the first wireless message was sent across the Atlantic Ocean. It is stated that the work at this station, which has one of the largest wireless-telegraph equipments in the country, is exceptionally hard on the engines, as the load often changes momentarily from 25 per cent. overload to no load, and this is a severe strain on any form of engine. It will be remembered that this variation in load is continually occurring, as many of the ocean steamers publish daily papers on board, and the news items are transmitted from land by this long-distance apparatus, frequent interruptions causing extremely variable loads for both engines and electrical generators.

In the United States War Department hundreds of oil engines are employed, not only in the fortifications, but also in other places, the total capacity of these engines aggregating over 1,000 horsepower; and they are also utilizezd etxensively by the British government, as well as by the army and lighthouse departments of Japan, Russia, Norway, India and Cape of Good Hope.

A number of 50-horsepower oil engines have been installed in long-distance wireless-telegraph stations in Cuba and Panama by the United States Navy Department. In many of the wireless stations engines of the Hornsby-Akroyd type have been installed of seven-horsepower capacity, operating the electrical generators for supplying the necessary current to the electrical instruments. The illustration on the next page (Fig. 4) shows the engine room of the Navesink wireless plant, while Fig. 1 shows the twin lights on the Highlands of Navesink, N. J., of the United States Lighthouse Department. Two 25-horsepower oil engines are installed in the electrical generating room of this plant, which supplies one of the largest lighthouses in the world. Fig. 3 shows the Southwest Ledge station, which is equipped with two seven-horsepower engines and electrical generators. The two 25-horsepower engines for Navesink Highlands are of the Hornsby-Akroyd type, using oil as fuel, and belted to generators which furnish current for the great revolving searchlights. These engines, it is stated, have run continuously from sunset to sunrise for over seven years.

In the Stratford Shoal light station there are two oil engines driving dynamos of small size, each engine having a capacity of only four horsepower. In many lighthouses similar engines are utilized for driving air condensers supplying the necessary air pressure for operating the fog signals, and it is obvious that every detail of the mechanical equipment of these lighthouses must be of the highest grade, where the momentary stoppage of the signals in case of fogs, or the searchlights, particularly in stormy weather, might result in shipwreck. Absolute reliability is made even more essential, because these stations are so far from any repair shop, and beyond the immediate reach of skilled mechanics. It is impossible for tenders to make a landing when the sea is high during or after a storm, and the apparatus, including the generators and engines, must always be in perfect working order.

In many of the lighthouse plants the current is used for government wireless-telegraph stations, and a most complete plant of this character has been installed at Navesink Highlands, N. J. Not only must the electrical and mechanical equipment be reliable, but the governing qualities of the engines must be almost perfect. The regulation in these oil engines is effected by a governor, the lever of which, working on the by-pass valve, allows a certain amount of the oil displaced by the positively driven oil-pump piston to flow back to the reservoir. When operating under ordinary conditions of load, the governor cam opens only the small inside valve, which regulates the amount of oil injected into the vaporizer. But should the tendency of the engine be to speed up, due to a quick reduction of the load, the governor arm will open not only the small inside valve, but also the larger concentric valve outside, in which case all of the oil will return to the reservoir and none enter the vaporizer. These lighthouse oil engines are operated on the four-stroke cycle. The searchlights of both German and American lighthouses are now very largely operated by electricity.

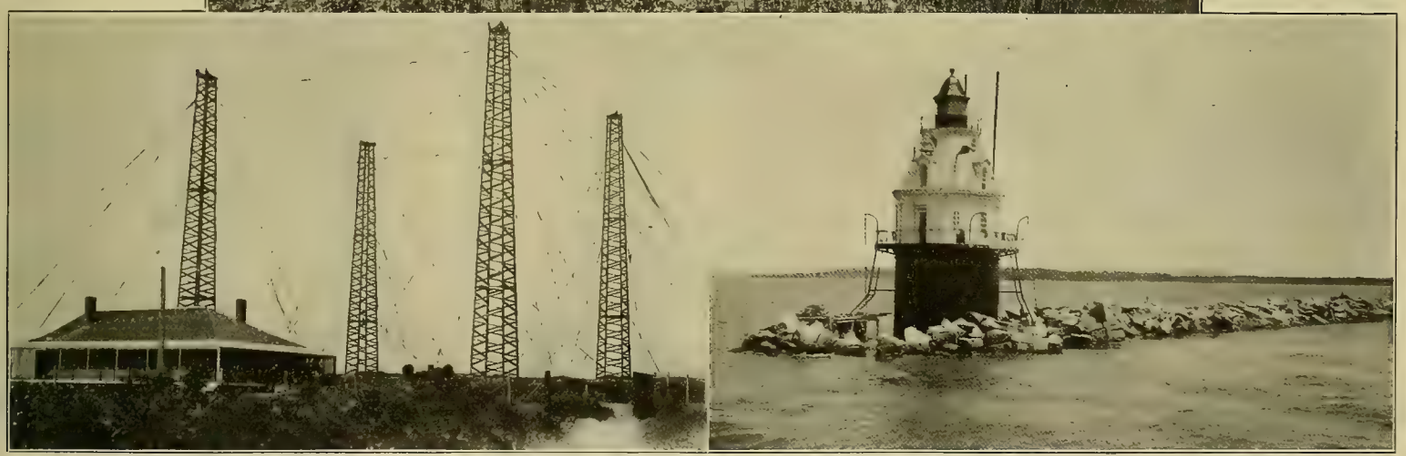


Fig. 1. Twin Lights and Wireless Station at Highlands of Navesink, N. J.
Fig. 2. Wireless Station at Cape Cod, Mass. Fig. 3. Lighthouse at Southwest Ledge Station.
LIGHTHOUSES AND WIRELESS STATIONS WHERE ELECTRIC GENERATORS DRIVEN BY OIL ENGINES ARE USED.

Soft Graphite Artificially Produced.

Edward G. Acheson, the discoverer of carborundum, of siloxicon and manufactured graphite, has discovered a process for making a very soft graphite that may revolutionize the lubricant and stove-polish fields. Mr. Acheson is at the head of the International Acheson Graphite Company of Niagara Falls. The graphite he has been making is known as hard graphite, and it has been devoted to the manufacture of articles not touched upon by the natural graphite industry, such as electrodes, etc., while it has also entered into paint pigments. For six years Mr. Acheson has been experimenting in hope of finding a process that would give a soft, soapy-like product. This he states he has accomplished. Several experimental furnaces at Niagara Falls have been operated and opened. The new graphite will be sold for stove polish and as a lubricant.

Precautions In Electrical Flour Bleaching.

Electrical flour bleaching is rapidly coming into use in the larger flouring mills of the United States, and special requirements have been established for the installation of the apparatus used in connection with the system in full compliance with the rules of the National Electrical Code. Following are the electrical requirements:

First.—All electrical apparatus used in connection with any electrical flour-bleaching process must be installed in the same enclosure, whether located outside of the mill building, in room built specially for the purpose, or inside of the mill building or power plant, in rooms built to comply with the rules and requirements given below; and all electrical apparatus must be installed in full compliance with the rules and requirements of the

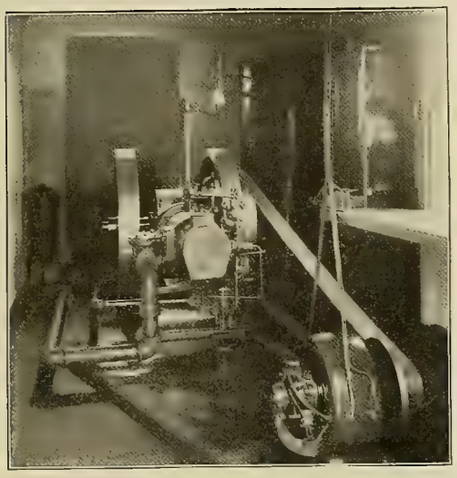


FIG. 4. OIL ENGINE AND GENERATOR FOR NAVESINK WIRELESS STATION. (SEE PAGE 155.)

National Electrical Code and the following special requirements:

Second.—Dynamos and motors shall be set in metal pans sufficiently large to catch all grease droppings and any sparks which may be thrown off.

(a) Transformers and spark coils, when immersed in oil, shall be located in metal pans.

(b) The terminal blocks on dynamos and motors shall be made of fireproof insulating material.

(c) Switchboards shall be constructed of slate or marble, and shall be supported on iron framework.

(d) All wires used must be rubber covered and shall be carried on porcelain cleats or knobs. For three hundred (300) volts or less, wires shall be spaced 2½ inches, and not less than eight (8) inches when the voltage exceeds 300 volts. No wire smaller than No. 14 B. & S. gauge shall be used, and when the voltage exceeds 300 volts, wires shall not be smaller than No. 10 B. & S. gauge.

(e) All joints shall be properly soldered and taped.

(f) All movable connections, such as connections to the upper electrodes of the Alsop apparatus, must be made with stranded wire.

Third.—When the enclosure containing the electrical apparatus is lighted by incandescent lamps, fuseless rosettes, rubber-covered lamp cord and fiber-lined sockets must be used.

(a) When the current is brought in from outside sources each wire must be protected by lightning arrester located outside the building.

(b) At the point where the wire enters the building the main fuses must be installed in tight iron fusebox. The wire must enter the box through either the top or sides, and must be protected at these points by porcelain bushings.

Fourth.—The pipe conducting the gas to the bleaching reel or agitator must have an insulating section near the machine producing the gas, or not less than two feet of rubber hose; and the section of pipe between the rubber hose and bleaching reel or agitator must be thoroughly grounded.

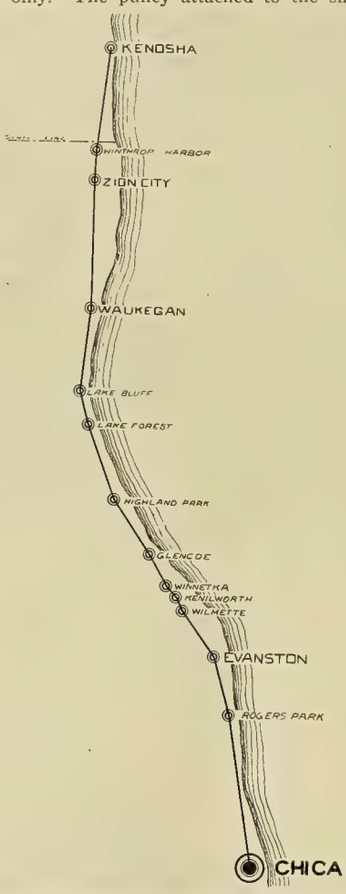
Fifth.—A wire gauze strainer must be inserted in the pipe between the electrodes and the pump or fan, and close to the gas-generating machine to prevent any incandescent particles that may be thrown off by the electrodes from entering the pipe conducting the gas to the bleaching reel or agitator.

Following are the requirements for the construction of enclosures:

First.—If the electrical apparatus be located in brick, stone or frame building, attached to the mill building, the interior woodwork containing same must be lined with one-eighth-inch asbestos, the floor made of cement, and all openings leading to the mill protected by fire doors.

Second.—If the electrical apparatus be located in power plant used in connection with the mill, the apparatus need not be specially enclosed, but must be accessible from all sides.

Third.—If the electrical apparatus be installed in mill building, or additions operated in connection with the mill (excepting power plant), the room containing the electrical apparatus must be both fire and dustproof. If built of wood, must be sheathed inside with surfaced and matched lumber to make it as nearly dustproof as possible and furnishing a smooth surface for the asbestos lining. Floor must be made of cement and the walls and ceiling lined with not less than one-eighth of an inch asbestos, absolutely covering all the woodwork. Power to be brought into the enclosure by shaft only. The pulley attached to the shaft driving the electrical apparatus must be located outside the room containing the apparatus.



ROUTE OF SOUTHERN END OF CHICAGO-MILWAUKEE UNDERGROUND TELEPHONE LINE.

Fourth.—If the dynamo and other electrical apparatus used in connection with the process be completely enclosed in a dustproof iron casing and the bottom of same constructed so as to allow an air space of three inches between it and the floor, no other special enclosure is required in its installation.

Electric Light and Power Statistics of Boston.

From the recent annual report of the Wire Department of the city of Boston the following interesting table, showing the extent and operating characteristics of Boston's electric-light and electric-railway interests, is taken:

TABLE SHOWING THE AMOUNT AND DISTRIBUTION OF BOSTON'S ELECTRICAL POWER, JANUARY 31, 1906.

Companies.	Total Rated Horsepower of Boilers.	Total Rated Horsepower of Engines.	Capacity in Incandescent Lamps.	Capacity in Arc Lamps.	Number of Motors.	Horsepower of Motors.	Number of Stations.
Boston Elevated Railway Co.	28,770	54,450	44,670	496	4,056	153,860	8
Edison Electric Illuminating Co.	22,743	44,840	635,233	9,851	7,455	28,030	13
Charlestown Gas and Electric Light Co.	.....	.....	.....	.....	54	261	.....
Boston Consolidated Gas Co.	1,250	3,100	74,000	600	76	472	1
Block Plant Electric Light Co.	273	417	5,250	.....	3	16	1
Sudbury Building	202	230	719	3	33	171	1
Steam and Power Co.	267	295	4,000	400	41	214	2
Hecht Building Plant	300	200	2,400	240	32	234	1
*Isolated Plants	62,049	39,399	205,439	3,681	1,074	9,235	276
Totals	115,854	142,031	971,711	15,271	13,724	192,493	303

*The capacity of generators for Isolated Plants in K. W., 21,287.

Underground Telephone Construction, with Load Coils, from Chicago to Milwaukee.

Within a year long-distance telephone users between Chicago and Milwaukee will enjoy the distinction of getting their service through the first long-distance underground telephone cables equipped with Pupin load coils. The cables will be drawn through an underground conduit extending from Chicago through the North Shore towns and on to Milwaukee. The work of constructing this conduit is now in progress by the Chicago Telephone Company, and the various phases of the undertaking are of considerable interest.

The two cities are about 85 miles apart, a distance which, until recently, was considered nearly three times the practicable limit for the successful transmission of voice currents through underground

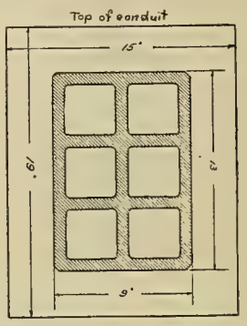


FIG. 1. CHICAGO-MILWAUKEE UNDERGROUND TELEPHONE LINE.—CLASS A CONDUIT CONSTRUCTION.

cables. The first condition which brought about the decision to put in this long underground telephone conduit was the question of how best to improve the service and increase the capacity of the North Shore lines to meet the rapidly growing demands upon the company in this territory. To rebuild the aerial lines and provide for future increase in business meant a large outlay of money, besides the added maintenance cost. Then, too, there was a growing objection to telephone poles and a network of overhead wires on the part of the fashionable suburbs of the North Shore, which the Chicago Telephone Company serves.

The company then turned its attention to underground cables, to be equipped with inductance or load coils as invented by Prof. M. I. Pupin of Columbia University. Experiments proved that by the introduction of these coils at regular intervals, as planned by Professor Pupin, the theoretical advantages claimed could be obtained in actual practice. The American Telephone and Telegraph Company bought the Pupin patents covering the load coil in January, 1901. The invention has been successfully applied to overhead cables of the company, but the Chicago-Milwaukee line will be the pioneer application to an underground system of considerable length. Several articles relating to the Pupin invention have appeared in the Western Electrician. One—an account of successful experiments with the improvement in Germany, with illustrations of the load coils as designed for underground and overhead arrangement—was printed in this journal on March 14, 1903.

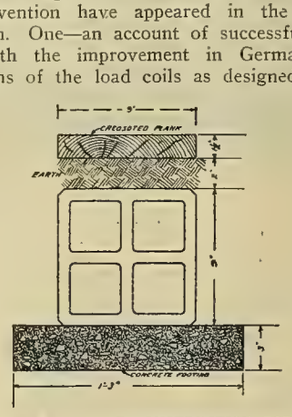


FIG. 2. CLASS B CONDUIT CONSTRUCTION FOR CHICAGO-MILWAUKEE UNDERGROUND TELEPHONE LINE.

The work is being done under the direction of Mr. Allard Smith, superintendent of construction of the suburban department of the company. In planning and prosecuting this work many interesting engineering problems and some obstacles were encountered. All of these have been apparently surmounted. There were hills to climb, ravines to cross, winding roads, wide ranges of grade, soil mixture, water supply for concrete, drainage, board and lodging for laborers and teams, private rights-of-way, municipal regulations and many other conditions to face. The territory traversed is also comparatively thickly populated by well-to-do or

wealthy people. Many of the residents along or near the right-of-way own beautiful homes, and they naturally demanded the most exacting conditions in the carrying out of the work.

The Chicago Telephone Company will do the work only to the southern city limits of Kenosha, Wis., 51.6 miles from Chicago, where its jurisdiction ends. From Kenosha to Milwaukee the Wisconsin Telephone Company will complete the work. The accompanying map shows the route of the conduit to Kenosha.

Vitrified-clay conduit is used throughout. From Chicago to Rogers Park 12 ducts have been installed, and from Rogers Park to Evanston 10 ducts. This part of the job was completed about

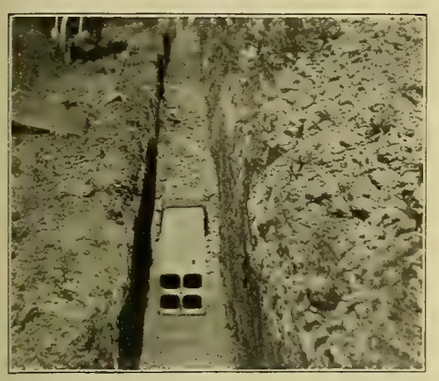


FIG. 3. FOUR-DUCT CONDUIT IN TRENCH BEFORE CAPPING WITH CREOSOTED PLANK.

a year ago and the cable has been pulled in. Since that time the conduit has been laid between Evanston and Waukegan except a few short gaps which are now being closed. Just at present the large gangs are working between Waukegan and Kenosha. From Evanston to Winnetka there are eight ducts, from Winnetka to Lake Forest six, from Lake Forest to Waukegan four and from there to Kenosha three.

Each duct will be provided with a Western Electric standard 120-pair paper-insulated lead-covered cable, 60 pairs of which are 16-gauge and 60 pairs 14-gauge wire. The cables, as previously mentioned, will be equipped with Pupin load coils,

FIG. 4. CHICAGO-MILWAUKEE TELEPHONE CONDUIT, SHOWING PROTECTION OF JOINTS.

which will be contained in iron pots and placed in manholes of special large size inserted in the line at intervals of about 1¼ miles. These manholes are of varying sizes and construction to meet the special conditions.

The trench is dug two feet to grade. The topography of the route is such, however, as to require a ditch five or six feet deep occasionally, while in other places filling in has to be done. In crossing streams and viaducts special construction has been necessary in several cases.

Conduit construction is of two classes—class A and class B. The former is used through city limits, under improved streets, over sharp hills and through ravines or other places where there is considerable liability of interruption. In this class the tile is entirely surrounded by three inches of concrete, as shown in Fig. 1. Class B, shown in Fig. 2, is used in cross-country work. As shown in the drawing of this construction, a four-inch bed of concrete is laid in the bottom of the trench, upon which the tile is laid. Two inches of earth is placed over the tile, followed by a 1½-inch creosoted plank. Fig. 3 shows a four-duct trench just before the creosoted plank is placed in position. Fig. 4 is a view in Western

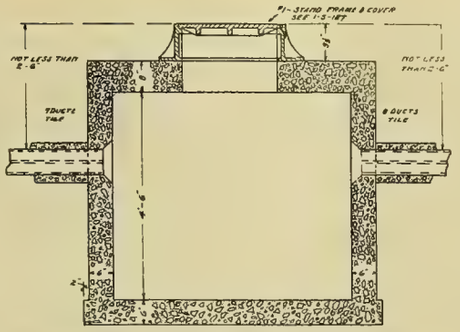


FIG. 5. CROSS-SECTION THROUGH DRAIN VAULT FOR CONDUIT LINE.

Avenue, Lake Forest, showing how the joints are protected in class B construction. A piece of burlap is placed about the joints, which are then covered with a one-half-inch coat of cement mortar.

At intervals of 600 feet concrete vaults are installed, into which the conduit is drained. The drain to each vault is from 300 feet on either side, the fall being two inches in 100 feet. A cross-section through the vault is shown in Fig. 5, which gives a good idea of the construction. In cities the vaults are drained to the sewers and in the country to low places.

The mixture for the construction of the vaults

FIG. 6. WORK ON CHICAGO-MILWAUKEE UNDERGROUND LINE NORTH OF ZION CITY.

is, for the roof and sides, one part American Portland cement, three parts sand and five parts No. 3 gravel. In the trenches and for the floor of the vault the mixture is 1, 4, 8. Concrete mixers are used, which deliver six cubic feet of concrete every two minutes.

At present four gangs ranging from 50 to 100 men are at work. The men, with the exception of one gang, camp along the route. The gang working near Zion City (founded by John Alexander Dowie) is composed largely of citizens of that unique city. Some of the industries are closed,

FIG. 7. PLOW USED IN TRENCHING FOR TELEPHONE CONDUIT.

and the men out of employment are glad to get this work. In Fig. 6 is shown part of the Zion City gang working just north of the city. The trench is dug alongside the roadway or in the parkway beside the road.

In many places where the surface is tough a plow (see Fig. 7), especially built for the work, is used to cut the trench. It is drawn by a cable attached to a capstan which is turned by a team of horses, as shown in Fig. 8.

The work is progressing rapidly, although some difficulties are encountered. Considerable trouble has been caused in places by running quicksand, and in some places running water is encountered just below the surface.

The work is being done in a thorough and permanent manner, and when completed it will be probably the most modern telephone toll line in the country. The cost is considerable, but it is figured that improved service, ample provision for future expansion and the absence of the large maintenance cost incident to aerial lines warrant the expenditure. The total cost of the conduit complete will be in the neighborhood of $250,000 and of the cable installed $400,000. It is expected that the conduit will be completed to Kenosha by October. Then the cable will be pulled in. An

FIG. 8. CAPSTAN USED IN DRAWING PLOW FOR TRENCHING.

electrical survey will then be made in order to provide against electrolysis.

The Chicago Telephone Company has modern exchanges in all the towns between Chicago and Waukegan. Locally the wires are underground in all the suburbs. When the new conduit is completed all the exchanges will be connected up for toll and long-distance service, and the existing toll wires will come down. The company has been spending large sums in improvements in Chicago, and this latest move is but another in the same direction.

The Edison Convention.

This year's convention of the Association of Edison Illuminating Companies will be held at Hotel Frontenac, Thousand Islands, New York, on Tuesday, Wednesday and Thursday, September 4th, 5th and 6th. Interesting papers on live electrical subjects will be read at the convention. Below will be found a list of the papers:

"Costs of and Results from Advertising and Soliciting." By H. K. Mohr, Philadelphia, Pa.

"Details and Costs of an Inexpensive Underground System for Alternating Distribution in the Semi-suburban Residence Districts of a Large City (a symposium of short papers by the underground experts of the large companies)." By W. T. Morrison, New York; William C. L. Eglin, Philadelphia; D. W. Roper, Chicago; Sidney Hosmer, Boston.

"Adjuncts to the Power Load." By C. J. Russell, Philadelphia.

"Investigation of Various Losses in the Electrical Systems of the Edison Electric Illuminating Company of Boston." By L. L. Elden, Boston.

"Recent Developments in Incandescent Lamp Manufacturing." By F. W. Willcox, Harrison, N. J.

"Various Types of Lamps and Practical Hints on Illumination." By Steven B. Burrows, Brooklyn.

"The Isolated-plant Question." By M. F. McAlpin, New York.

"Alternating-current Motors for Various Purposes, with Especial Application to Elevators." By E. W. Lloyd, Chicago.

An evening talk, with stereopticon illustrations. By W. S. Andrews, Schenectady.

"Legislative Influence on Income Through the Meter." By Caryl D. Haskins, Schenectady.

"A Brief Report on Municipal Ownership." By Arthur Williams, New York.

To those wishing to travel after the convention, the New York Central and Hudson River Railroad offers a trip from New York to New York, via Frontenac, Thousand Islands, St. Lawrence River, Montreal, Lake Champlain, Lake George, Saratoga Springs, Albany, Hudson River boat to New York. Time limit, 15 days. Price, $16.75; if Lake George is included, $18.25. Tickets for this tour will be on sale for the evening train of August 30th and morning and evening trains of August 31st, September 1st and 2d. Many have signified their intention of going on the evening train of August 31st from New York city. Sleeping berths should be secured in advance, the railroad company having promised to arrange for one or more extra cars if the business warrants.

Power Plant of Ivorydale Railroad Shops.

Ivorydale, Ohio, is about seven miles from the center of Cincinnati, and is the site of the new terminal locomotive repair shops of the Cincinnati, Hamilton and Dayton steam railroad. The improvements contemplated in connection with these shops are shown on the block plan (Fig. 1). The plant is intended to provide facilities for the storage of and care of locomotives lying over at Cincinnati between trips; for the necessary light running repairs to be made in connection with the locomotives operating on this division of the railroad, and for similar repairs on cars.

The engine house, 254 by 90 feet, of the rectangular type, is served by a transfer table, and contains 14 pits on 18-foot centers. The foundations of the building are of concrete, which is used for all foundation work in connection with the plant. The structure itself is of reinforced concrete and hollow partition tile. Artificial illumination is provided for this building by means of arc lamps installed between the pits. The wiring is all in conduit work, the conduit being laid in the concrete structure. The arc lamps are suspended by conduit screwed directly into a special top made for the lamps, which prevents the exposure of the wire at any point, this being particularly desirable on account of the deleterious influence of the gases.

Steel and brick construction is used for the main erecting shop, the exterior finish being such as to correspond with that of the engine house. This building is 201 feet long by 123 feet wide, and contains nine tracks served by the transfer table. An addition about 70 feet square is built at one corner, which provides space for a power house and a portion of the smith shop. A small addition 24 by 20 feet provides space for the heating equipment.

For the oil house, which is 42 by 33 feet, reinforced concrete construction was employed, as far as the columns, beams and floors are concerned. Brick veneer is also laid over the outside of columns and the outside girders to maintain an appearance uniform with the exterior of the other buildings. This building is one story in height, with basement, in which are located the large tanks for oil storage. The oil is handled by means of air pressure, this pressure being applied, not to the entire tank, but to a small tank into which the oil to be lifted is run by gravity from the large containing tank. Manholes are provided in the top of the tanks, allowing the oil to be delivered to the tanks from the oil-house floor in case it is received in barrels. It may also be delivered directly to the storage tanks through pipe connections when oil is received in tank cars.

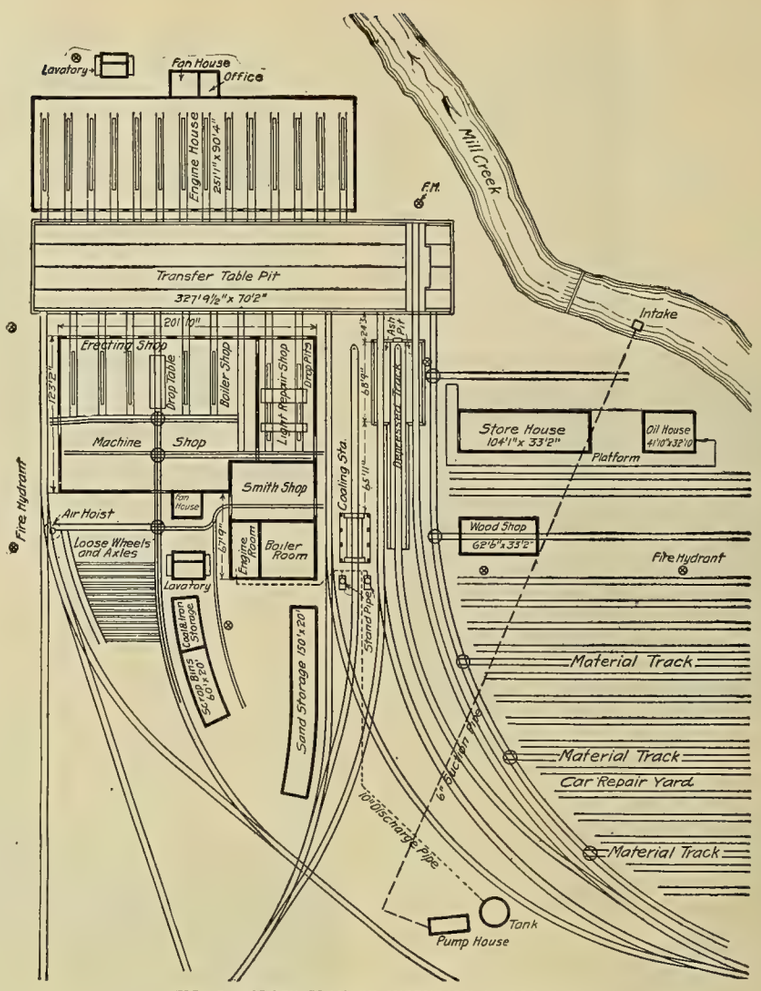


FIG. 1. BLOCK PLAN OF IVORYDALE RAILROAD SHOPS.

As seen on the block plan, the coaling station for the power plant is immediately adjacent to the boiler room of the power house. A coal chute leads directly from the bunkers in the coaling station to the boiler room, thus delivering coal on the boiler-room floors directly in front of the boilers. The coal is fired by hand into the two 150-horsepower internally fired boilers. The two steel stacks are each 33 inches in diameter by 100 feet in height. The grates are of the rocking type. From the boilers the steam is led through long bends to an eight-inch steam header, supported in the boiler room on the wall separating the boiler room from the engine room (see Fig. 2). From the header steam lines are led through the wall into the engine room to the engines and compressors. Angle separators have been installed on the engines and compressor and connect directly with an angle throttle valve, thus providing an efficient and compact arrangement. The exhaust header is located under the engine-room floor and extends throughout the length of the engine room to the oil separator. The outlet from the oil separator connects directly to a tee which allows the exhaust steam to be taken either through a suitable valve directly to the heating system or through another valve being installed in the free-exhaust line.

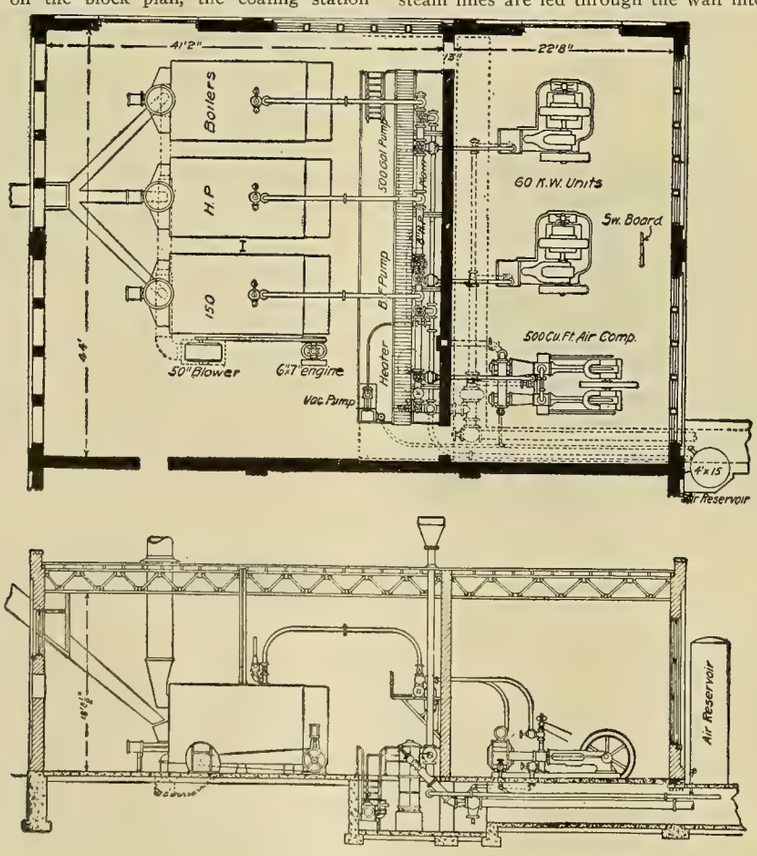


FIG. 2. PLAN AND SECTION OF POWER PLANT FOR IVORYDALE RAILROAD SHOPS.

In a pit in the boiler rom next the engine-room wall are located the auxiliaries. The heater has a capacity of handling 1,500 pounds of water an hour and is nominally rated at from 400 to 600 horsepower. Here also are the boiler feed pump, the fire pump and the Marsh vacuum pump used in connection with the heating system.

In the engine room are installed an air compressor having a capacity of 500 cubic feet per minute; also two 12 by 12-inch Ide Ideal engines, with shafts extended for receiving generators, rated at 100 horsepower each and operating at 275 revolutions per minute. Each of these engines is connected to a direct-current Allis-Chalmers generator of 62½-kilowatt capacity, supplying current at 240 volts when operating at 275 revolutions per minute. A switchboard consisting of two generator panels and one feeder panel was furnished by the Western Electric Company.

Cables for distributing electrical energy for light and power throughout the shops lead from the switchboard in the engine room to panel boards located in the various buildings. The motors installed throughout the shops are provided with special starting panels, consisting of a starting rheostat and a circuit-breaker mounted on black enameled slate. The circuit-breaker serves as a motor switch. These motor circuits are further protected by fuses installed in cast-iron service boxes connected directly to the power main leading through the building in which the motor is located. The lighting feeders lead directly to the panel boards, and from the panel boards the various secondary circuits are taken off as may be necessary. In the engine house the wiring is all installed in iron conduit, the conduit being laid in the concrete structure of the building.

Special methods have been used for supporting the arc lamps whereby all of the wiring is kept inside of the pipes supporting the lamp. A special top is provided for the lamp and this top contains a screw connection for the supporting pipe, which makes it possible to bring the wires down through the supporting pipe into the lamp without exposing them at any point to the gases in the roundhouse. The wiring throughout the other shop buildings is, in general, open, conduit, however, being used where wires are carried along iron columns or side walls.

Drop lamps are provided over all machine tools throughout the shops. Adjustable fixtures are installed where desirable along the side walls, and in some cases over machine tools. Arc lamps are used throughout for general illumination and this light is supplemented where desirable by incandescent lamps. Portable lamps with extension cords have been provided for use in working around the engines and other machinery. An ample number of receptacles have been provided for this purpose.

All motors for the shops were furnished by the Crocker-Wheeler Company and are supplied with direct current at 230 volts. A few of the heavier machines, viz., a planer, steel-tired car-wheel lathe, double punch and shear, etc., are driven by individual motors. The remaining, or lighter, tools are driven by shafting, the motors in each case being installed on the side wall of the buildings, supported by suitable structural-steel brackets. The shafting installed throughout the shop is supported on structural-steel supports attached to the lower chord of the roof trusses, the arrangement adopted being simple in construction and furnishing a very rigid support for the shafting.

The transfer table was furnished by Manning, Maxwell & Moore. It is 70 feet long over all and is fitted with a 70-pound standard rail. It is designed to handle a locomotive weighing 177 tons, the speed when loaded being 150 feet per minute. Two motors are used for traveling the table in the pit. The motors drive the five wheels on one side of the table through the necessary gearing and shafting. A separate motor provided for car haul is connected through suitable gearing and shafting with a drum to which the hauling cable is attached.

A drop table in the machine shop is designed to carry a load of 50,000 pounds on each of four axles, spaced five feet on centers. It is supported by four lifting screws, one at either corner of the structural-steel framework, the screws being operated by a motor installed in the pit. This table is provided with two speeds, one such as to raise or lower the table with a full load at about six inches per minute, and the other designed to raise or lower the table with a load of 20 tons at the rate of two feet per minute.

The plans and specifications for these Ivorydale railroad shops, as described, with the exception of the coaling station, which was installed by Fairbanks, Morse & Co. of Chicago, were prepared by The Arnold Company of Chicago, which company also did the construction work.

Wellman Polar Trip Delayed.

The Chicago Record-Herald in its issue of August 25th prints a cable dispatch from Walter Wellman, who will attempt to reach the North Pole by airship. The dispatch is dated from the Record-Herald House, Danes Island, Spitzbergen, August 14th (via Hammerfest, Norway, August 24th), and is as follows:

"It is still impossible to determine whether we shall be able to make the northward voyage this year. Should the weather be favorable we may start the first week in September. The completion of the balloon-house has been greatly delayed. Many minor defects also have been discovered in the mechanical parts of the airship, but these are remediable, time permitting. The motors work excellently. I have sent a number of wireless messages to Hammerfest, but so far have been unable to get an answer and am without information whether our messages have been transmitted. All are well. We are establishing a great plant for next year's campaign, if such be necessary."

The interruption of space-telegraph communication with Mr. Wellman is said to be due to lack of power at the Hammerfest station. A message was sent by the Record-Herald on August 8th to Auris W. McQueen, who is in charge of the wireless station at Hammerfest for the Wellman-Record-Herald expedition, asking if he was in aerial communication with the establishment at Danes Island. Mr. McQueen answered by cable that wireless messages had been received from Mr. Wellman on July 21st, 22d and 23d, but since that time no signals had been heard or transmitted.

Eleventh Station of Boston Edison Company.

One of the more recent sub-stations of the Edison Electric Illuminating Company of Boston is the one bearing the name Eleventh Station, which is worthy of especial attention in that it is located in what formed a portion of the sub-basement of a mercantile building in the heart of the city, but which was so treated in the construction of station that it now has no direct communication with any other portion of the building.

The entrance to the station, which is located in the Houghton & Dutton Tremont Street Building, is at 59 Tremont Street, where by means of iron ladders, descent to the sub-basement level may be made. The well through which this entrance is made also serves the purpose of a ventilating shaft, through which air is forced by ventilating apparatus in the station. The operating room in this station is 40 feet six inches by 71 feet by nine feet two inches. It is enclosed on two sides by the foundation walls of the building, and on the other sides by brick walls, each two feet six inches in thickness. The ceiling is of steel and brick arch construction, and is plastered, as are also the east and south walls.

Four columns two feet four inches square support the floors above. The floor of the station is built of concrete, of sufficient thickness to furnish proper foundations for the apparatus to be installed. The entire construction of the station is such that it embodies the requirements of fireproof construction.

The high-tension switchboard for controlling the 6,600-volt three-phase 60-cycle service for this station is composed of concrete and cement slabs and barriers, with each line entering the station isolated in individual compartments. The alternating-current cables are of the three-conductor type, under one lead sheath, and are guaranteed for a working pressure of 15,000 volts. They terminate in potheads from which flame-proofed cabled connections are made to the various switches, bus-bars and alternating-current apparatus for the operation of the station. Each cable is controlled by oil switches mounted in individual compartments and operated by means of extended handles from the front of the direct-current board.

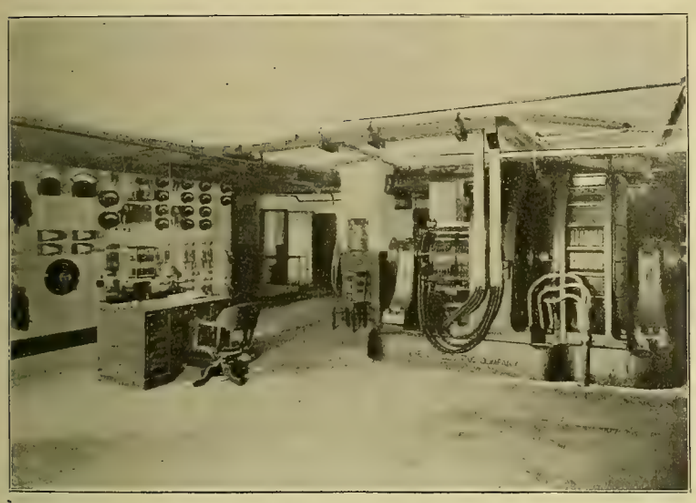
The 230-volt direct-current switchboard is composed of seven marble panels, and is located approximately six feet distant and directly in front of the alternating-current switchboard.

From the generators to the switchboard the direct-current leads are bare copper construction supported on suitable hangers attached to the ceiling. The direct-current cables to the street system drop from the rear of the switchboard to a pit beneath the floor, from which they enter the conduit system of the Edison company for the distribution of current to the adjacent district. This pit is covered by slate slabs two inches thick, arranged for removal at any time desired. An additional panel board is installed adjacent to the above boards for the control of the station lighting, ventilating apparatus, etc.

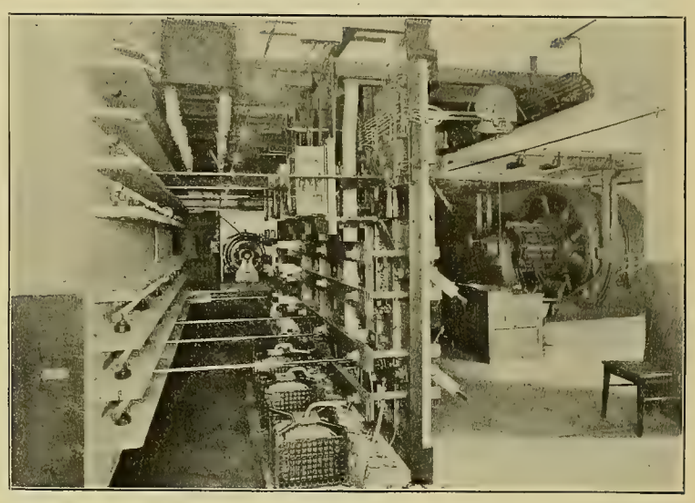
For the Houghton & Dutton buildings the entire lighting service is supplied from this station and is taken from a special panel board on the direct-current switchboard, via a duct line in the floor to a room adjacent to the sub-station, where a suitable distributing switchboard is installed for the control of the building circuits.

The equipment of the station consists of three 500-kilowatt 60-cycle three-phase 6,600-volt alternating-current to 230-volt direct-current synchronous and induction motor-generators, with provisions for the installation of four additional sets of the same size, making 3,500 kilowatts capacity in all. A balancing set of 60 kilowatts capacity is installed in one corner of the room, and is used to compensate for the unbalancing of the station. Two large ventilating fans are also included in the equipment, one of which is used to draw air into the station and the other to expel it. The fans are of such capacity that they will change the air in the station once every minute, this being necessary owing to the confined space in which the station is located. The station is supplied by duplicate alternating-current cables for the purpose of insuring continuous service, and both the alternating-current and direct-current switchboards are provided with duplicate bus-bars. In addition, the station is connected by heavy direct-current tie lines to the Atlantic Avenue station and to the Hawkins Street station, which are equipped with storage batteries in addition to the regular generating apparatus, thereby insuring the service to this station in every way practicable.

The accompanying illustrations give a good general idea of the station. They, with the facts of this account, were taken from the recent annual report of the Wire Department of the city of Boston.



General View of Plant.



View Showing Rear of Switchboard.

ELEVENTH STATION OF BOSTON EDISON COMPANY.

A University Electric-railway Laboratory.

The new interurban-car laboratory of Purdue University, Lafayette, Ind., has been completed, and the extensive equipment to be used in testing large electric cars and motors is now in readiness for the opening of the fall term on September 12th. The laboratory is in a large brick addition to the electrical engineering building and is built to conform to the main building. Inside there is a large lecture room, overhead cranes strong enough to pick up an entire car and convey it to any portion of the building, and a large pit in the basement, enabling the students to work beneath the car as it stands on the rails. The tracks leading into the building are connected with the steam railroad, affording direct connection into the laboratory.

Purdue University is the first school to take up the study of electric cars in such an exhaustive manner. The lecture room will seat more than 300 students, and the tracks and overhead cranes are so arranged that entire cars or sections of the motors and other apparatus can be carried directly into the lecture room from the laboratory and be exhibited to the students. The motors and other apparatus can also be brought into the lecture room and placed on large demonstration tables, where electrical connections enable the professor in charge to operate the piece of machinery as he demonstrates it before the students.

WESTERN ELECTRICIAN

EVERY SATURDAY.

PUBLICATION OFFICES:

507 Marquette Building, - CHICAGO.

TELEPHONE, MAIN 1746.

Eastern Office, 150 Nassau Street, New York.

Telephone, 5220 Beekman.

Trade Supplied by Western News Co.

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SUBSCRIPTION, in advance, postage prepaid, $3.00 for a full year of 52 numbers; in clubs of four or more, $2.50, with free extra copy for eight subscriptions; foreign countries, $5.00 a year; single copies, 10 cents. When change of address is requested, the **old address** as well as the new should be given.

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REMITTANCES.—All checks, drafts and other remittances should be made payable to the order of the publishers, the **Electrician Publishing Company,** and addressed to the offices of publication, Suite 507, Marquette Building (204 Dearborn Street), Chicago, Illinois, U. S. A.

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DATES AHEAD.

Association of Edison Illuminating Companies (annual convention), Hotel Frontenac, Thousand Islands, N. Y., September 4th, 5th and 6th.

Colorado Electric Light, Power and Railway Association (annual convention), Denver, September 18th to 20th.

Illinois State Electric Association (annual convention), Springfield, Ill., September 19th and 20th.

Central Electric Railway Association (outing), Robinson Park, near Fort Wayne, Ind., September 26th.

Old Time Telegraphers and Historical Association, and United States Military Telegraphers (annual meeting), Arlington Hotel, Washington, D. C., October 9th, 10th and 11th.

American Street and Interurban Railway Association (annual convention), Columbus, O., October 15th to 19th.

DESPITE the excessive heat the Ohio Electric Light Association held a profitable and interesting convention at Put-in-Bay last week, as reported in this issue. The principal subjects discussed were the timely ones of high-efficiency lighting units and the best methods of increasing business, although there were a few papers on other subjects. On each of these topics there were a number of short, crisp papers and a good discussion. The attendance at the convention was fair, although, as at former gatherings, the number of supply men present was greater than the number of central-station men.

INCANDESCENT LAMPS have received more attention within the last two years than for a dozen years preceding. The 220-volt lamp, the metallized-filament lamp, the tantalum lamp and others have all had zealous advocates. There are not wanting those who declare that the familiar carbon-filament lamp will soon be relegated to the museum of electrical curiosities, being replaced by the metallic-filament variety. And a great electrical company of the United States announces that tungsten lamps will soon be commercially available. But the problems of the ordinary carbon-filament lamp are still threshed out with energy and animation, as is shown by Sir William Preece's paper on glow lamps and the succeeding discussion at the recent British Association meeting, given in abstract in the Western Electrician of last week. One interesting feature of the paper was the comparison of American and British lamps, greatly to the advantage of the former.

GLASS is, of course, so low down in the scale of electrical conductivity that it forms one of the most common insulators. Nevertheless, there is glass and glass, in an electrical sense, and Mr. Charles E. S. Phillips, at the recent meeting of the British Association, reported a glass that will conduct electricity comparatively well. It is made by fusing together 32 parts of sodium silicate and 8 parts of calcined borax. Greater stability is obtained if 1.25 parts of flint glass be added. This glass is suitable for the cases or windows of electrostatic instruments and is capable of being cast into plates, but on account of its low fusion point is not otherwise very workable. It may be readily drawn into rods and takes a fine polish. The density of this glass is 2,490, and it is somewhat harder than the ordinary soda glass of commerce. With regard to other physical properties it shows no fluorescence under cathode radiation, is very transparent to X-rays and opaque to ultra-violet light. Its electrical conductivity is about 500 times that of the most conducting glass so far made, although, of course, still high. The change of resistivity with heat (which is very marked) is being examined, Mr. Phillips says.

EVEN if the theory of municipal ownership be correct (and we do not think it is), the administrations of all or nearly all American cities are so saturated with "practical politics" that it would be most unwise to entrust the management of the great quasi-public utilities to their tender mercies. A striking example of this has recently been afforded in Chicago, where the commissioner of public works, appointed by Mayor Dunne, has taken the chairmanship of the county committee of his political party, which is also, of course, the mayor's party. If this gentleman is to manage the fall campaign for his fellow-partisans, he will have enough to do to occupy his time between now and the November election without paying any attention to his duties at the City Hall. Which task will he neglect? Will he allow the management of the campaign to suffer or will he entrust his public duties to subordinates? These questions are asked very pertinently by the Chicago Daily News, which adds: "The Public Works Department is one of the most important in the city government. It has a large number of employes. It is one of those most liable to abuse at the hands of the politicians. The idea of taking the head of the Police or the Fire Department for campaign manager of a political party ought to be no more offensive to public sentiment than that of taking the head of the Public Works Department for the position." And further: "Citizens may well inquire what could be expected in the way of public management of street-railway lines from an administration that tolerates political control of its Public Works Department." The spectacle is one that should furnish food for reflection for many honest advocates of public ownership.

IN A PAPER recently read before the Société Internationale des Electriciens of Paris Mr. Brylinski points out some of the results of his experiments upon the effect of arc and incandescent lamps when operated upon different frequencies, using alternating current ranging from 88 to 25 cycles. At 88 cycles, which is the normal rate for one of the city mains whose current was used, all the lamps show a steady light. For incandescent lamps a good light is also obtained at frequencies of 50, 40 and 33 cycles, but for 25 cycles some flickering is noticed, especially for lamps of five candlepower. Arc lamps cannot be made to give a good light at 25 cycles. The best lamp at this frequency, says our author, is the Auer-Blondel. At 33 cycles the light is far from good, and a flickering can still be noticed when running at 40 cycles, but in the latter case it is not so objectionable. Even at 50 cycles the light is not steady. Mr. Blondel, an eminent authority, considers that in general incandescent lamps will not work well as low as 25 cycles, and only commence to give a steady light at 33 cycles. Arc lamps cannot be operated at either of these periodicities with satisfaction, he says.

These conclusions do not vary much from American practice, although it is contended that 25-cycle current is suitable for outdoor decorative incandescent lighting.

WILL the time come when we shall write of controlling by a "reostat" a motor whose "tork" is well represented by the input in "wats"? Shall we even be forced to transform the unit of resistance into an "ome"? Probably not; but the possibility of some such "reform" is brought to mind by the widely heralded adhesion of President Roosevelt to the list of 300 words in the revised spelling advocated by the Board (or is it Bored?) of Simplified Spelling. In this list we fail to find any word which may be regarded as of the electrical nomenclature, and we breathe a sigh of relief. But if 300 words are to be simplified, why not 3,000 or more? If the camel gets his nose inside the tent, he may follow with his whole body, and then the superfluities and eccentricities of our familiar (we cannot, perhaps, in this case, say time-honored) electrical terms will be eliminated by the inexorable rule in such case made and provided.

But whether a real beginning has been made to simplify the spelling of the English language is one of those things no fellow can find out—at present. English orthography is, of course, a curious mass of contradictions and absurdities; but to reform it—aye, there's the rub! Perhaps 'twere better to endure the ills we have rather than venture seriously into a movement which may very possibly result in confusion worse confounded. And in any case, conceding that improvement is needed, it is desirable that an effort be made to secure co-operation in this important matter among all English-speaking peoples. There is sufficient divergence now between the spelling considered correct in England and in the United States. If possible, this breach should be narrowed rather than widened. If we are going in for spelling reform, let us at least make an effort to secure joint action on the part of those who still live where our English speech—noble with all its faults—originated. We may admit that they have some right to be heard. The spelling reformer may retort that there is little hope of enlisting the support of conservative British public opinion, and that a start must be made somewhere sometime. Nevertheless, the subject has more than a philological interest; the English language is an international, world-wide affair, destined to be even more extensively used; and the question has a bearing on the science, art, industries and literature of many millions of progressive men and women. Such a stupendous task as reforming the spelling of English, even beginning with only 300 words, is a very proper subject for grave international consideration.

OHIO ELECTRIC LIGHT ASSOCIATION.

The twelfth annual meeting of the Ohio Electric Light Association, held at Put-in-Bay, Lake Erie, Ohio, on August 21st, 22d and 23d, was well attended by central-station men as well as manufacturers' representatives. It is the rule of these outings for members and guests to bring with them their ladies and families, and considerable attention is paid to the social as well as the business side of the convention. The innovation introduced last year of distributing prizes to the ladies was continued at this meeting, and a number of the companies contributed electric fans, cooking utensils, fixtures and other articles of domestic use or ornament.

The first business session was called to order at 2 p. m. Tuesday, August 21st, by Secretary-Treasurer D. L. Gaskill of the Greenville Electric Light and Power Company, who announced that, owing to the fact that President Valentine had during the year taken up other business and severed his connection with electric-lighting interests, his duties had devolved upon Vice-president W. E. Russell of the Massillon Light, Heat and Power Company, who would preside over the convention, and had been the acting president since Mr. Valentine's retirement.

Mr. Russell delivered the annual address of the president, in which he referred to the fact that during the year the business of electric lighting has shown a healthy growth in Ohio, although prices have ranged downward and gas competition has been met. The address emphasized the necessity of careful attention to cost of production, in the direction of which practical work has heretofore been done by this association. He commended the determination of the association to expend its effort in conventions more to the practical side of the central-station business from the standpoint of new business, and how best to get and keep it. In closing, the necessity of united effort was spoken of, the recent great improvements in lamp making approved, and further advances hoped for. The absence of President Valentine from the association membership and convention was greatly regretted. President Russell paid his compliments to all who had assisted the work of the association during the year past.

The following new members were elected:

Active—Toledo Gas, Electric and Heating Company, J. E. Lockwood, manager electric department; Bucyrus Gas and Electric Light Company, H. O. Dutter, manager; Citizens' Gas and Electric Company, William M. Adams, general manager, Elyria; United Electric Company, Denison, O. B. Welch, general manager; Dayton Lighting Company, F. M. Tait, general manager; Bellevue Illuminating and Power Company, F. B. Carr, secretary-treasurer; Salineville Electric Light, Heat and Power Company, Salineville.

Associate—Illinois Electric Company, Chicago, F. D. Rusling, Ohio representative; Pittsburg Transformer Company, H. G. Steele, secretary, Pittsburg, Pa.; C. W. Lee Company, Newark, N. J., Frank P. Rae, Jr., secretary; Shelby Electric Company, Shelby, Ohio; Co-operative Electrical Development Association, Cleveland.

The remainder of the afternoon was given over to reading of papers, discussion of same being deferred until next day, owing to the excessive heat. All of the papers were printed and distributed to the audience, so that the speaker might be intelligently followed and points for discussion noted.

High-efficiency Lighting Units in Ohio.

On the general subject of "High-efficiency Lighting Units in Ohio" three papers were contributed by central-station men, one of these being the joint production of two authors. The first of these was by A. N. Cope of the Public Service Company, Columbus, Ohio, who announced as his text "Progress in High Efficiency." His paper, he stated, had for its purpose a relation of the experience of his company in the operation of the Nernst lamp in a commercial field, in which its success had not been due entirely to its own high-efficiency feature, but also to the contributing effort of the central station in its introduction and exploitation. This necessitates a careful study of the needs of the customer, especially where strong competition from electricity or gas or both must be met. When the Nernst was first installed by this company it was not satisfactory, but this the writer thought due to the then poor regulation existing and to deficient knowledge of the lamp and its capabilities. About April, 1905, conditions changed; the regulation improved and, the demand for the Nernst continuing, it was adopted as the sole means of securing business from gas users, in which field it has since proved amply successful and satisfactory.

The writer gives statistics showing, as the result of his company's experience, that the average kilowatt-hours return per kilowatt connected to a classified and miscellaneous list of consumers was 70.47 for the arc, while for the same unit in Nernst it was 84.75 kilowatts, or 20 per cent. more; 16⅔ per cent. less connected load with the Nernst lamp therefore giving the same revenue, with the additional benefit of an increased power factor, an increase in burning hours and a better station load factor. The flexibility of the system is especially appreciated; with the Nernst it is an easy matter to drop out a glower in each lamp, and reduce the current consumption 25 to 33⅓ per cent., and retain the good-will of the kicker.

A feature of the Nernst lamp that must not be overlooked, said Mr. Cope, is that with the same current density as in the 110-volt circuit, twice the amount of watts may be distributed, or the same energy with half the drop—a decided advantage in overloaded circuits in old installations. It is a panacea for unbalanced three-wire distribution. The writer thought that the lamps are defective in one point, that it is too hard to get at the ballasts to see their condition. The system of maintenance will depend upon the number of lamps installed. The number of ballasts burned out will indicate how well the glower voltage is adapted to the light voltage. The right kind of a maintenance man will get his glower instruction from the ballast condition. In conclusion, the writer says: "I firmly believe that, had our electric competition been less keen, central-station conservatism would have had less general progress of high-efficiency lighting units to report."

The next paper of this series was jointly written by T. D. Buckwell and John Gilmartin, both of the Toledo Railway and Light Company. They hold that the introduction of these high-efficiency lighting units has been beneficial to the central-station man in broadening the field for the employment of electricity as a lighting agent. The central-station man is thus better able to meet competition and satisfy the most exacting as to the quantity and quality of illumination. The Nernst, the tantalum, osmium, the luminous or flaming arc, mercury arc, and the Moore vacuum tube are considered briefly, the last four, for obvious reasons, being considered by the writers as of more or less limited application, and barred, except under favorable conditions, for general indoor commercial lighting purposes. Some of the reasons which limit the usefulness of these lamps are the color of the mercury arc, the dirt and fumes of the flaming or luminous arc, and the high cost of installation of the Moore vacuum tubes.

There remains for practical consideration by central-station men the Gem, the Nernst and the tantalum. The latter, as at present manufactured, will not operate satisfactorily on alternating current, and is sold for use on direct current only, which limits its field of usefulness materially. The Gem units possess many features that are valuable to the central station, their color is pleasing, and efficiency and maintenance cost seem to meet the requirements. They can be used on either alternating-current or direct-current service. They can be attached to any ordinary socket and in any position, and no attention is needed to the end of their useful-life period. They have been used successfully in Toledo in displacing four-mantle gas arcs with the 250-watt lamp, and single gas-mantled arcs with the 125-watt lamp. The policy in intorducing has been to furnish and hang lamps free, together with chandeliers. At present a charge of one-half cent per kilowatt-hour is being made for renewals. Now have about 250 installations, distributed among all classes of business. In closing, they hold that the high-efficiency lamp is a realization of a long-felt want in illumination, and certain to maintain electricity as the best of artificial light.

The closing paper on this subject of high-efficiency lighting units in Ohio was contributed by C. C. Collins of the Columbus Railway and Light Company, who, while referring en passant to the flaming arc and the Nernst lamps as among recent improvements, treated more especially of the Gem filament incandescent lamp. He thought the improvements in the incandescent field are more welcome than in other units, since the incandescent constitutes the greater portion of the central-station load and source of revenue.

The writer deplored the timid policy of clinging to the older types of lamps for fear that sufficient revenue may not be secured by the introduction of a better lamp, and believes that to be governed by such a policy is to invite discontent and competition. On the other hand, the adoption of a liberal policy will cause the consumer to increase his lighting and outshine his neighbor, who in turn will retaliate, and thus the sum total of consumption be largely increased. It is possible in many cases to substitute in existing installations a lamp of higher candlepower, but consuming the same amount of energy, thus making friends for the central station in a satisfied customer. No improvement is too good for your customer if you would retain him when reverses set in in the way of competition with other as well as with electrical illuminants.

The writer mentioned with commendation the new factory markings of the Gem lamp. This method of marking is intended to measure the degree of useful light rather than the candlepower, technically speaking, about which the average consumer knows very little, accurately speaking. A direct comparison of illuminants is probably the best method of convincing the public of the merits of one illuminant over another. This can be done either on customer's premises or in a display room owned by the central station. By this method all the effects of reflectors, globes for filtering out objectionable colors, general diffusing properties, etc., can be taken into full account. The customer sees that he is buying light, not candlepower nor kilowatts, and can see for himself what he is going to get. Such a display room can be made invaluable.

Great care should be taken in the selection of reflectors. The high-efficiency Gem lamp and its shade must be used together as a unit. It is generally used with one of two shades, the concentrating and diffusing being so designed that they give an even distribution of light over a specified area. The source of light is distributed over a much larger area than with the arc lamp, the Nernst lamp and the flaming arc, when used at their maximum efficiency, that is, without dense globes. The Gem large size, although not equal to the arc in efficiency, is far better suited where ceilings are low, and in every case where clusters are now used. The writer then made a comparison illustrating this position. A strong point is that the customer is able to increase his lighting with no additional wiring, as the Gem can be taken on without any change in existing installations. A number of companies are at present making fixtures suitable for the Gem lamp and at very reasonable prices.

All incandescent lamps should be used with shades, and their selection is a matter of considerable importance, and should have an eye to giving proper distribution always. A wide difference will be found in shades with respect to their evenly distributing the light and their absorption. An arc lamp, preferably the direct-current, should be used where it is essential to show the daylight color of an article; but where color is of little consequence, or white light is not so effective as a light rich in red or yellow rays, the Gem can be used to great advantage. Articles sold should be, so far as possible, displayed under light similar to that with which they will be used; for example, a rug or piece of carpet. In lighting large stores or halls a combination of arc and Gem lamps gives very good results, and is probably the most efficient method. Where the ceilings have a height of less than 10 feet, in rooms too small for an arc lamp, in show windows, offices, stores with hangings, porches, etc., the Gem lamp with its proper shades will be found entirely feasible.

The Gem lamp is recommended to all lighting companies as being in sizes of 250 watts or less the best lamp obtainable at the present time. It may at first be put out as a specialty until it has proved its feasibility to the customer, and then be adopted as standard. There is no reason why the 50-watt 20-candlepower size should not be used to displace all carbon-filament 16-candlepower lamps.

For lighting companies whose regulation will not permit the use of 3.1-watt carbon-filament lamps the Gem can be used at either its middle or bottom voltage, and still give an efficiency of 2.65, or 2.8 watts per candle. The writer in summing up expressed his belief that the tantalum lamp is not yet in a commercial form, owing to its high initial cost, and, further, should be used only on direct current. On account of the method of suspending the filament, the lamp can only be burned in a vertical position, on account of the danger of rupturing the filament.

Mr. F. W. Willcox of the General Electric Company, Harrison, N. J., read his paper on "New Lamps and New Opportunities," which was a vigorous and clear presentation of the subject from the writer's standpoint. Mr. Willcox believes in no half-way measures, but that central-station managers should boldly put out the highest efficiency lamps found feasible, with the design of giving to their customers the very best service possible in pursuance of a policy of liberal progressiveness which he thinks will be surely profitable in the long run. He instanced the policy that the gas companies maintained for a long period in reluctantly putting out the Welsbach mantels, which have now become their only salvation.

Mr. Willcox outlined a method by which to introduce the new high-efficiency lamps, in the course of which he incidentally refers to the new system of ratings as superior to the old method in use, as allowing even watt ratings instead of fractional ones, and as insuring a more uniform appearance and a more uniform performance of individual lamps by reason of the even degree of incandescence or efficiency at which a filament so rated will burn. It also permits central stations to gradually advance their standard of efficiency from time to time to meet changing conditions.

Attention was called to the voltage markings arranged in a vertical column in steps of two volts apart. These voltages are known as the "top," "middle" and "bottom," or first, second and third voltages. Central stations now using 3.1-watts-per-candlepower lamps would naturally adopt the new lamps at full efficiency (top voltage), and thus keep their watt consumption per lamp unchanged. While the total cost of lamp renewals would be increased somewhat on this basis, the added charge is a small one to pay for the ability to give consumers 25 per cent. more light for the same revenue. Central stations now using 3.5-watts-per-candlepower lamps could opportunely adopt the new lamp in the middle or second voltage. This would share the improvement with the

consumer, giving 12 per cent. more light with 15 per cent. less wattage. The total cost of lamp renewals, which is very low for the present, 3.5-watts-per-candle lamps—only about one-third cent per kilowatt-hour—would be only slightly increased, and there is hardly any lighting company that could not profitably afford to make the change to at least this intermediate efficiency of the new lamps. Its useful life, 750 hours (with average life materially longer), is commercially sufficient, as it is equal to that formerly given by 3.5-watts-per-candle lamps. The life of 3.5-watts-per-candle lamps is at present too long for the most economic service, and could with advantage be shortened to correspond with that given by the new Gem lamp in middle voltage. The writer advocates the policy of free lamp renewals as desirable. Indeed, said the writer, practice goes much further, in many instances giving free signs to burn the lamps in; a policy which, experience has shown, pays handsomely. With the advent of the new Gem lamp the importance of central-station direction and control of lamps is greater than ever. Full and complete control is only obtained with free renewals, and the adoption of a free-renewal policy where not already in vogue could therefore most opportunely be made with the introduction of the new Gem lamp.

The writer gave interesting data in tabulated form with reference to the tantalum-lamp units in comparison with the ordinary carbon filament and the Gem, and touched on reflectors, with especial reference to the new bowl holophanes. In conclusion, he recommended:

First—To secure free renewals and promote a more liberal use of lamps.

Second—To furnish suitable and efficiently designed reflectors to consumers on as liberal terms as possible.

Third—To undertake illuminating engineering work on all lighting installations, both old and new, to the end of aiding consumers to secure the most efficient illuminations.

Fourth—To eliminate as far as possible all the worthless reflectors and replace them with efficient types, and to generally improve conditions of lighting service in every way possible.

The last paper of the afternoon was that by Mr. Max Harris of the Nernst Lamp Company, Pittsburg, Pa., entitled "Some Notes on High-efficiency Units by the Manufacturer." This paper was written by Mr. Harris in response to an invitation extended to him to present the standpoint of the manufacturer in connection with the views expressed in previous papers by central-station men as to high-efficiency units. With this in mind, and realizing that what is wanted by the central-station man is facts as to results achieved, the paper gives first a brief description of the system itself, next methods of marketing the lamps, showing that it has been found practicable to introduce these lamps with benefit to the central stations in revenue results. Next the writer shows how to create a demand, and finally some notes on the value and utility of the system.

Discussion of High-efficiency Lamps.

On Wednesday afternoon there was an interesting discussion of the lamp papers. Max Harris objected to the statment made in the paper by Mr. Collins with regard to the comparative merits of the Nernst as opposed to the Gem, with reference to renewal cost. Mr. Collins replied that he had been given to understand, from what he believed to be a reliable source, that the figures quoted were accurate. Mr. Harris stated it as his belief that the experience of a large number of present users of the Nernst lamps would not corroborate the figures referred to, but, on the contrary, would show a much better record for the Nernst in that particular.

Samuel Scovil of the Cleveland Illuminating Company, one of the past-presidents of the association, rose to inquire what was meant by a "high-efficiency" lamp, referring to the report of progress at the National electric-light convention which told of lamps that some of the Germans were getting out under special circumstances that were claimed to run as low as one watt per candle, and in some cases as low as one-half watt per candle, which he instances as an example of what might be called "high efficiency."

Mr. Kermode referred to the successful performance of both the Nernst and the Gem lamps in Cleveland, especially in competition with 30-cent natural gas.

Mr. Duncan of Salineville inquired whether in his town of 3,000 to 4,000 inhabitants, with not extra good regulation, probably about three per cent., and a variation in voltage of about five per cent., the new high-efficiency units could be used with success. Mr. Harris stated that the Nernst units could be operated successfully on circuits having a variation averaging within five per cent. above or below normal, and all guarantees on the average life are based upon a condition of that sort. Mr. Osborne of the General Electric Company stated with regard to high-efficiency lamps of the Gem type that they can be placed on any circuit where incandescents are used at the present time. Provision has been made to take care of central stations that are using 3.1 or 3.5-watts-per-candle lamps, and by adopting the middle or bottom voltage of the new units it will give them the same life as they are now getting on the 3.5 lamps.

Mr. Turner suggested that the question asked was how to regulate the high-efficiency lamps; for instance, if the average on the circuit is 118 volts, what is the most efficient lamp? Mr. Osborne replied that with a central station operating 118 volts that has been getting satisfactory service from the 3.1-watts-per-candle lamps, it should adopt the new lamps in the middle voltage.

C. E. Inman reported that they had quite a number of Nernst lamps on their circuit, and so far had not found the maintenance cost any greater than renewals of incandescent lamps. He had not figured in the labor in the cost of replacing glowers, but the maintenance on renewal parts is about two mills per kilowatt. His company had purchased its first lot of Nernst lamps two years before it made its further purchase, and is using them now a year and a half since the second purchase was made and had found them satisfactory.

D. L. Gaskill of the Greenville Electric Light and Power Company thought that the high-efficiency units were a godsend to the smaller towns, especially because they permit the central station to offer a light of great power for the minimum of expense, and the peculiarity of the smaller towns is that the people want the best light, but they do not want to pay a high price for it. In Greenville, a town of some 8,000 population, both the Gem and the Nernst lamps are in use. The higher efficiency lamp that can be put out the better for the business in general.

Mr. Scovil asked Mr. Rust if he would give some further reasons in support of the policy of free-lamp renewals. Mr. Rust stated that if the lamps were renewed free, patrons would not allow the sockets to be empty, whereas if they had to replace burned-out lamps themselves, they would allow their lamps to run out, and many times not use lights where otherwise they would do so, and thus affect the monthly bill. Mr. Willcox agreed with Mr. Rust, and stated that the renewal cost does not amount to more than an average of one-quarter to one-half cent per kilowatt. It certainly pays to furnish the customer a device with which he consumes current for which he pays and which current he would not otherwise use in the same quantity. The policy has been fully demonstrated with respect even to free signs. The customer who buys his sign becomes an economist in its use. Mr. Inman instructs his repair men whenever they discover a black lamp to see that it is replaced promptly.

In response to inquiry from Mr. Scovil as to the method of carrying the free-renewal idea into effect, Mr. Rust stated that his company let it be understood that any consumer upon bringing a burned-out lamp to the office could exchange it free for a new lamp. All regular lamps are included under this offer. Mr. Willcox suggested that a good plan would be to offer a specified number of renewals for a certain number of kilowatt-hours' consumption. This would give to the consumer something in proportion to the amount of revenue derived from him.

Mr. Scovil stated that in his city, Cleveland, they did not give free renewals, but he thought it was more a question of precedent with them than conviction. In the smaller cities the speaker thought that no doubt the furnishing of free renewals was probably all right, but there was something to be said on the other side.

J. E. Lockwood of Toledo asked for figures tending to show what was the average cost to the central station of furnishing free renewals, as compared to the increased revenue believed to be secured by such a policy. Mr. Willcox replied that this was a hard question to answer definitely, as the results would go into the general profits of the station. It was a fact that the practice is growing among the larger stations and most successful ones, and when adopted he had never known a company to regret it. Such companies must have found it profitable or they would not keep it up. The actual cost of lamp renewals will depend upon the efficiency of the lamp used. For a 3.1-watt-per-candle lamp it would be about half a cent, or six-tenths of a cent per kilowatt-hour, to which should be added perhaps one-fourth cent per kilowatt-hour for labor.

Mr. Lockwood did not think it a logical conclusion that because a company had adopted a policy and not abandoned it later that it had necessarily found it profitable. It might be possible that after once adopting free renewals they found themselves in a position where they could not retrace their steps. It would be desirable to have some specific data showing cost and net returns due to this practice.

Ways and Means of Increasing Business.

The first announcement of Wednesday morning was the appointment of a committee on nominations by the executive committee under the rules—viz., Messrs. Rust, Maxon and Hanley.

Under the general subject of ways and means of increasing business the association listened to a series of papers by central-station men, all of which were short, crisp and practical. The first was by S. M. Rust of the Greenville Electric Light and Power Company, whose keynote was attention to details and cultivation of the patrons' wants.

The next contributor was W. C. Anderson of the Canton Electric Light and Power Company, who, like Mr. Rust, emphasized the factor of good service as the principal one in getting and retaining business for the central station and the giving of the very best value possible for the money.

The third paper of this series took up the same problem as applied to a large city, and was by Frank M. Tait, manager of the Dayton Lighting Company, one of the new members. His paper is given elsewhere in this issue of the Western Electrician.

J. Robert Crouse of Cleveland addressed the convention briefly in reference to the objects, plans and results of the work of the Co-operative Electrical Development Association, which comprise the promotion of the more extended use of electricity by the public for lighting, heating and power against all competitors for like service, and the establishment of co-operative relations both morally and financially among the different electrical interests from the manufacturer to the consumer, to the end that each may contribute in some measure toward bringing about results desired in common by all. He asked that the Ohio Electric Light Association appoint a co-operating committee of two, one of whom shall be a representative of a purely electric and the other of a combination gas and electric company. The suggestion was favorably acted upon. Frank M. Tait of the Dayton Lighting Company and D. W. Low of the Alliance Gas and Electric Company were later appointed as such committee.

A further series of papers on successful ways of increasing business were next presented, the first one by J. Kermode of the Cleveland Electric Illuminating Company, who gave attention principally to the exploitation of cooking devices, incidentally suggesting the securing of the co-operation of contractors and architects in providing a proper number of outlets, and in other ways contributing to the improvement of the standards of construction from an electrical standpoint.

J. H. Maxon of the Gallipolis Light and Coke Company advocated in his paper the placing of appliances, such as desk fans, laundry irons, small motors, etc., on trial and approval.

D. W. Low of the Alliance Gas and Electric Company, in his paper under this head, explained the methods adopted by him to introduce gas stoves for cooking and other appliances. In introducing motors, small horsepower motors were offered to persons who were using other forms of power, such as gas engines, with the understanding that if not satisfactory no trade, and they would be removed without expense.

The last paper of Wednesday morning was by M. E. Turner of Cleveland on the same subject. He pointed out considerations which should tend to make the public liberal in its use of electricity for many purposes that add to its comfort and enjoyment of life.

A short discussion was had upon the subject of furnishing current for telephone exchange batteries, and it developed that some eight or ten of the companies represented present had been supplying current for this purpose; while to many the idea appealed as something that they had learned and could carry home with them profitably. It transpired that the rates varied. Reports were had from Lisbon, Defiance, Toledo, Gallipolis and Piqua. As it is an all-day load it was favorably considered.

On Wednesday afternoon Charles A. Parker of Detroit, Mich., read a paper on "Advertising and New-business Getting." Mr. Parker asked why the central-station man, purveyor of one of the most advertisable things in the world, should shut himself in a gloomy barracks of a power house way out on the city limits and preserve a deadly silence toward the rest of humanity. The successful central-station man of today and tomorrow is the man who welcomes and makes much of a possible customer; who keeps his bright, well-trained solicitors constantly busy calling on interested people; who employs good, live advertising capable of arousing popular interest, and sends it out to lists of residences, stores and factories situated adjacent to or upon the company's lines, and who has always a broad-minded, up-to-date business welcome for new business and a proper fostering care of the business already contracted for. Mr. Parker urged the adoption by central stations of the monthly bulletin to instruct people as to the manifold uses of electricity.

Other Papers of Wednesday.

The association on Wednesday afternoon listened to a paper by William Wolls of the Columbus Railway and Light Company on "Electric Motors in Competition with Gas Engines." This paper will be printed in a future issue.

J. R. Cravath of Chicago presented his paper on "Wiring and Lighting Equipment of an Eight-room $3,500 Residence." By request, Mr. Cravath supplemented the paper by some remarks upon the subject of the lighting of churches. He referred to the fact that lighting units are generally placed in halls and churches where they are visible, or at least the fixtures are visible, and the lights are not turned out during the service usually, so that a person must sit and let the light shine in the

eyes during the entire service. This is objectionable, and the speaker outlined a remedy.

Demurrage and Coal Confiscation.

On motion of B. S. Young, chairman of the publicity committee, a resolution was adopted protesting against the action of the Toledo Car Association in reducing the time limit for unloading coal from 96 hours to 48 hours; also for fixing the demurrage charge per diem for further delay in unloading at $1 for each 24 hours thereafter, whereas the agreement between railroads or transportation companies is that a charge of only 20 cents for each 24 hours is made for cars while off their right-of-way.

Protest was also lodged against the custom of railroads to confiscate coal shipments and to divert them to their own use. The executive committee of the association was authorized to co-operate with the proper officers of public-service corporations to the end that proper legislation be enacted to effectually correct this evil.

Election of Officers.

On Thursday morning the nominating committee made its report. The report was adopted and the gentlemen named therein were unanimously elected, as follows:

President—W. P. Engel, Defiance.
Vice-president—C. C. Collins, Columbus.
Secretary-treasurer—D. L. Gaskill, Greenville.
Finance Committee—E. J. Bechtel, Toledo; B. S. Young, Ada; J. H. Maxon, Gallipolis.
Executive Committee—W. E. Russell, Massillon; M. E. Turner, Cleveland; D. W. Low, Alliance; E. H. Beil, Youngstown; F. M. Tait, Dayton.
Advisory Committee—Samuel Scovil, Cleveland; W. E. Miller, Mt. Gilead; D. L. Gaskill, Greenville.

After some other routine business, including adoption of report of Secretary-treasurer Gaskill, which showed a balance in the treasury, the discussion and reading of papers was proceeded with.

Papers of Thursday.

N. R. Birge read his paper on "The Series Luminous Arc Rectifier System," describing briefly its construction, operation, advantages, efficiency, distribution, color and low-maintenance cost. It was discussed at length.

Secretary Gaskill presented an interesting paper on "Legislation: Its Uses and Abuses," in connection with the report of the advisory committee.

Mr. Scovil of the Cleveland Illuminating Company, one of the charter members of the association, discussed the report and descanted somewhat broadly upon property rights in general, holding that the tendency which has manifested itself too widely of late years to attack these rights indiscriminately oftentimes seemed to discharge without reason its main effort against public-service companies; whereas if the individuals who make these attacks would give a moment's thought to the subject they would find that in attacking the rights of public-service companies they are like Sampson pulling down the strong columns which support the fabric of civilized society.

Cost Determination.

Further discussion followed in the nature of an executive session, and the report of the committee on cost determination was submitted through Mr. E. J. Bechtel of the Toledo Railway and Light Company, who, however, was unable to be present. The Ohio association, in common with others, several years ago realized the necessity for definite work along lines of cost determination, and the present report is a further contribution to the subject.

A synopsis of the last report is given and reference is made to an interesting paper read before the New England Association of Electric-light Engineers by Mr. J. S. Codman, a feature of which paper is a bibliography of former papers bearing upon this subject.

The committee regrets that criticisms upon the previous work done by it have not been as numerous during the year as desirable, and the members are urged to procure and read as many as possible of the papers scheduled by Mr. Codman, to write their opinions, arguments or criticisms and send them to the committee for its further information and guidance. Criticisms received during the last year, mostly from persons outside of the association, are referred to.

Attention is invited to the case of the Columbus Railway and Light Company vs the City of Columbus, and a brief outline of the principles successfully contended for in that case is given, together with the findings of the special master. The report of the committee concludes as follows:

"This case has been a pioneer case in establishing the fact that the cost of supplying electricity varies with the hours use which the customer makes of his installation. It is not only a case of interest to members of the electric-light fraternity in Ohio, but is important in establishing a precedent throughout the United States.

"Your committee on costs has been endeavoring to establish the fundamental principles of properly determining costs among the members of this association for the last two years. This case establishes the fact that this method of determination has judicial recognition. It cannot be too strongly urged upon the members of this association that all systems of tariff be based upon cost determinations and that the cost determination be based upon fundamental principles of running and standing costs."

In discussing the report Mr. Scovil remarked that companies who might have to go into the question of a maximum-rate ordinance would do well to establish charges for current on a basis of standing and running charges; that in order to go into the United States court on the ground that a given rate would deprive the complainant of its property without due process of law it would be necessary to show that such maximum rate fixed by the ordinance would not give a reasonable return for the use of the property devoted to the public convenience, taking into consideration all of the elements of cost.

Uniform Accounting and Records.

The convention next listened to the report of F. E. Crawford (Library Bureau, Cleveland, Ohio) of the committee on uniform accounting and records. He deplored the fact that methods of recording results and arriving at correct data with reference to the use of electricity and its allied appliances have not kept pace with the development of the business itself, but the necessity for some measure of uniformity in reports of public-service corporations has been recognized and urged for many years by economists and students of public affairs.

The state of Ohio is fortunate in having erected by statute the Bureau of Uniform Accounting, which is introducing uniform schedules for counties, cities and school districts, thus rendering it possible to make intelligent comparisons. Little has yet been done, however, covering the operation of industries municipally operated, such as waterworks, electric-light plants, etc., and it is frequently impossible to get today any reliable data for taxpayers' information of the operations of such plants.

The committee regretted that the system in use by many small plants in Ohio is based on cash receipts and cash disbursements instead of on the scientific principles of "revenue and expense." The employment of a thoroughly practicable public accountant by such plants periodically to systematize and devise a systematic accounting system, and thereafter make a semi-annual or at least an annual audit of the books and analysis of the working of every department on a revenue and expense basis, was recommended.

Placing Small Motors.

Mr. Low gave some account of his experience in placing small motors along the same lines as covered in his paper, and Mr. Inman told of his success in installing similar motors, stating that he had in July a continuous output of 24.2 kilowatts on the power circuit and 38.8 kilowatts on the alternating current, showing that the power circuit was coming up. His rates on the power circuit ranged from four cents per kilowatt down to 2¾ cents, if the consumer used 1,865 kilowatts per month. He has now two customers on the line who claim the 2¾-cent rate nearly every month. On elevator load for small motors below five horsepower he charges six cents per kilowatt. Upon first establishing these rates he was afraid that the peaks might conflict, but this has not proved to be the case, as the motor load commences to drop off just before the lighting peak comes on.

Electric Heating Devices.

The paper on "Electrical Heating Devices, Their Latest Commercial Development," by H. J. Mauger of the General Electric Company, Schenectady, N. Y., was an elaborate one, handsomely illustrated. The fact that the first devices did not have the confidence of central stations tended to retard their development, but as now presented they show remarkable endurance.

The subject of safety is important to the central station, since it stands as sponsor for these devices to the general public. This has been worked out so that a water heater running dry will not even scorch the table upon which it rests. All soldered joints are avoided. The designers of these new types sought to add as many conveniences and combinations as possible that would lead not only to the efficiency of the device but facilitate its economical operation; for example, a gluepot of this design does not require the usual water bath, a great economy being thereby effected. Special attention is given to the new departure in cooking by the use of steam instead of boiling water. Neither time nor energy is lost in heating a large amount of water.

In exploiting heating devices the writer lays down the following classification which central-station men should keep in mind: First, devices that can be used on existing lighting services, taking less than 600 watts, and second, those that require special heating circuits. The former bring immediate returns. The flatiron was selected as the one device which is capable of bringing the largest income with the least expenditure to the central station. A number of cities were mentioned in which gratifying results had been obtained with comparatively little effort, in Washington, D. C., for example, one solicitor averaging 25 to 50 weekly continuously. The method uniformly used for placing flatirons was free trial with option of purchase. Experience has shown that advertisements or demonstrations alone cannot be relied upon to sell these devices.

Laundry installations form an attractive power business and must be gone after with power rates. The coffee percolator, baby milk warmer, and heating pad were selected by the writer as three devices which can be placed in nearly every household because of their great convenience and splendid advertising and talking points.

The large amount of business which is to be looked for in the future in this direction can only be fully secured by enlisting the co-operation of the up-to-date architect and wiring contractor in order that every new house be provided with wiring adequate to take these cooking and heating devices. Incidentally, the writer approves the plan of central-station people themselves setting an example in their own homes and in the construction of new homes of this sort of an equipment. He instances the residence of Mr. J. E. Davidson, manager of the Consolidated Lighting Company of Montpelier, Vt., as a striking illustration of this progressive spirit which will make the heating business on a broad scale successful among central stations.

Discussing the paper, Mr. Scovil inquired if the writer had calculated the cost of such a simple cooking outfit as a central-station man should use in his own kitchen or home. Mr. Mauger replied that they had a tentative outfit which would cost $55 net. This, however, is not large enough for a large family, which is estimated at, say, $75. These figures are not final, however.

Mr. Selig inquired if the cooking table when wired fulfills all the requirements of the underwriters; to which Mr. Mauger replied in the affirmative, and stated that it is the well-known policy of the General Electric Company strictly to comply with the regulations of the underwriters. The company would not put out anything that was not approved by them.

Address of President-elect Engel.

The convention having now completed its regular programme, President-elect Engel took the floor and briefly addressed the meeting. Pledging himself to work throughout his administration for the best interests of the organization, he invited suggestions from all, whether central-station managers, supply men or manufacturers. He congratulated the material men and manufacturers on their hearty co-operation with and interest in the association, and referred approvingly to the handsome exhibits made, which, he stated, were of a very attractive character. He was pleased that so many ladies had attended, and reminded the members that their presence did much to render these annual meetings enjoyable and to cultivate sociability and good feeling.

Prize Winners in Ladies' Contests.

On motion of Secretary Gaskill the thanks of the convention were extended to the donors of the several prizes presented to the ladies in various contests. The contests and winners were as follows:

Eucher Contest—(1) Mrs. P. J. Williams, Columbus; (2) Mrs. F. M. Tait, Dayton; (3) Mrs. George A. Williams, Cincinnati; (4) Miss Mary Gaskill, Greenville.

Guessing Contest—(1) Miss Helen Gaskill, Greenville; (2) Mrs. George A. Williams, Cincinnati; (3) Mrs. H. C. Houck, Cincinnati; (4) Mrs. J. T. Kermode, Cleveland; (5) Mrs. A. A. Serva, Fort Wayne, Ind.

Bowling Contest—(1) Mrs. Z. T. Dorman, Greenville; (2) Mrs. William Adams, Elyria; (3) Miss Annette Miller, Mount Gilead; (4) Miss Mary Gaskill, Greenville.

Pedro Contest—(1) Mrs. W. H. Kelsey, Cleveland; (2) Mrs. E. L. Booth, Bellaire; (3) Mrs. George R. Craven, Cleveland.

Second Eucher Contest—(1) Mrs. A. A. Serva, Fort Wayne, Ind.; (2) Mrs. P. J. Williams, Columbus; (3) Mrs. Z. T. Dorman, Greenville; (4) Miss Mary A. Gaskill, Greenville; (5) Miss Annette Miller, Mount Gilead; (6) Mrs. F. M. Tait, Dayton; (7) Mrs. R. E. Gorton, Warren; (8) Mrs. F. B. Houghton, Cleveland.

The prizes consisted of electric heating and cooking utensils, fans, lamps, etc., donated by the General Electric Company, the Westinghouse Electric and Manufacturing Company, the W. J. Barr Electric Manufacturing Company, the W. G. Nagel Electric Company, the Robbins & Myers Company, the Fish Electric Company, the American Electrical Heater Company, the Post-Glover Electric Company, Cleveland Electrical Supply Company, Moreau Gas Fixture Manufacturing Company, the Star Electric Company, the F. Bissell Company, the Erner Electric Company, the Doubleday-Hill Electric Company, Fort Wayne Electric Works and the Cleveland Window Glass Company.

Concluding Business.

On motion of Mr. Turner the committees on cost determination, on records and on publicity were continued, and a committee authorized to report on the progress of high-efficiency lighting units and of electric heating devices.

It has been customary in this association to take

a straw vote as to the next place of meeting for the guidance of the executive committee, which determines the place and also fixes dates. The subject, however, was not brought up at this time.

At the suggestion of Mr. Scovil and others it is probable that an invitation will be extended to central-station men in Indiana (in which state there is at present no state organization) individually and informally to attend next year's convention of the Ohio association. On motion, this matter was referred to the executive committee, the intention being to invite them to attend the meeting as visitors and honored guests.

The regular business of the convention having been concluded shortly after noon on Thursday, an adjournment was taken sine die.

CONVENTION NOTES.

Elliott Reynolds of Pittsburg represented the Doubleday-Hill Company.

J. H. Hodde of the Sangamo Electric Company, Springfield, Ill., was present.

Fred W. Godfrey of Chicago was present to represent the Bryan-Marsh Company.

The Pittsburg Transformer Company, with its transformers, was represented by H. G. Steele.

The National Carbon Company was represented by A. B. Pyke and A. G. Summerell of Cleveland.

The Cleveland Electric Supply Company was well taken care of by H. H. Cudmore and W. C. Marker.

Fred Bissell, F. N. Knierim and A. F. Knierim came from Toledo in the interest of the F. Bissell Company.

The Electric Appliance Company showed Sangamo meters, Gem-Zenith and Gem-Packard lamps. P. R. Boole and George H. Porter of Chicago were on hand.

The exhibit of the Shelby Electric Company, owing to a hitch in transportation, failed to arrive. J. C. Fish, however, radiated his pleasing personality and made up the deficiency in tangible material.

H. W. Johns-Manville Company exhibited its oil switches and cut-outs, service and subway boxes, fuse boxes and Sachs Noark fuses and blocks. R. R. Braggins and H. McKinley represented the company.

Lafayette Electric Manufacturing Company showed its transformer, the merits of which were capably exploited by Mr. William Hornberger, who attended this convention for the first time. He made many friends.

Allis-Chalmers Company's exhibit, consisting of induction motor and sample of turbine blading, with full line of literature, was delayed in arrival, but finally "got there," and was in charge of George A. Williams of Milwaukee, Clay Sprecher of Cleveland and F. C. Colwell of Cincinnati.

Simplex Electric Heating Company of Cambridge, Mass., exhibited quite a line of household, laundry and tailor irons, cooking utensils, including chafing-dish outfit; also quick-heating water cups, soldering and curling-iron heaters, dentists' sterilizer, gluepot and heating pads, in charge of I. W. Reynolds.

Brilliant Electric Company had a handsome exhibit of new high-efficiency Brilliant tantalum and Gem lamps. This exhibit when lighted up in the evening was very generally admired. It also showed the tipless lamps. Representing the company were E. V. Hannecke, R. S. Jackson and E. J. Kulas of Cleveland.

The Wagner Electric Manufacturing Company displayed switchboards, portable indicating instruments and single-phase elevator motors, in charge of that Chesterfield from old St. Louis, Mr. C. E. Delafield. Others in the Wagner crowd were Walter Robbins of St. Louis, Dean Emerson of Cincinnati and L. B. Hoit of Cleveland.

The Phelps Company of Detroit showed its advertising novelties, including Wink sign frame, Skedoodle "J," turn-down lamps, etc. The latest thing it has put out is the owl and dog, each of which were well trained and would wink whenever Benson looked their way. The ladies liked the dog; the men liked the owl. W. J. Phelps and F. T. Benson represented the company.

The Nernst Lamp Company, Mr. Max Harris, general sales manager, made an exhibit of its series street-lighting system, using the Nernst lamp in conjunction with arc lighting on either 6.6-ampere or 7.5-ampere circuits. Besides Mr. Harris there were present S. P. Wilber of Pittsburg, J. F. Hoover of Cincinnati, James L. Anderson of Columbus and Charles H. Davis of Chicago.

Among the familiar faces were those of Robert E. Gorton of Warren, representing the New York and Ohio Company; W. P. Ambos of New York, of the Osburn Flexible Conduit Company; E. L. Van Winkle of Cincinnati, Post-Glover Electric Company; S. R. Fralick of Chicago, Benjamin Electric Company; Oscar Carman, Stanley-G. I. Electric Manufacturing Company; N. C. Cotabish of Cleveland, National Carbon Company; F. Bliss of Cleveland, Buckeye Electric Company; A. A. Serva and George B. Edgar of the Fort Wayne Electric Works, Fort Wayne, Ind.

General Electric Company's exhibit included a number of the new heating and cooking devices, new high-efficiency lamps and latest improvements in Holophane shades. The G. E. men present were: W. J. Hanley, H. B. Goodloe, Columbus; J. B. Pevear, H. C. Houck, A. H. Meyrose, L. R. Dunkle, A. E. Alley, R. W. Palmer, Cincinnati; A. S. Hertz, Cleveland; C. F. Conn, N. R. Birge, Schenectady; F. W. Willcox, George C. Osborn, Harrison, N. J.; H. J. Mauger, Schenectady.

Westinghouse Electric and Manufacturing Company was out in force. It exhibited a full line of portable instruments, direct-current, single-phase and polyphase wattmeters, arc lamps for all circuits, fan motors for all currents, ceiling and desk types, and distributed incandescent lamp baby dictionaries, issued in behalf of the Sawyer-Man Company; also a book of Westinghouse views and one-eighth-horsepower type D alternating-current motors. Mr. J. C. McQuiston came along to help advertise, and with him were G. B. Dusinberre, R. W. Beebe, C. O. Baker, C. P. Billings, Cleveland; J. W. Schrantz, J. A. Brett, Cincinnati; T. L. Schrantz, H. C. Marsh, Columbus, and W. F. Fowler, Pittsburg.

Waterpower Development for Montreal and Quebec.

The Montreal Light, Heat and Power Company has undertaken to develop the power at Soulanges Rapids, so that the St. Lawrence River, at a point 40 miles away, will be made to furnish power for the city's needs. The power house is being erected near Lock No. 4 of the canal. This company has already accomplished much toward the "harnessing" of the neighboring waterways. It has drawn power from the Lachine Rapids, four or five miles away, the Chambly Rapids on the Richelieu, about 17 miles away, and the Shawinigan Falls, on the St. Maurice, 86 miles distant.

The development at Soulanges Rapids is the only plant of similar capacity and class so far designed and built on this continent. The contract for furnishing the hydraulic turbine and governing equipment was secured by the Canadian representatives of the Allis-Chalmers Company.

The principal turbines, three in number, are each designed for a maximum capacity of 5,350 brake horsepower on the shaft, under a head of 50 feet. Each machine will drive a 3,750-kilowatt generator, direct coupled to it. The turbines will be equipped complete with self-contained type oil governors for the purpose of securing the necessary speed regulation.

There will be furnished, in addition to the main turbines, two smaller exciter units, each with a capacity of 300 brake horsepower and operating at a speed of 450 revolutions per minute.

In laying out the power house, ample provision is being made for the addition of another turbine generating unit at some future time. A feature of the hydraulic construction is the draft tubes for the larger units. They will be molded in concrete, and it is said that this construction will be the first of the kind in Canada. The wheel chambers will be built in concrete, and the roadway along the canal will pass over them. It is asserted that with concrete the necessary curves in the tubes can be made to cause less friction than with the ordinary steel or iron penstocks and that great power can be developed from the given fall of the development.

It is expected that the first main turbine and exciter will be delivered at the power house early in November. The chief engineer in charge of the plant is Mr. William MacLea Wallbank, well known in the United States and Canada.

An important addition to the developments of waterpowers, with which the province of Quebec is well supplied, has been undertaken by the Quebec Railway, Light and Power Company. Up to the present time this company has derived power from the famous Montmorency Falls, but this has proved inadequate for present needs, especially in the winter season, when the water is low. Additional power has therefore become necessary, so that the present development will supply an everyday requirement.

The city of Quebec has apparently recovered all its old-time prosperity, and, with the arrival of the new Canadian Pacific express trains and the construction of the Grand Trunk Pacific, a large demand for additional power has set in.

Owing to the conformation of the banks, it is impossible to increase the power at Montmorency itself, but half a mile above the falls the river lends itself admirably to further development, for it widens and forms a natural reservoir in which to store surplus water and to provide for the season of drought. The company has erected there, according to the plans of Mr. E. A. Evans, chief engineer and general manager, a dam 84 feet high, the highest in Canada, for such a purpose. The dam is 67 feet four inches wide at the base and 12 feet wide at the crest, with a reservoir capacity of 52,000,000 cubic feet of water.

The contract for the plant to develop this power has been awarded to the Allis-Chalmers Company's Canadian representative, the Allis-Chalmers-Bullock, Limited, Montreal. The equipment to be furnished will consist of a 1,500-kilowatt alternating-current generator, driven by a 2,225-horsepower turbine waterwheel. The new power house is expected to be in operation by early December of this year.

The Quebec Railway, Light and Power Company has under consideration a further development at the Three Falls, two miles up the river, which, when developed, will provide for future demands for power.

Electric Drive for a Tacoma Sawmill.

A notable example of electric drive for a modern sawmill plant now in process of building is the mill belonging to the Dempsey Lumber Company of Manistee, Mich., located at Tacoma, Wash. This company, which has been operating for over 30 years at Manistee, where its cut was completed last season, has acquired large tracts of standing timber in the state of Washington sufficient to supply the new mill for many years to come. Building operations were begun some time ago on the Tacoma mill, which is to be situated in the city of Tacoma on a mill site of about 50 acres area, located on tide water.

The entire equipment for this plant—sawmill, steam and electrical—was purchased from the Allis-Chalmers Company of Milwaukee. The contracts for the sawmill machinery, which were placed some time ago, specify an outfit which will be of the heaviest type that has ever been built. The steam and electrical equipment ordered recently is designed amply to fulfill all requirements of the heavy service contemplated. The sawmill machinery outfit includes an 11-foot bandmill carrying band saws 18 inches wide and a nine-foot bandmill having double-cut saws of the same width, with a complete equipment of log-deck machinery, Pacific Coast carriages, etc., for handling logs up to 10 feet in diameter and 120 feet long. The edger is capable of handling 10-inch timber and is 84 inches wide. The slashers and trimmers will take lumber up to 50 feet in length.

The mill building will be 66 feet wide and about 500 feet long. The power plant will consist of eight 72-inch by 18-foot high-pressure boilers, with Dutch oven settings, connected to a concrete stack 100 inches in diameter and 120 feet high. A twin Reliance engine having cylinders 26 inches in diameter by 36 inches stroke is to be installed seperate from the electric plant, which will be driven from separate engines for the generating of power and for lighting purposes as well as for operating the planing mill, where each machine will be driven from individual motors. The dry kilns will be constructed of concrete blocks, making them fireproof.

The recently purchased equipment for the electric plant consists of a 22 by 36-inch Reliance Corliss engine direct-coupled to a 300-kilowatt 60-cycle three-phase engine-type generator, two exciter sets, each of 25 kilowatts, and 11 induction motors of various capacities for driving individual machines.

Two 10-horsepower motors operating at a speed of 1,120 revolutions per minute will drive the trimmer saw. A 30-horsepower motor will be direct-coupled to the ripsaw running at 680 revolutions per minute. Another 30-horsepower motor will operate a moulding machine running at 850 revolutions per minute, and two 40-horsepower motors will run No. 94 matchers, operating at 850 revolutions per minute, to which they will be direct-coupled. A bandsaw running at 690 revolutions per minute will be driven by a 40-horsepower motor, and a 100-horsepower motor will be belted to a blower equipment operating at 680 revolutions per minute. A planer and a twin matcher will each be driven from 50-horsepower machines running at 850 revolutions per minute.

The generator is an engine-type machine with revolving field. The armature is stationary and bears the high-voltage winding. Each armature coil can easily be taken out and repaired in case

of injury, thus insuring continuous operation and minimum loss of time for repairs. The generator is separately excited from an engine-driven exciter with current not exceeding 85 amperes at 120 volts. One exciter is direct-coupled to a 440-volt three-phase induction motor, while the other is driven from a New York Safety engine. The finished plant promises to be in every way the finest of its kind ever constructed on the Pacific Coast.

Two-phase Motor Equipment of a Uniontown Lumber Mill.

In many respects the conditions encountered in lumber mills present problems in power transmission that are not found in other industries. The inflammable nature of the material used, the size of the work handled and the severe power demands for starting and operating wood-working machinery of necessity require a motive power that is not only immune from fire risk, but one that will withstand heavy fluctuations in load and operate the various machines with as little obstruction to the handling of material as possible.

Three-horsepower Motor Driving Rip Saw.
15-horsepower Motor Driving Molding Machine.
Five-horsepower Motor Driving Cross-cut Saw.
15-horsepower Motor Driving Planer.
INDUCTION MOTORS DRIVING WOOD-WORKING MACHINERY IN A UNIONTOWN LUMBER MILL.

These conditions have only been partially fulfilled in the past by the use of overhead belting and shafting, driven from a central source of power, which is transmitted through numerous countershafts to the final point of application. In such installations there is an excessive loss of power by overcoming friction, which is increased by the slipping of belts and the severe fluctuations of load. Belts and shafting also obstruct the free handling of material and add to the fire risk, on account of the accumulation of dust and grease on pulleys and around bearings.

The foregoing conditions led to a demand for some method of operation that would in the main eliminate many of the objectionable features, and electric drive was the natural outcome. By its adoption the various floors and sections can be subdivided so that any machine or group of machines may be operated independently, producing a flexibility which is especially valuable in overtime work, when power requirements are small. Further, the use of electric motors to a large extent eliminates the use of overhead belting and shafting, which removes the objectionable features attending its use.

It was these considerations that led the Eggers & Graham Lumber Company of Uniontown, Pa., to adopt electric drive in its mills, and the installation furnishes an excellent example of this mode of operation.

The electrical equipment consists of Westinghouse two-phase induction motors operating on 60-cycle 200-volt circuits, the current being furnished by the West Penn Railways Company. Each machine throughout the entire plant is individually driven, as shown by the following enumeration of motors and the machines they drive:

One one-half-horsepower motor driving an emery wheel; one one-half-horsepower motor driving a grindstone; one five-horsepower motor operating a rip saw varying from eight to 14 inches in diameter; one 15-horsepower motor driving a molding machine; one 15-horsepower motor operating a universal planer; one five-horsepower motor driving a 10-inch cross-cut saw; one two-horsepower motor operating a tenoning machine; one five-horsepower motor driving a pony planer; one four-horsepower motor driving a panel raiser; one one-horsepower motor driving a shaper; one three-horsepower motor driving a hand-feed planer; one three-horsepower motor driving a band saw; one three-horsepower motor driving a rip saw.

The accompanying illustrations show several of these applications and are striking examples of the severe conditions encountered in this class of service. Owing to the rush of work in this plant —the mill running night and day—there is necessarily a large accumulation of shavings and sawdust, which, in some instances, nearly cover the motors, furnishing a forcible illustration of the immunity from fire risk secured with induction motors. Some of the motors have covers, which, with the accumulation of refuse coming from machines, prohibit ventilation; and that, together with the severe starting conditions, requires motors of exceptional strength, capable of operating under adverse conditions.

The installation is operating night and day, and is giving entire satisfaction to the owners, who consider electric drive the only successful method of operating lumber mills.

Trolley Extensions in Chicago.

The West Side cable lines in Chicago have been converted to trolley service. With this work done two of the three tunnels under the Chicago River that long have obstructed navigation are clear for the work of temporary lowering. Contracts for lowering the two West Side tunnels and the La Salle Street tunnel to the North Side have been let by the receivers of the Union Traction Company.

"Trolleyizing" of the North Side cable lines will be completed within the next 30 days, according to General Manager Roach, and then the contractors for the La Salle Street tunnel will start lowering that structure.

The British Association has accepted an invitation to hold its meeting in 1909 in Winnipeg, Man., Canada. Next year's meeting will be held in Leicester, and that in 1908 in Dublin.

QUESTIONS AND ANSWERS.

Current Required for Electric Hoist.

QUESTION.

A. I. M., Joliet: What current would be used by an electric hoist on a 200-volt circuit when required to raise a load of two tons 180 feet in a minute, assuming that the efficiency of the whole arrangement is 50 per cent.?

ANSWER.

The power needed is

$$\frac{2 \times 2{,}000 \times 180}{33{,}000} \text{ horsepower,}$$

or

$$\frac{4{,}000 \times 180 \times 746}{33{,}000} \text{ watts.}$$

The power supplied is:

$I \times 200$, where I is the current.

Then $I \times 200 \times .50 = 4{,}000 \times 180 \times 746 \div 33{,}000$

$$I = \frac{7{,}200 \times 746}{33{,}000} = 162.8 \text{ amperes.}$$

Efficiency of Arc Circuit.

QUESTION.

B. M. G., Evanston, Ill.: What would be the efficiency of an arc circuit supplied by a generator giving 6.4 amperes over a line 12 miles long of No. 6 B. & S. wire to 53 arc lamps, each adjusted to 46 volts? The temperature of line is assumed to be 70° F., and the power required to run the generator is 30 horsepower.

ANSWER.

Taking 0.395 as the value of the resistance in ohms per thousand feet of No. 6 wire at 70° we get for the resistance of the line:

$2 \times 12 \times 5{,}280 \times 0.395 = 50.05$ ohms.

Then the power lost in the line is:

$(50.05 \times 6.4) \times 6.4 = 2{,}050$ watts.

The power given to the lamps is:

$53 \times 46 \times 6.4 = 15{,}603$ watts.

The horsepower given by the generator is therefore

$(15{,}603 + 2{,}050) \div 746 = 23.7$ horsepower.

And the efficiency is $23.7 \div 30 = 79$ per cent.

Copper Loss.

QUESTION.

P. H. C., Valparaiso, Ind.: What number of amperes of current at two per cent. loss, 220 volts direct current at the generator, can be carried 1¼ miles over a 300,000-circular-mil copper cable?

ANSWER.

The answer to this question is 9.84 amperes, provided the return of this circuit also has a cross-section of 300,000 circular mils.

Wiring Distribution.

QUESTION.

Arkansas Reader asks: Kindly give me the correct size of copper wire to carry 20 lamps of 16 candlepower and 3½ watts at 110 volts as per diagram at two per cent. loss. Where is the center of distribution in the diagram, assuming that all lamps are of equal distance apart? How is the "center of distribution" determined as per standard wiring tables?

ANSWER.

With wiring laid out as in Fig. 1, a No. 15 B. & S. wire will be needed on each side of the circuit, or a total of 130 feet of this size of wire. With the wiring as in Fig. 2, a No. 13 B. & S.

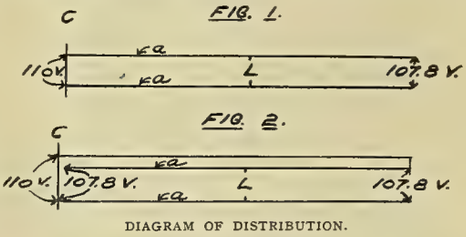


DIAGRAM OF DISTRIBUTION.

wire will be needed on each side of the circuit and an additional run of 65 feet of this size wire, or a total of 195 feet of No. 13 wire. In the first case the maximum lamp voltage will be 110 and the minimum 107.8. In the latter case the voltage of all the lamps will be 107.8. In each case the lamps are connected across the wires (a a).

The center of load is at (L) and the center of distribution at (C) in each case, the latter being at a point in the circuit nearest to the center of load where the total current is flowing in each side of the circuit.

SELLING ELECTRICITY.

Under this heading will appear, from time to time, articles, suggestions and examples which will be of assistance in the constant effort to increase the existing demand for electric current and to create new demands.

Central-station Business—How to Get It and How to Keep It.[1]

By Frank M. Tait.

Time was when the average central-station man was bending every energy to secure the lowest possible generation and distribution costs of his current, and the greater problem of securing a larger volume of desirable business was not the leading question it has become the last few years.

Today the central-station man is asking how he may improve the power factor of his plant, and what are the best means of procuring the desirable new business, and when it has been obtained how he may best retain it and encourage the further use of electricity after it has been connected to the system.

These questions are ones that must be very carefully considered, and a plan of action to produce quick results must depend upon the past performances in the particular town or city considering the problem.

Assuming that the getting of new business has not been followed in a systematic manner or perhaps not at all, and the results obtained meager or not satisfactory, it will be necessary to make a fresh start. If the company does not possess a complete card index of the town, active young men of pleasing address should be sent out to make a building-to-building canvass to procure the data necessary to compile a complete card index showing the style of house, location, owner of same and his business, tenant and his business, whether the house is wired or piped, if the fixtures are in, and, when possible, the feeling of the tenant toward the electric-light company and the use of its current. These cards should also bear the date and the name of the canvasser. When the cards are carefully taken and properly filed they form a true guide to the whole field desired to be worked for better and more electric business.

After the card has been obtained a complete list should then be made from same, indicating the buildings, etc., that seem to offer the best opportunities for business. The town or city should then be divided into sections or districts, with the list of prospects located in each district and tabulated. The next problem is to secure a proper type of canvasser to solicit the business in each district, and this part of the central-station scheme is a difficult one, for it is soon learned that good solicitors are hard to obtain, and it is acknowledged that a first-class canvasser, who can close good business every day, is one of the most important personages about the whole central-station system.

A satisfactory method is to employ bright, energetic, clean-cut young men of pleasing address and courteous manner and carefully train them for the position of canvassers.

The new canvasser should be placed in the several departments of the company until he obtains a good insight into the requirements of first-class electrical service and thoroughly appreciates the necessity of observing the details that go to make up the satisfactory electric current he is to sell.

When the candidate has advanced far enough in the operating and complaint departments he should be turned over to the chief canvasser or other official who has charge of the new-business department, to be further coached along the line of his duties, and then sent out for a few days, in company with an experienced canvasser, that he may observe the method of approaching prospective customers, arguments used, etc. He should then be given a district and started off to produce the proper amount of profitable new business required of him.

In order to keep an accurate record of what each canvasser is doing, it is very necessary to have them fill out daily an accurate report blank, and these daily blanks must be correctly kept, and the results obtained by each man should be tabulated each week, showing the names of parties called upon, number of contracts closed, reasons for not closing all of them, amount of new business added to old customers, expense items, etc. From these weekly sheets may be readily learned the percentage of contracts closed to calls made, the cost per call, per contract closed, per kilowatt of new business obtained, or in any particular way the data may be desired.

These weekly sheets quickly indicate the men who are producing the business, and by properly allotting the districts no trouble would be found in producing satisfactory results all around, and the canvasser who does not put in good substantial work in his district cannot escape the weekly inquiry.

Each canvasser should be paid a definite weekly salary, and at the end of stated periods should receive an additional recompense, in the way of a commission or bonus, based on the value to the lighting company of the new business he obtains. Further rewards should also be offered to the canvasser making the highest record in a given time. The districts covered by the various men will indicate the proper method of handling this feature of the new-business department.

To facilitate the efforts of the canvassers, it is desirable, if possible, that a room be especially devoted to their use. Every morning the first hour should be given over to the discussion of the past day's trials, troubles and tribulations, and a full and frank talk on the best ways and means of obtaining better results and of avoiding past difficulties should be engaged in by the respective canvassers and the chief canvasser, superintendent or whoever is responsible for the new business of the company. These meetings are a great help and with the proper man at the head of the canvassing department will fill the men with enthusiasm for each day's work.

To afford the canvassers and other men about the plant as well an opportunity for studying the theoretical as well as the practicable side of the business and make them better salesmen and workmen, every company should feel able to purchase a number of the best books published on the various branches of the business and also keep on file the leading electrical magazines, journals, etc.

The men should be encouraged in their desire for more knowledge of the business they are engaged in and nothing helps promote this spirit more than to have meetings in the evenings at regular intervals, at which meetings a talk may be given by the superintendent or any man in the company who is capable of affording information along any line of the business.

Pertinent questions should be solicited from the men and all should feel that their interests and the lighting company's interests are the same. Efforts spent along these lines will be liberally repaid by the higher quality of work performed by the men and the larger amount of good new business obtained by the canvassers.

The number of canvassers that may be used to advantage will depend upon the locality, and in some places it is found desirable to have special men in addition to the regular canvassing force. These special men may be experts along the line of electric signs, cooking and heating apparatus, decorative and window lighting, power, etc., while in others the chief canvasser or superintendent is usually a man capable of looking after this special work.

To further facilitate the canvassers' work it is desirable to have advertising matter that will keep the lighting company's product constantly before the public. This result may be partly accomplished in the local newspapers and satisfactory space should always be purchased and attractive, timely copy inserted and frequently changed. The newspapers will also be likely to be friendly to your company if this medium is used.

To enable the canvasser to get to the man who is thinking about wanting electric current, the follow-up scheme of individual letters is a good one. These letters should be written in a clean-cut style, with as few words as possible, and sent to the merchant, manufacturer or tenant, and enclosed with each letter a stamped return postal card ready for return if they are interested. These letters should be mailed to a well selected list compiled from the card index and should be sent at intervals close enough to keep the matter ever before the prospect until he finally decides to investigate and returns a postal card and the canvasser's opportunity arrives.

All envelopes leaving the electric-lighting company's office and going to consumers or others in the territory covered by your mains should always carry a dodger or booklet, relating to some appliance for the economical use of electric current, and the leading manufacturers of these appliances are now furnishing, gratis, quantities of their booklets with the lighting company's name printed on same.

All construction work, wagons, tool boxes, etc., should be properly decorated with banners or labels calling attention to the use of your product, and no opportunity should be lost sight of in keeping your commodity in the public eye.

A convenient and very satisfactory method of keeping before the public day and night is the use of prominent billboards in the various districts and have a concise advertisement painted on same and by means of trough reflectors illuminate the billboard at night.

The use of electric signs for advertising the company's business is also a good means of burning the lighting company's product into the public mind. Both of these methods indicate to other advertisers the value of electrically lighted signs and billboards and indicate new business in this direction.

It is this publicity and constant pounding of the word "electricity" into the minds of the public that brings a central-station business. When a manufacturer's steam plant breaks down and he wonders what he can do; when a kerosene lamp explodes and the user wants safer light; when the decorator sends in a large bill for retouching walls in a residence and the owner thinks of a light that will not smoke and disfigure paperings and tapestries—then it is that the constant hammering of these advertisements, letters and canvassers' efforts has its effect and the electric current its reward.

To assist the canvassers, exploit the use of current during the daylight hours, and it is well to arrange that they may offer appliances like electric sad irons, sewing machine motors, vibrators, etc., on a free trial basis for two weeks or more with the understanding that the appliance will give satisfactory and economical results during the trial and allow the customer the privilege of purchasing same at the end of the trial at about cost price or return to the company without expense if they are not satisfactory and merely pay for the current consumed during the trial. It is a fact that very few trial installations ever come back on the company.

It will be well to remember in this connection that a canvasser should see to it that the trial user thoroughly understands the proper use of the appliance and the trial should be carefully watched to this end by the canvasser concerned.

With all the advertisement and follow-up systems, dodgers, bulletins, etc., it is necessary that the canvassers follow up every possible clue to new business and present the matter in the proper light personally, for there is nothing as good as the personal interview by a clever canvasser.

When new business has been obtained and connected to the lines the central-station should then make the satisfactory service of the customer its particular object of attention.

A polite letter of appreciation should always be mailed to every new customer and enclosed with his approved copy of the electric current agreement, and the anxiety of the lighting company to give absolutely satisfactory service at all times and to everyone on the line should be touched upon in this letter.

The canvassers responsible for the new business should inquire of the new user, after it is in use a few weeks, if everything is satisfactory and as represented, and also remind the customer that the company is always waiting to do the right thing if the service requires any attention from any cause whatever.

The complaint department of every lighting company bears a vital relation to the keeping of new business and the enlarging of the old business. Those in charge of same should be diplomatic and courteous to a high degree and fully posted on the policy of the company. Telephone calls or complaints relating to the service should always be handled intelligently, promptly and courteously.

Every complaint received should be attended to at the earliest possible moment, and it should be the aim of every person connected with the lighting company to give the customer entire satisfaction.

This may be a difficult proposition in some instances, but it is a matter of record that special effort along this line always pays the lighting company, and too much stress cannot be laid upon this particular point.

While this paper may not fit the requirements of all lighting companies, the scheme noted, enlarged or curtailed, as may be needed by the size of the district covered, will be found satisfactory. Human nature is nearly the same everywhere, and the central-station man who will see to it that every person in his company, from the president down, studies the interests of the customers, attends to their complaints promptly and satisfactorily, renders honest and good service, properly rewards the canvassers who bring in the business, will soon find as much new business and enough enlargement of the old business as the most active electric-lighting man can take care of in a rapidly growing power plant. In addition to this, think of the possibilities for a large business in any community served by a central station that has the confidence of the entire public and the business good-will of the individual citizens.

1. A paper read before the Ohio Electric Light Association, August 22, 1906. Mr. Tait is manager of the Dayton (Ohio) Lighting Company.

School of Instruction in the Gas and Electrical Business.

The Denver Gas and Electric Company of Denver, Colo., has a practical school of instruction which in two years from now, it is expected, will turn out men fitted to take hold of any end of the gas and electric business with efficiency. The school is a plan evolved by Henry L. Doherty, president of the Denver company, to supply his various companies with men qualified to handle every branch in connection with the manufacture and sale of gas and electricity.

The pupils of the new school are students from Purdue, Cornell, Wisconsin, Michigan, Massachusetts Technology and Dartmouth. They have all had some experience in engineering work, but their training in the Denver school will not be confined to the technical side. They will spend a short time in each department, so that when they have completed the course they will be able to manage a gas and electric company with intelligence and success. Mr. Doherty's plan has considerable merit, as it will give the gas and electric world men thoroughly trained in the most advanced principles of the business.

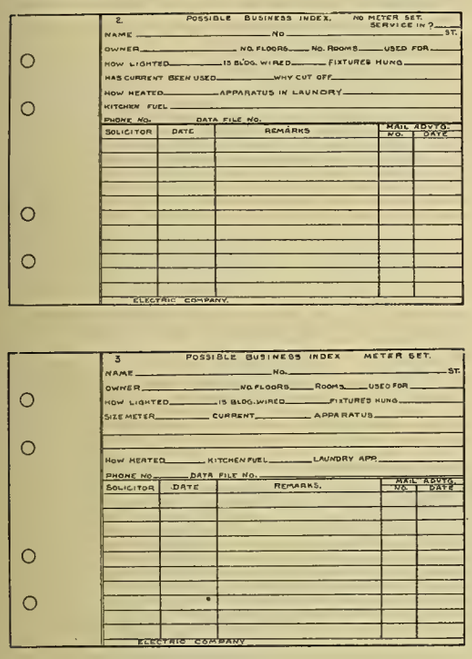
The management of the Galesburg (Ill.) Electric Light Company announces that the company will increase the capacity of the plant this fall. A new addition to the building will accommodate the new machinery.

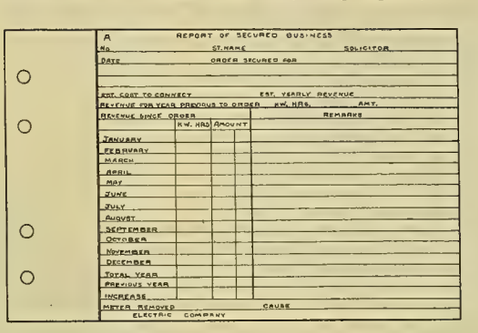
An Index of Possible Business.[1]

By J. M. Robb.

One of the most necessary essentials of a systematic campaign for new business is a Possible Business Index. A Possible Business Index is to the conduct of a new-business department what plans and specifications are to a piece of construction work. No two men will work up their new-business data precisely alike. Where one will want a complete plan, setting forth every detail, another will be content with a freehand pencil sketch with a very few notes.

It is well to bear in mind that when a man goes hunting he must have a pretty definite idea of what he seeks. If you have in your new-business campaign a complete index of the possibilities in your territory, you will waste less of your new-business appropriation.





BLANK FORMS OF A POSSIBLE-BUSINESS INDEX.

While cards are generally used for such an index, loose sheets five by eight inches in size and bound in binders will be found to be far more useful, and, in addition, will give all of the advantages of a card index.

Some of the advantages over cards are as follows:

The sheets are larger, giving more space for useful data.

The sheets bound in the binders will always be found in their proper sequence, and, if necessary, can be removed from the binder as easily as a card from a file.

By using thin paper much more information can be filed in a given space.

By using a thin binder, it may be carried in the pocket, and in this manner the sheets are much easier to handle in the field than cards.

Forms 2 and 3 and "A" give a set of forms for a Possible Business Index. Form "A" is to be printed on the reverse sides of forms 2 and 3. These forms are self-explanatory. The telephone number is put in because often very effective soliciting can be done by telephone. The data file number is to be used when correspondence or estimates, etc., accumulate in soliciting a prospect.

An envelope, large enough to contain all of the letters, estimates, etc., in flat sheets, is used, given a number and filed in your data files. The envelope number posted to the index sheet gives quick reference to all of the data on file for the prospect.

Your Possible Business Index should contain a sheet for each house or prospect in your territory.

As your territory is extended put in a sheet for each house or prospect in the new territory.

Arrange your orders so that every meter set, remove or transfer order and every appliance order will go to the person in charge of the Possible Business Index, so that it will be always up to date and show a complete list of all electrical appliances you are supplying with current.

Remember that your index is your guide for directing your fight for more business, and the more careful attention it receives the less effort you will waste.

Use different colors of paper to indicate the different classes of new business. For instance:

White paper may indicate a building where no current has ever been sold.

Yellow paper to indicate a building now being supplied with current. Make the sheet for this class of business show an itemized statement of the connected load.

Red paper for a building where current has been supplied, but, for some reason, has been disconnected.

Brown paper to indicate power prospects.

Green paper to indicate sign prospects.

Properly laid out and handled, the Possible Business Index will not only show the possibilities for business, but it will also show the amount of work done on each prospect, and when the business is finally secured, the index sheets can be used to keep a record of the business obtained by each solicitor. This is easily accomplished by noting on the sheets the orders to be credited to the solicitors and then filing them in a separate binder behind the name of the solicitor who is entitled to credit.

Then, periodically, the revenue from such business can be posted to the sheets credited to each solicitor and his income-earning value is thus readily determined.

One of the best methods of starting your solicitors is to have them first go over their territory to make up reports for the Possible Business Index. In this manner the ice is more easily broken for a new man, and he quickly becomes familiar with his territory.

Periodically, at regular intervals, depending upon your local conditions, have your man check up the New Business Index and carefully make the necessary corrections.

If you are mailing matter to your prospects, this practice will not only save money in postage, but the moral effect upon your prospects will increase the efficiency of your new-business department many per cent.

To assist in keeping your Possible Business Index up to date, give your solicitors credit for any business closed in your office, where the index shows the solicitor has called on the customer within 30 days of the date of the order.

1. Part of a paper on "Organization and Conduct of a New-business Department Suitable for Central Stations in Cities of 50,000 Population and Under," which was awarded the third prize in the recent competition of the Co-operative Electrical Development Association. Abstracts of papers winning the first and second prizes have already appeared in the Western Electrician. Mr. Robb is connected with the Peoria Gas and Electric Company.

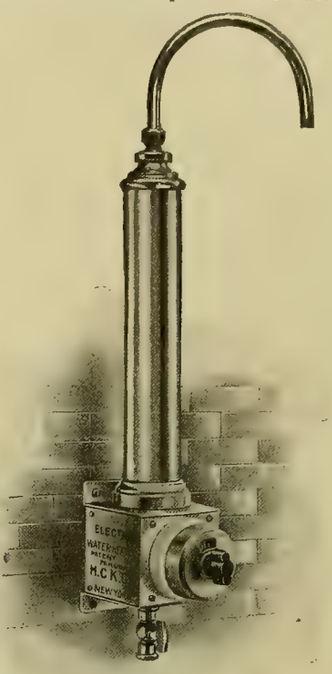
Instantaneous Electric Water Heater.

After considerable experimenting and many tests conducted during the past year, the H. C. K. Company has produced a new form of electric heater for heating water instantaneously. It was found during the tests that it would be impossible to heat water instantaneously by any other method than direct contact between the water and the heating element. This form of heater was then developed, but while the efficiency could be maintained extremely high, and the heating of the water could be made as rapid as desirable, the life of the heating element depended altogether upon the presence of the water. The problem was solved when an automatic cut-out was applied to the electric water heater, which would interrupt the current when the water ceased to flow, or if the flow should be reduced to such an extent that the water in the heater would boil.

At first sight it might appear that the water flowing through the heater around the heating coil would introduce a ground on the electric system. This is, however, not the case, as insulating joints are provided at top and bottom of the heater tube and the resistance of the water is sufficiently great to prevent any flow of current. Where the heater is connected to the regular Edison three-wire systems, the neutral, or grounded, connection, is connected to the lower part of the heater, which prevents any grounds, as there can be no difference of potential. This is also the case where the heater is used on alternating systems where one side of the neutral of the secondary circuit is grounded.

The HCK instantaneous electric water heater consists in the main of a supporting box, upon which is mounted a double-pole quick-break switch and an insulating joint of special design, to the lower end of which is attached a one-quarter-inch water valve. Screwed into the upper part of the insulating joint is a bronze fitting within which is placed the cut-out, which automatically opens and closes the electric circuit as the water is turned off and on. In the upper end of the bronze fitting there is held (in a similar manner as is a water glass for a boiler) a porcelain tube, with one terminal at each end. Within the porcelain tube is placed the heating element, which consists of a specially designed spiral, made of a material which is guaranteed not to rust or corrode, or be injured in any way by the action of the current and the presence of the water. At the upper end of the porcelain tube there is another bronze fitting, with insulating joint above it, which supports the spout. One wire leads from the switch to the upper bronze fitting on the porcelain tube, and the wire from the other side of the switch leads to the lower bronze fitting. The porcelain tube and the bronze fittings are surrounded by a brass tube 1¾ inches in diameter. The total height of the heater from the bottom of the inlet valve to the top of the spout is 20 inches, and all fittings are nickel plated and highly polished.

If the water valve is open but the switch not turned on, cold water will flow from the heater. The moment the current is turned on the water becomes heated instantly, and by regulating the flow of the water the temperature can be adjusted up to 200° F.



INSTANTANEOUS ELECTRIC WATER HEATER.

The standard heater requires about 10 amperes at 110 volts, and it is said that it will heat a glass full of water to 190° F. in 40 seconds, which, at the rate of 10 cents a kilowatt, would cost .014 cent. The same heater would heat one gallon of water to the same temperature in 10 minutes for less than 2 cents.

The HCK electric heater is made in several sizes, from 10 to 25 amperes at 110 volts, and 5 to 12 amperes at 220 volts, for either direct or alternating current of any frequency. The heaters will be ready for delivery by October 15th.

BOOK TABLE.

How to Make an Experimental Wireless Telegraph Outfit. By A. Frederick Collins. New York: W. L. Hedenberg Publishing Company. 1906. Price, 25 cents. (Pamphlet.)

Mr. A. Frederick Collins, the well-known wireless telegraph expert and inventor of the wireless telephone, has in this booklet given those who wish to study the principles of wireless operation the necessary information for the construction of an inexpensive set of instruments with which it is practicable to communicate over a distance of a quarter of a mile. As its title indicates, this work is intended for the novice or student, and no attempt is made to describe the various "systems" of wireless telegraphy or tuning and coupling devices. It simply describes the construction of a set of instruments devoid of refinements, and to cost the amateur not to exceed $20 for both sender and receiver complete. There are four diagrams which clearly explain the wiring connections of the experimental transmitter and receptor. The set of instruments described could, with very little additional expense, be made to cover longer distances, even up to a mile or two over hand; and in this respect it is noteworthy that a complete set of wireless apparatus may be constructed from material on sale in any electrical shop at a sum not over $20. Incorporated in the work is a copy of the Morse telegraph alphabet as used in America on both ordinary and wireless lines.

An order of the United States Patent Office says that all applications, communications and other instruments in writing or print, which should properly constitute a permanent record in that office, must be prepared with a substantially permanent ink. Aniline and other perishable inks will not be accepted.

THE SMALL CENTRAL STATION.

Practical Hints on Its Construction and Operation.

CHAPTER IX. (*Continued.*)

ELECTRICAL EQUIPMENT.

Operation of the Series Alternating Arc-lamp System.—In connection with the series alternating arc-lamp system just described, it may be of interest to quote from a paper on this subject read before the National Electric Light Association at its latest convention in Chicago. The paper gave a detailed account of the street lighting system employed in Cincinnati, Ohio, where four-ampere series enclosed alternating arc lamps were employed. These lamps are fitted with alabaster inner globes, open at the bottom, and clear outer globes. Each lamp is further equipped with a porcelain enameled reflector. Regarding the efficiency, power factor and operation of the system, the writer, Mr. J. Henry Hallberg, says:

"The entire arc-lighting system operates on a three-phase 4,500-volt 60-cycle generator. Switching devices and automatic transformers in the generating station are arranged in three groups. Each group consists of 12 60-light transformers, and any or all groups can be switched on either of the three phases, which arrangement permits the proper balancing of the load on the three-phase system. The commercial efficiency of the system, exclusive of generator, lines and cables, is over 91 per cent. The initial power factor of the apparatus is between 70 and 75 per cent. at all loads above quarter-load.

"Due to the capacity of the lead-covered cables connected to the apparatus, the commercial power factor of the entire system is maintained from 10 to 15 per cent. above the initial power factor of the apparatus; consequently the operating power factor of the installation is about 80 per cent. The current is maintained at exactly four amperes, and the lamps are adjusted for about 75 volts at the arc. Each lamp consumes 240 to 260 actual watts at the arc, and is equipped with half-inch carbons. Although this is a large diameter for the carbon for such a low-energy arc, the regulation of the lamp is perfect, and the light alabaster inner globe is well fitted for a steady diffused light.

"The life of one 0.5 by 10-inch carbon is depended upon to be 115 hours. The trimming of 4,500 lamps is taken care of by eight trimmers, who work on specially constructed tower wagons. The open-base inner globe is used, and all globes are cleaned at the sub-stations, where the carbon stubs are also cut to proper length and fitted in an extra set of lower carbon holders for the next trim.

"There are comparatively few people outside of those interested in street lighting who understand the value of low-energy series alternating-current arc lamps as applied to city lighting. Due to this fact, complaints may be expected from the public when a 9.6-ampere open arc is replaced with two low-energy series alternating lamps. It is, however, an interesting fact that when a change of this kind is made and established, the public soon realizes the advantage of a steady, shadowless, well-distributed and diffused light, and would not willingly go back to the old method of illumination.

"The writer's experience at Cincinnati during the last year has established the following facts:

"First—The open-base inner globe is safer and more economical than the closed-base globe.

"Second—The large metal reflector is not necessary on four-ampere series alternating-current lamps hung only 12 or 15 feet above the street, but a small enamel reflector immediately above the arc is beneficial.

"Third—The initial or natural power factor of a four-ampere series alternating-current system should not be depended upon to be greater than 75 per cent., varying between 70 and 75 per cent.

"Fourth—The 75 per cent. power factor applies to ordinary overhead circuits. When the current is supplied underground in lead-covered cables, the capacity of such cables introduces leading currents; hence the operating power factor of the underground circuits at Cincinnati is maintained above 90 per cent.

"Fifth—The efficiency can be maintained above 91 per cent. and the regulation still be perfect.

"Sixth—Four amperes is the lowest practical limit at which successful alternating-current arc lighting can be practiced.

"Seventh—Half-inch diameter carbon is the most practical size to use in a four-ampere alternating-current lamp.

"Eighth—Notwithstanding the large size of the carbon (considering the low-energy arc), the regulation of the system is perfect, and there are no objectionable shadows from the carbons.

"Ninth—It requires only eight trimmers to take care of 4,500 lamps.

"Tenth—The outages or lamps requiring starting in the underground district are less than one-fourth of one per cent., and in the overhead district the outages average one per cent."

Direct-current Series Arc Lighting.—A system of street lighting which has been in almost universal use since its introduction is the direct-current series arc-lighting system. This method of lighting streets found favor in the eyes of the public with marked rapidity, undoubtedly through its simplicity of operation. It is not necessary to spend time on the description of this system. It may be taken for granted that all readers of this series are familiar with its general design.

This system, while at all times satisfactory, has at present reached a more advanced stage through the betterment of the apparatus required to operate it. The modern direct-current series arc dynamo will care for from one to four circuits, operating a total of from 35 to 220 arc lamps. The regulators of the recognized manufacturers of this type of dynamo are well built and will operate satisfactorily from a short-circuit to the full load of lamps, even though the load increases or decreases with extreme rapidity.

The first arc lamp used with the series direct-current system was of the open type and operated on from 40 to 50 volts at the arc. Modern practice employs the enclosed-type lamp, which operates with from 70 to 80 volts at the arc. While the open type of arc lamp is much cheaper than the enclosed type, it is also much inferior as a lighting medium. The pole-line construction for the series direct-current system is practically speaking the same as for the series alternating-current system, excepting, of course, the use of transformers.

The restricting feature of the system for small plants is its inflexibility. It is only suited for arc-lamp work, will not operate incandescent lamps, and inside the station costs much more to install and operate than does the tub system. Arc dynamos require attention and regulation, and, once out of order, are not easily repaired.

Multiple Arc System.—The old multiple arc system is obsolete for small central-station work, requiring too heavy line construction and too great operating expense. In large cities, where alternating current is furnished to numerous sub-stations at high potential through underground conduit and then rectified to direct current at a low voltage, the multiple arc lamp is capable of being operated in the districts surrounding these sub-stations. The runs are short, and therefore multiple work can exist economically.

Multiple Alternating-current System.—The multiple alternating-current system affords us an opportunity of describing a multiple system capable of operation on an economical plan, although the first cost is considerably higher than that of a series alternating-current system. Both the alternating-current multiple and the alternating-current series systems employ the same type of generator, and both employ transformers, with this difference: the series system employs one constant-current transformer which supplies the proper current to each and every arc lamp, while on the other hand the multiple system employs a transformer for each and every lamp, these individual transformers sometimes being built into the lamp casing and practically becoming a part of the lamp. The line voltage may be the initial voltage of the generator, or it may be higher or lower, according to the length of runs. The lamp cost here is naturally higher than that of the series system.

A feature of this method of lighting which partially offsets its high cost of installation is the possibility of so arranging the circuits as to utilize one wire of the street-lighting circuit for one side of the commercial circuit.

The scheme is as follows: Three wires are led out of the power house—two from one terminal of the generator and one from the other. It is of course understood that the three wires lead through the switchboard. Let us call the single wire (A) and the two remaining wires (B) and (C). On the switchboard we will install single-pole switches in each of the circuits (B) and (C). Across the wires (A) and (B) the multiple arc-lamp transformers may be installed, while across the wires (A) and (C) the commercial-light transformers operate. During the daytime the switch in line (B) will be open and the street-lighting circuit dead, although the commercial circuit will remain intact. The wire (A) common to both circuits must be chosen of sufficient carrying capacity to operate both systems, for at night it must carry current for both street and commercial circuits. Where the commercial circuit branches away from the street-lighting circuit, two wires for it alone must be run, the same as in any of the foregoing systems.

Nernst System.—The last and most recently developed system of street lighting is called the Nernst, after the lamp which it employs. The Nernst lamp is a form of incandescent lamp which requires no vacuum.

An alternating-current generator similar to that used for the tub system is usually employed. Current is led from the generator at the generated voltage over a pair of mains to a second pair of distributers which extend the length of the main street of a town. To these distributing wires transformers are connected which feed the side streets, the transformers being located on the main street poles. The lamps are bridged or multipled across the feeders taken from the transformer secondaries. Being a multiple system, it requires large feeder wires, besides necessitating almost double the amount of wire of a series system. The lamps cost considerably more than do the ordinary incandescent lamp. Sudden fluctuations in voltages are much more disastrous to them than to any other form of incandescent lamp, thus necessitating much closer attention to the generator than is ordinarily required. The light of the Nernst lamp is, however, particularly pleasing, and it is highly esteemed.

Generators.—The rapid improvement made in the design and construction of the generator during the last decade causes one to hesitate in passing an opinion on or in giving a description of the present up-to-date machines. The next ten years contains a possibility, although scarcely a probability, of an equal amount of advance along the same lines. The generator, as turned out by the leading manufacturers today, will, if given intelligent attention, operate satisfactorily for a period of years far in excess of the economical life of the engine driving it. The temperature rise of a machine worth the purchaser's consideration is today not above 40 degrees Centigrade on continuous full load. At 25 per cent. overload the guaranteed limit of rise is not above 55 degrees Centigrade after a continuous run of two hours. A few manufacturers guarantee temperatures even below these.

The bi-polar (two-pole) type of generator has disappeared entirely in sizes above 10 kilowatts capacity. An increase in the number of poles has so reduced speeds in small machines as to make it possible for the purchaser to figure direct-connected apparatus wherever conditions demand without being afraid of a too high piston speed for his engine.

At this point it may be well to make a few remarks concerning direct-connected apparatus. In units of the size under consideration, viz., up to 150 kilowatts capacity, there will occur but few instances where the saving obtained by direct connection over belt drive will warrant the increased first cost. Under 75 kilowatts capacity few if any engineers will advise such an installation. The above statements are made from the viewpoint of economical operation. First cost not being a vital factor, or floor space commanding a premium, then the purchaser naturally turns to direct-connected machinery

Another point worthy of consideration in modern practice is that of employing revolving-field-type alternators. Machines (alternators) of 75 kilowatts capacity and upward and those designed for high potentials are built with revolving fields for the following obvious reasons: Where large currents are to be drawn from a revolving armature, it is difficult so to design the alternator as to do away with more or less sparking at the brush contacts. The stationary-armature machine does away with these brush contacts. Again, the large copper bars of the armature are stationary and not subjected to that vibration which always accompanies revolving-armature machines of large capacities, and which sooner or later tends to bring about complications necessitating costly repairs.

Further, the revolving field being much simpler in design than the revolving armature, higher rates of speed may be employed wihtout danger. Lastly, the current supplied to the revolving field is, relatively speaking, so small, and the voltage at which it is supplied so low, that no trouble whatever is met with in its delivery, while to draw current from a revolving-armature machine of extremely high voltages or of large capacity always requires close attention and a ready remedy for the trouble which one finds will invariably occur. The revolving-field-type alternator is most certainly crowding the older type out of the market.

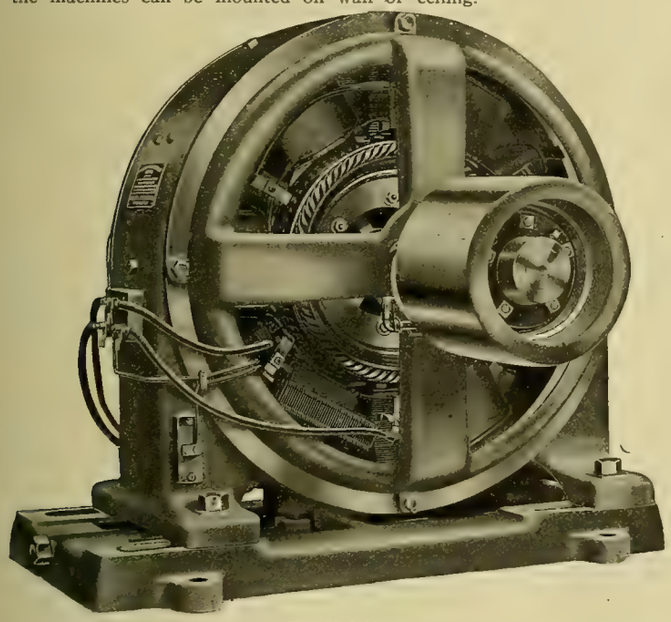
[*To be continued.*]

Commutating-pole Variable-speed Motors.

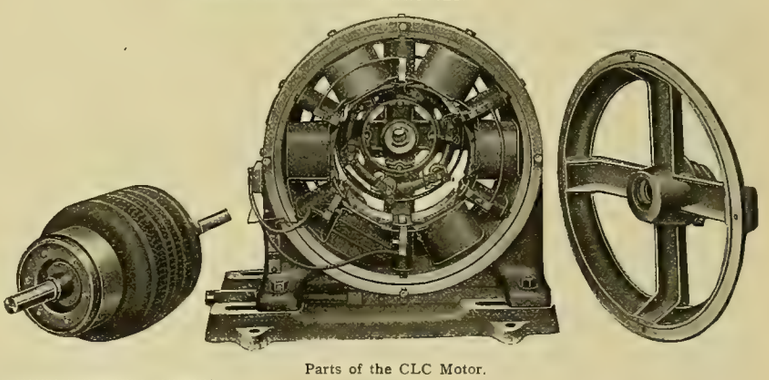
The exacting requirements of machine-tool motor drives, hoist work and other classes of severe service have created a demand for a variable-speed electric motor. In order to meet these conditions and also to increase the output from a given motor frame, the General Electric Company is placing on the market a line of variable-speed commutating-pole motors. This new line of motors is known as the CLC type for large power, while the smaller sizes are designated as type CQC.

As can be seen from the illustrations, the commutating poles in these new machines are placed between the main field poles and are so wound that they are excited by a portion of the main current. The main field is usually provided with an ordinary shunt winding, but may be also compound-wound when service conditions require. The commutating poles provide a magnetic field of sufficient intensity to neutralize the effect of the current in the armature coils, which are short-circuited during commutation. Sparkless commutation at all loads within the speed range specified is thus obtained. As the action of these poles is reversible, the motors can be run equally well in either direction. Not only does the addition of commutating poles improve the operating conditions of the motors, but the new machines can be operated at a higher output over a wider speed range, so that greater power is concentrated in a small-size frame.

The mechanical details of construction of the new line of motors is similar to that of the well-known CL and CQ motors, made by the same company. In the CLC motor the field frames are of cast-iron, while in the smaller size CQC type they are built of steel. Both types of motors are so constructed that, by turning the bearing brackets through 90° or 180° relatively to the frame, the machines can be mounted on wall or ceiling.



The CLC Motor.



Parts of the CLC Motor.

COMMUTATING-POLE VARIABLE-SPEED MOTORS.

Where motors are used in places where flying particles or dirt are liable to injure the machine the bearing brackets are fitted with perforated hand-hole covers which furnish complete protection to the motor, and at the same time allow free circulation of air through the windings. Solid hand-hole covers can be supplied when it is necessary totally to enclose the motor. The capacity of motors under such circumstances, however, will be somewhat reduced, owing to the decrease in ventilation.

The CQC motor, combining as it does the compactness and general efficiency of the CQ type of motor, together with the advantages accruing from the use of the commutating pole, is particularly suitable for individual variable-speed machine-tool drive. It is small in diameter, comparatively short along the shaft and substantial in construction. All these qualities make it an ideal motor for driving lathes, as it can be mounted on the top, bottom or side of the driven machine. Similarly, the commutating-pole type CLC motor is suitable for the larger classes of machine-tool work as well as for ordinary commercial requirements. Type CQC motors range in size from five horsepower to 20 horsepower. For heavier work the CLC motor is built in capacities up to and including 130 horsepower.

The Knoxville (Tenn.) Woolen Mills report that it is a little premature to say that they are running their plant by electricity. They are experimenting with some small motors, and say that it is up to the Knoxville Railway and Light Company to show them that it can furnish the power cheaper than the mill people can make it themselves.

Navy Department Testing Set.

The Queen portable test set, illustrated herewith, is a type recently devised to meet the revised Navy Department portable testing set specifications, which have been altered considerably and made much more exacting than heretofore. However, the arrangement of this set has been made, also, with a view to securing the maximum portability, with due regard to convenience in mechanical arrangement, while the connections of circuits are such that a large variety of tests beyond those indicated in the government specifications may be executed.

In general, the outfit consists of a Wheatstone bridge with a one, 10, 100 and 1,000-ohm coil in each arm. The rheostat consists of 10 coils of units, tens, hundreds and thousand denominations, the last or tenth coil being added for convenience in checking up the next higher series of coils; that is, the 10 coils in the unit row in series can be checked with the first coil in the 10 row, and likewise the 10 10-ohm coil can be checked against the first 100-ohm coil, etc., an operation which confirms the accuracy of adjustment, but one not possible to execute in a decade set where each row consists of but nine coils.

The bridge and rheostat are properly connected to an improved D'Arsonval galvanometer, deadbeat and of such high sensibility that a change of one-tenth of one per cent. in the rheostat when measuring resistances of approximately 1,000 ohms value will give a decided galvanometer deflection. The needle is free from outside magnetic influences, and so balanced that the test set can be used in practically any position; it is also provided with an adjustment lever, so that the pointer of the galvanometer can also be made to indicate zero.

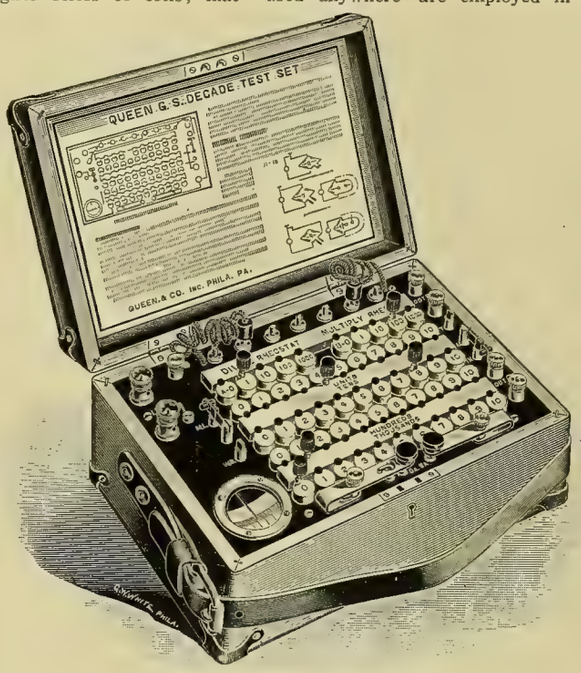
The battery consists of six chloride-of-silver cells, connected so that any one or number up to six in series may be used, while a pair of binding posts allow the use of an outside battery when desired.

Both the galvanometer and battery keys are on the front of the case in a most convenient location, and are made extra heavy, with a liberal supply of platinum iridium at the actual contact points.

Binding posts and a small switch allow the use of an outside galvanometer if desired.

A ground post, as well as an auxiliary galvanometer switch, is provided, so that both the Murray and Varley loop can be executed. The resistance coils in the bridge arms are adjusted to an accuracy of one-twentieth of one per cent., while that of the rheostat coils is one-tenth per cent., the wire used being manganin and having a negligible temperature coefficient.

The over-all dimensions of the set are approximately 12 by eight by six inches, and the weight is about 12 pounds, the case being made of polished quartered oak, and protected with nickel-plated brass corner pieces. In addition to the usual measurements of resistance, this set can be used for locating grounds, crosses and other cable troubles, utilizing either the Murray or Varley loop tests, while it can be used for insulation resistance measurements and numerous other tests, such as checking up voltmeters and ammeters, measuring battery resistance, etc. The instrument is manufactured by Queen & Co. of Philadelphia.



NAVY DEPARTMENT TESTING SET.

1,500-horsepower Motors in Rolling Mill.

Very large electric motors—perhaps the largest used anywhere—are employed in rail mill No. 3 at the Edgar Thompson Works of the Carnegie Steel Company, Pittsburg, which has the distinction of being the first rolling mill entirely equipped with electric motors. These motors are of the 220-235-volt direct-current type. There are two main motors of 1,500 horsepower each, driving rolls, and 18 other motors ranging in size from 25 horsepower to 90 horsepower on the auxiliary equipment used in rolling. There are two trains of rolls, No. 1 and No. 2, each of which is direct-connected to a 1,500-horsepower motor. Each train, says B. Wiley in the Electric Journal, consists of two sets of rolls, and all except the outside set or finishing pass of No. 2 train are three high. There are tilting tables at the No. 1 rolls to convey the pieces from the bottom to the top passes, and an inclined table to guide the pieces into the bottom pass after leaving the top pass of No. 2 and No. 3 rolls. The remaining equipment of the mill proper consists of heating furnaces, drawing machines and roll tables. Hot saws, cooling beds, straightening presses and drills are located in the lower part of the mill.

The roll motors are duplicates and are of the Westinghouse two-bearing type. They are direct-current, 1,500-horsepower, 30-pole, 235-volt, compound-wound, with 15 per cent. series field excitation; and have a normal range of speed from 125 revolutions per minute at no load to 100 revolutions per minute at full load.

Particular attention was given in the selection and design of the motors to the question of capacity and mechanical strength. The shaft is 28 inches in diameter at the flywheel and the bearings are 25 inches in diameter and 62 inches long. The bearings are lined with babbitt metal, and although of the oil-ring type are water-cooled.

This is an extra precaution against an accident due to heating, as the oiling alone gives good service. A large babbitted thrust collar is mounted on the shaft on the outside bearing next to the mill. The outer end wall of this bearing is five inches thick and acts as a seat for the collar. This arrangement provides for the end thrust which might occur should there be a diagonal break of the shaft in the mill. If this thrust was not provided for in some way, serious damage to the motor armature might result.

A heavy cast-steel flywheel of the segment type is mounted on the shaft next the armature on the mill side. It weighs 125,000 pounds, is 18 feet in diameter, and at 130 revolutions per minute has a peripheral speed of 123 feet per second. The radius of gyration is approximately 6.75 feet.

There have been many cases where the motors selected for mill work have proved too small, and it has been necessary to install larger machines. Although the capacity of the original motor might have been sufficient for the normal load, the excessive electrical and mechanical strains due to the reversing of the motor caused trouble. In other cases the location was not favorable, and external heat and dirt caused breakdowns. As a result of these experiences there has been a growing tendency to use a more liberal safety factor in selecting motors for steel-plant work.

These roll motors are examples of what is considered good practice in this respect, for both the mechanical and electrical features have been given generous consideration. This statement has been verified by actual practice during the eight months of operation, as no trouble has been experienced.

A switchboard and starter is provided for each motor. The starter was designed and built by the Cutler-Hammer company and is composed of 12 large, special type hand switches, so arranged with a mechanical interlock that it is impossible to close them except in their proper order. To prevent the motor from racing, two shunt field relays are so arranged that one of the circuit-breakers and all of the starting switches will be tripped in case the shunt field circuit of the motor is opened while the motor is running. To prevent injury from excessive speed each motor is provided with a centrifugal speed-limit device placed on the outer end of the armature shaft and mechanically connected to one of the circuit-breakers by a series of linked rods. As a further protection the second circuit-breaker is provided with a no-voltage coil, which opens the motor circuit in case of failure of the line circuit.

Each motor is provided with a separate resistance of unusual design, the steel-mill idea of steadiness and reliability being well exemplified. Each bank of resistance consists of 105 30-foot lengths of 25-pound steel T rails and 295 lengths of 40-pound rails. The supporting rack is also constructed of rails and insulated by special shaped fire brick. The capacity of the resistance is such that the motors can be run on any desired point of resistance without undue heating.

Electrical Fires and Casualties in Boston.

The Wire Department of the city of Boston, in its excellent report for the year ended January 31, 1906, records the fact that all reports of fires and accidents as due, or supposed to be due, to electrical causes have been given prompt attention, careful investigations made and records of such fires and accidents kept. During the year no fire occurred caused by wiring approved by the department.

During the year the number of electric fires originating in the interior of buildings has been 20, as compared with 23 and 32 fires respectively for the two years previous. Of this number, 14 were of minor character and entailed no insurance loss. The other six fires were comparatively small, there being but one fire where the insurance loss was over $700, and the total insurance loss by the six fires, and including loss by two fires that started on the outside wall of building and burned through to the interior of building, was but $6,576.31.

The heaviest insurance loss for the year due to a fire attributed to electrical causes was $4,080. This fire occurred on July 14th, at the New Old South Church, and was evidently due to a defectively wired wall bracket, insulation of flexible cord with which bracket was wired breaking down, a hole being melted in a gas pipe back of insulating joint and gas ignited by electric arc.

Of the other fires, one, causing a loss of $404.37, was caused by sparks from an electric motor igniting inflammable material; one fire, resulting in a loss of $200, was caused by the flash of a short-circuit igniting cotton; one fire, causing a loss of $652.94, was attributed to grounding of electric-light circuit by a nail driven through insulation on wire and into contact with a gas pipe; one fire, resulting in a loss of $200, was caused by a short-circuit in service cables entering building from underground; one fire, causing an insurance loss of $489, mostly due to smoke damage, was caused by a short-circuit in cable in elevator well, cable being used for conducting current to lamps in elevator car; two fires, causing losses, respectively, of $300 and $250, were started on the outside of a wood stable from a grounded series arc circuit, the fire in each case burning through wall to the inside of building. While these two fires started outside of buildings, they are included in the losses of interior fires due to electrical causes, as holes were burned through walls and fire communicated to the interior, where the greatest amount of damage resulted.

There were two cases where electric current entered buildings over pipes, with consequent arcing between gas, water and other pipes, and damage, the source of current being underground electric mains in which burnouts had occurred in street.

There were two cases where high-potential current entered buildings over the secondary wiring. In both cases a cross occurred between high and low-potential circuits at points near where secondary wires left transformers on poles to enter houses.

During the year there were 19 electrical accidents, two of which resulted in the death of the victims. With few exceptions the injuries resulting from the other 17 accidents were slight. One of the fatal accidents occurred to a telephone lineman, who, while at work on wires of his company, came in contact with a high-potential wire, causing him to fall to the ground, he thereby receiving injuries which caused his death. The other fatal accident occurred to an experienced workman who was at work in one of the stations of the Edison Electric Illuminating Company at the time of accident, and who made contact with a high-potential wire, current from same being grounded through his body. Of the 17 other accidents, five were to experienced men who were at work on wires at the time accidents occurred; two were to painters at work on the elevated-railroad structure at the time; one was to a boy who had climbed up to where he came in contact with a high-potential wire, and who, in addition to receiving shock and burns, was seriously injured by falling to ground; one passenger on elevated train who fell from the train received, in addition to other injuries, severe burns by coming in contact with live third rail; a policeman who received severe shocks and slight burns while attempting to use a police signal box which was charged with high-potential current as a result of a cross between pole signal and high-potential wires; a fireman who received slight shocks by coming in contact with wires at a fire; two laborers at work on a derrick, the guy wire of which came in contact with high-potential wires, received severe shocks; two persons received severe shocks and slight burns from a secondary circuit which was crossed outside of building with a primary circuit, and two persons received slight shocks from an electrically charged trolley pole.

Italian Markets.

Conditions and prospects for American goods in the Milan consular district is the subject of a report from Consul J. E. Dunning, in which he says:

"The Milan district comprises the active and populous provinces of Milan, Como, Brescia, Cremona, Sondrio, Parma, Mantua, Pavia and Piacenza, with a total population of about 2,000,000. Electricity as motive power is rapidly supplanting steam, and is furnished by a steadily increasing number of waterpower plants in the northern hills. Including new installations and conversions from steam to electricity, about 20,000 horsepower a year is being added to the mechanical equipment of the district. American manufacturers who can supply machine tools and that class of imports are profiting by the industrial activity. The field continues fertile. German and Austrian competition have had their day in Milan among the experienced manufacturers, who have found and admit that the American machine, at its higher cost, offers a certainty and uniformity of result which, since they can be attained in no others, renders it the cheapest in the end. In Milan it is the American machine which is relied upon to effect that new hold upon their own market which is the prime object of the Italian manufacturers."

Long-distance Telephone Line Proposed for Mexico.

It is said that the Compania Telefonica Mexicana of Monterey, Mexico, is to begin work on the construction of a long-distance telephone line to Saltillo, and thence on south to San Luis Potosi. It is also stated that the company contemplates connecting the line with Mexico City, thus giving Monterey direct telephone connection with Mexico City. The line will run from San Luis Potosi to Mexico City, a distance of about 500 kilometers, if the present plans of the company are carried out.

This line to Mexico City has been contemplated for some time by the directors of the company, and it is expected that it will be only a matter of time when Monterey will have direct telephone connection with Mexico City. The entire distance from Monterey to Mexico City is about 1,100 kilometers. The line will follow the course of the National Railroad for the whole distance. Branch lines will probably be constructed to the principal cities and towns along the route of the telephone line.

Italy Seeking Improved Telephone Service.

Paul Nash, the United States consul at Venice, reports that the telephone service in Italy, both local and long-distance, has hitherto been almost entirely in the hands of two great companies—the Societa Alta Italia, operating in Milan, Genoa and Turin, and the Societa Generale Italiana pei Telefoni ed Applicazioni Elettriche, controlling Bologna, Florence, Rome, Naples and the Sicilian towns.

In the beginning of 1904 the ministry of posts and telegraphs took over the Venice telephone system, extending the service, raising the pay of the employes, and reducing the rates, but, in spite of increased expenses, putting aside some $12,000 a year toward a fund for the changing of the entire system. The time has now come when bids for this change are being made, and already three have been received—one from an American, one from a French and one from a German firm. These bids are yet to be submitted to the ministry at Rome by the local director, and there is still time for other American firms to compete if they act promptly.

The ministry of posts and telegraphs recently appointed a commission to investigate the telephone service throughout the country, with the result that in many places a complete change was found to be necessary. In Rome, for example, the service was found to be extremely bad, and that city will probably be one of the first to be modernized in this respect. The appointment of this commission was the first step in the project of the ministry to take over control of the telephone service of the whole country. Thus the moment seems most propitious for investigation by American manufacturers, and because the government will undoubtedly prefer a uniform system throughout Italy a large business might possibly be the reward of the successful bidder for the modernization of the service in the first large towns in which it is undertaken under government control.

The director of the Venice exchange tells Mr. Nash that the American common-battery system is in use at Milan, and that, as it gives perfect satisfaction, the tendency will be to adopt it generally. He also says that of the three propositions already submitted to him for the new exchange in Venice that of the American firm seems to be the best, and that although the actual choice does not rest with him, he believes the minister will award the contract to this firm, provided, of course, nothing better is forthcoming. American desk telephones should also find a ready sale in Italy, according to Mr. Nash.

Telephone News from the Northwest.

The Northwestern Telephone Exchange Company installed an elaborate system of telephones for use during the G. A. R. encampment in Minneapolis. Information booths on leading downtown corners were all supplied with telephones, and lines were numerous enough, so that there was no danger of emergency calls finding all lines busy.

The Mesaba Telephone Company will make extended improvements to its exchange in Grand Rapids, Minn., including the erection of a new building.

The Scott County Telephone Company of Jordan, Minn., has reorganized and will construct a system of farm lines.

The council of Northfield, Minn., is considering the matter of a municipal telephone exchange.

Materials are being received at Fargo, N. D., for the establishment of an exchange and headquarters for the North Dakota Independent Telephone Exchange.

C. Swedback is installing a local exchange for Big Falls, Minn., to be in operation by September 1st.

Benjamin Baker has been succeeded as manager of the Mutual Telephone System at Villisca, Iowa, by W. L. Robbins of Malvern.

The South Dakota Union Telephone Company of Northville has filed articles of incorporation with a capitalization of $50,000. F. C. Mariner heads the list of stockholders.

The Harrison Telephone Company has gone out of business at Deadwood, S. D., and the exchange is being dismantled.

The Northwestern Telephone Exchange Company has increased its capital stock from $10,000,000 to $15,000,000. The increase is to meet the expense of improvements now being made throughout the Northwest, and the stock will be placed in the market shortly in small blocks.

Plans are being made for the construction of an Independent telephone system at Polk City, Iowa.

The Menominee Range Telephone Company has sold its system to the Michigan State Telephone Company for $17,500.

The North Dakota Telephone Company met at Fargo and made plans for extensive new lines throughout the state. The company is closely allied to the Tri-state Telephone Company.

The Rice County Rural Telephone Company at

Faribault, Minn., has surrendered its stock and the Tri-state Telephone Company has taken hold of the business.

The Mutual Telephone Company and the Bell Telephone Company have consolidated the two exchanges at Dysart, Iowa, the latter closing its office and connecting its lines with the other exchange. R.

Indiana Telephone Items.

The New Long-distance Telephone Company of Indianapolis, which owns the Citizens' Telephone Company of Columbus, is said to have purchased the Hope telephone plant.

Mayor Brouse of Kokomo vetoed the ordinance recently adopted to permit the Citizens' Telephone Company to enter into long-distance service relations with the Bell Telephone Company. The council attempted to pass the ordinance over the mayor's veto but lacked one vote of being able to do so. This is twice the council has passed the ordinance and twice vetoed by the mayor, and the end is not yet.

The officers of the Richmond Home Telephone Company took a large committee of Richmond's citizens to Columbus, Ohio, to inspect the automatic telephone system in use there, with a view of allowing its patrons to determine what system should be installed in Richmond while the plant is being rebuilt.

As a result of a compromise between the Richmond Home Telephone Company and the Independent companies of Eaton, Camden and other nearby towns that brought suit against the Richmond company to enjoin it from cutting off their service because they had entered into service relations with the Bell Company, the suits have been dismissed. The towns agree to give the long-distance system of the Richmond Home Telephone Company the preference. S.

Southeastern Telephone Developments.

The merchants of Raleigh, N. C., are still engaged in a struggle to rid themselves of the inconvenience of three telephone companies. Some final action will soon be taken, and it seems probable that the Bell company will be given the field, as the Bell long-distance service is regarded as indispensable.

The Cumberland Telephone Company has suspended all improvements in various parts of Louisiana. A 10 per cent. reduction in toll rates was ordered by the state railroad commission.

The Southern Bell Telephone Company is greatly improving the service between Danville, Va., and Charlotte, N. C., and has completed the stringing of new wires as far south as Greensboro.

An up-to-date private system of telephones has been installed in the Atlanta, Ga., postoffice, and will be ready for use in a short time.

A toll line is being built by people in the country to connect with Southport, N. C., Little River, S. C., and Shallotte, each call being paid for as the service is used, the money being raised by the truckers and farmers along the route, making a convenient rural system. L.

GENERAL TELEPHONE NEWS.

The Farmers and Merchants' Mutual Telephone Company of Julian, Neb., has been incorporated with a capital stock of $5,000 by George F. Conlon and others.

The Independent Telephone Association of North Carolina and the Maine Independent Telephone Association have been organized within the last month. Both states will affiliate with the International association.

The Canadian Independent Telephone Association will hold its annual meeting at Toronto, Ont., on September 5th. It extends a cordial invitation to its associates in the United States to attend this meeting, and assures a profitable time to all who accept.

Theodore Thorward, president of the Home Telephone Company of South Bend, Ind., makes the official announcement of the transfer of that company's stock to the new owner, a Chicago syndicate headed by Joseph E. Harris. Mr. Thorward says that the deal will result in opening up Chicago to the Independent systems and the extension of the service to the east, north and south.

The International Independent Telephone Association is compiling, in a concise manner, for distribution, the most complete telephone statistics obtainable. All associations who may have late data not previously furnished are asked to kindly forward it as soon as possible. Companies in states having no association can forward information regarding their properties direct to the Cleveland office.

The following committees have been appointed by the president of the International Independent Telephone Association: Executive committee—C. W. Kline, Hazelton, Pa.; Frank L. Beam, Columbus, Ohio; A. C. Lindemuth, Richmond, Ind.; M. B. Overly, Louisville, Ky. Committee on litigation and legislation—J. B. Earle (chairman), Waco, Texas; F. H. Woods, Lincoln, Neb.; E. R. Conklin, Aurora, Ill.; E. B. Fisher, Grand Rapids, Mich.; Richard Valentine, Janesville, Wis.

CORRESPONDENCE.

Continental Europe.

Paris, August 15.—At present the traffic is very satisfactory on the new branch of the Paris Metropolitan road, which was opened up a few months ago. This line makes a semicircular tour through the southern part of town, and runs on an overhead structure for a good portion of its length, crossing the Seine upon two bridges, one in the eastern and the other in the western part of the city. Some of the work upon the tunnel portion has not yet been finished, and at present the trains are run only as far as the Place d'Italie, but as the operations are being carried on rapidly, there is no doubt that the entire section will be opened for traffic within a few months. The trains are now made up of one motor car and two trailers, which is a shorter train than is used on the rest of the road, but when the line is fully opened it is expected to use the regular train. An immense underground station will be located at the Place de la Nation, where three of the Metropolitan lines come together.

The city of Grenoble, in France, is one in which the use of current from hydraulic plants is the best developed, seeing that it lies in a mountainous region where waterpower is abundant. A concession was granted not long ago to the Romanche Power Company for supplying a large amount of current. This is transmitted over a 25-mile line from a hydraulic plant which has been erected at Livet, in the gorges of the Romanche River. Here is obtained a 200-foot head of water, and the station is equipped with three turbine-alternator sets of 2,000 kilowatts each. The overhead line runs from the turbine plant to a large sub-station in the suburbs of Grenoble. A second transmission line comes in also from the Fure and Morge hydraulic station, so as to have a reserve supply. At present there are some 65 transformer cabins in the city, and a number of other transformer stations located in the larger buildings. A large amount of current is used for public and private lighting.

The Municipal Council of Paris has been engaged for some time past upon the question of the future lighting system, seeing that the contracts of many of the lighting plants will soon expire, and some measures must be taken before long in this direction. A number of propositions have been laid before the council, but up to the present nothing has been definitely decided upon. This has aroused some dissatisfaction, as four of the concessions expire in the early part of next year, thus giving but a short time to make the needed preparations. At the last meeting of the council the matter was adjourned till the next session.

Among the new hydraulic plants may be mentioned the station which has been erected on the Aar River, in Germany, at Wangen, where a 27-foot head of water is secured. The turbine station contains six alternators of 1,500 horsepower each. Double turbines of Swiss make are used here, with a hydraulic governor. A hydraulic plant is now in operation for supplying the town of Rienz, in the Tyrol. From the dam laid across the River Rienz, a canal 4,000 feet long leads to the main water chamber, and three penstocks run from thence to the turbines. The latter are of the Francis type and give 700 horsepower, being connected with 5,000-volt alternators.

One of the interesting features of the Nuremberg Exposition was the electric plant for lighting and power on the premises. It occupied a large space and contained 17 boilers of different makes. Motive power was furnished by steam engines and turbines, gas engines and Diesel heavy oil engines. The new Zoelly steam turbines formed one of the novelties. Current was furnished for 600 arcs and 20,000 incandescent lamps, as well as for the circular electric railroad.

It is proposed to construct a tramway line of 10 miles length at Jasny, Roumania, and at Braila and Galaty there will be laid about eight miles of track. At Bucharest most of the lines still use animal traction, but some three miles of line will no doubt be changed over in the near future. The two leading tramway companies at Bucharest are to be consolidated in a single company, according to the present projects.

Among the recent company meetings, it may be reported that the Overhead and Underground Railroads Company of Berlin showed good receipts for the last year, including 4,280,637 marks for the subway, which is an increase over the preceding year. The annual record is 34,529,325 passengers carried on the underground road and 3,495,539 for the surface roads, making over 38,000,000 passengers in all. Counting the surface roads, the total receipts for the year are 4,499,147 marks. The company decided to pay a dividend of 4½ per cent. The Paris Metropolitan and Traction Company reports the receipts for the year to be 6,794,171 francs, of which the sum of 5,700,000 francs will be set apart to pay the dividend. This company is capitalized at 75,000,000 francs. The receipts have increased over last year's showing, which was 5,322,085 francs. A. de C.

Great Britain.

London, August 15.—For some considerable time past trouble has been brewing on the part of the local authorities who have embarked upon electrical undertakings, in consequence of the methods now being adopted by the Local Government Board when dealing with applications for electric-lighting loans. In fact, it is not putting it too high to say that in certain quarters open rebellion is the order of the day. Many thought that, with the advent of a new liberal government, something approaching the millennium had arrived, so far as municipal trading was concerned, but such an idea has been quickly laid by the heels, for the permanent officials of the Local Government Board are now pursuing a policy which, if put into operation 10 or 15 years ago, would have saved much of the reproach which indiscreet municipal trading has brought upon the electrical industry in Great Britain. The question of the period over which the loan for any individual portion of an electrical undertaking should be repaid is a most controversial one, there being no sort of uniformity of opinion, but the Local Government Board inspectors are now frequently finding instances in which plant is obsolete and has to be renewed long before the original loan is paid off. Consequently searching inquiries are made, which frequently stray into the region of questioning the policy of particular loans for particular purposes. In fact, within the last few weeks the remarks of a certain Local Government Board inspector concerning street lighting caused one borough electrical engineer to suggest that he was either the local gas manager, or was a close relative of that individual. In themselves these matters have largely a local interest, but there is a much wider issue, for it has been clear for a long while that some curb is necessary to the somewhat loose management which has existed. Whether the Local Government Board carries its policy of "peeping Tom" too far or not—and there are some who consider even a closer supervision necessary—the recent attitude will do much to check undue recklessness. In the past, very few questions were asked if an application for a loan were unopposed, a condition of things which it can be easily seen might lead to disastrous results. The matter is now reaching a head, and it may possibly give place to fresh and more enlightened opinions on this important matter.

The London County Council would appear to have an insatiable desire to extend its tramway system, an ambition—unlike many others of that body—not to be checked. The programme for new lines which it will present to Parliament next session will entail an expenditure of $3,500,000, and it is most pleasing to note that the erstwhile aim of confining London's system to itself and refusing junctions and running powers to adjoining tramway systems is being abandoned. There is a huge suburban residential district touching the borders of London outside, and if the County Council is to study the welfare of those who work in London but live outside it must arrange for through running, now so extensively carried out in the provinces. Therefore it is a welcome sign of the times that lines are proposed in conjunction with at any rate one outside authority, in order to satisfy the very natural desire of having no changes. A further fact, worthy of commendation, is the continued desire to make their system a mixed one of conduit and trolley, thus minimizing the capital expenditure. Objections are still held to this, however, in one or two unenlightened quarters, and for this the County Council is itself to blame, for in a weak moment, apparently of enthusiasm, before the southern lines were built, it gave to every local authority a veto to demand the conduit system, should it choose to do so.

The financial results of the Pacific Cable continue to show a loss. The gross receipts have slightly increased for the year ended March 31, 1906, being roughly $460,000, as against $437,500. The expenditure has also increased, but in less proportion, and leaving out capital charges there was a profit of $25,000. But the capital charges amount to no less than $387,500, and the net deficiency is $362,500. This is recoverable from England, Australia, Canada and New Zealand in certain specified proportions. The total capital expenditure up to March last amounts to close upon $10,000,000. Active competition with the cable companies in Australia is now being initiated in consequence of the negotiations for mutual cooperation having fallen through. The commonwealth government is assisting the Pacific Cable Board by granting special facilities. Some 80,000 messages were sent over the cable during the last year.

The postmaster-general's report contains an interesting statement concerning wireless telegraphy. With a view to testing the capabilities of wireless telegraphy for ordinary business purposes, two installations have been ordered, one from the Marconi company and the other from the British De Forest company. The former is erected on the east coast of England and the latter on the west coast of Scotland. It may also be mentioned here that an invitation has been received from the German government to the International Wireless Telegraph Conference in Berlin on October 3d, this year. It has been accepted. Another item of interest in the report is that high-speed automatic typewriting telegraph instruments are in use on

a few circuits, but they are not yet considered to be beyond the experimental stage.

The main-line railway companies are seriously considering the use of electric traction in order to meet the competition of electric tramways. The Midland Railway Company is going to equip a short line as an experiment on the high-tension single-phase system, while the London and Northwestern proposes to construct an electric line to serve a northwest London suburb.

An extension of the Baker Street and Waterloo Railway was opened last week, and through bookings have been arranged with the City and South London tube railway. It is now possible to book from the extreme west to the extreme south of London.

A most severe thunderstorm in London a few days ago completely flooded the conduits of the tramway system and suspended the whole service for nearly an hour. G.

Dominion of Canada.

Ottawa, August 25.—It is understood that a big steel concern of Pittsburg, Pa., is preparing to put up an electric smelting plant at some point in Canada where waterpower and ore are available.

Contracts have been let for two more space-telegraph stations by the Canadian government. One is to be at Father Point and the other at Seven Islands. This brings the number of stations on the Atlantic coast and the Gulf of St. Lawrence up to 15. The power of the Cape Race station is to be increased. It is proposed to increase this to 210 miles, from the 80-mile radius as at present.

The feature of the special meeting of the Electrical Development Company, held at Toronto recently, was the emphasis given to the statement that the company would have a large surplus of power after supplying the demand on it from Canada. This surplus will be sold in the United States, where it is said there is already a great demand for it on the part of several companies.

The city of Toronto will ask a figure for 30,000 horsepower from the hydro-electric commission of Toronto. This is in response to the invitation from the commission to find out the use that Toronto can make of power from Niagara Falls.

In a conference between the Ottawa Electric Company and the electric commission of this city, the former company made a straight offer to buy the civic plant, which was rejected. The Ottawa company has succeeded in getting a declaration of the courts that the city has no authority to lease power, and an application for relief has accordingly been made by the city to the Ontario hydro-electric power commission at Toronto.

Before another year is over telegraphic communication for a portion of the distance to the Yukon will be made by the wireless system. Owing to the many interruptions, last winter, to the Dominion government's telegraph line, by storms, avalanches and landslides, particularly in the Cariboo district, it has been suggested that the danger sections be covered by the wireless method. This suggestion has been accepted by the Public Works Department at Ottawa and it is understood that tentative offers from the Marconi and the De Forest companies have been received. For a stretch of 1,200 miles 10 or 12 power-transmission stations will have to be erected and maintained. W.

New England.

Boston, August 25.—The Massachusetts Gas and Electric Light Commission has authorized an issue of 919 shares of stock by the Beverly Gas and Electric Company. The market value of the stock is fixed at $170 per share. This will increase the company's stock from $194,000 to $285,900, the par value being $100 per share. The proceeds are to be used for the payment for additions to the company's plant, made since May 31, 1906.

The Massachusetts Railroad Commission has recommended that the Old Colony Street Railway Company's fare between Quincy Square in Quincy, Mass., and Nantasket Beach, be reduced from 20 cents to 15 cents.

The Standard Manufacturing Company, maker of electrical supplies, is preparing plans for a factory 35 by 90 feet and three stories high, in Bridgeport, Conn.

At this week's meeting of the Boston aldermen the special committee on municipal lighting was given until September 20th to make its report. The committee's investigation of the matter has not been productive, but members of the committee have contracted bills for food and refreshments amounting to $300. The city auditor intimates that the city will not pay these bills.

James E. Harrington and William J. Mullane, convicted of the larceny of fares from the Boston and Northern Street Railway Company while acting as conductors, have been sentenced to the house of correction, the former for two months and the latter for one month. Both appealed.

The Boston Light, Heat and Power Company has bought eight acres of land at Still River, Mass., near Clinton, where it proposes to build electric-light and gas plants from which to furnish light and power for Leominster, Groton, Harvard, Lancaster and Clinton, Mass.

The General Electric Company has leased a building in East Boston, Mass., and will use it as a shop in which it will employ 300 people. The company has had some difficulty in getting the right kind of labor in Lynn, and it is said that this is the cause for its opening the shops in East Boston.

An automobile ran into an electric car containing 50 passengers on Huntington Avenue in this city last Friday night, and knocked it about three feet from the rails. None of the passengers were injured, but the damages to the automobile amounted to about $1,000.

The Portland and Northern Railroad Company has petitioned for a charter for an electric railway between Cumberland Mills and Bridgton, Maine, via Naples, a distance of some 35 miles. The company has received subscriptions for its entire stock. It proposes to carry freight. Electricity will be generated by waterpower. Sumner O. Hancock of Casco, Maine, heads the list of directors.

The will of Levi W. Eaton, late president of the Bryant Electric Company of Bridgeport, Conn., disposes of an estate of $200,000.

The New England Telephone and Telegraph Company has bought 1.1 acres of land at Concord Junction, Mass., and will erect a building thereon. B.

New York.

New York, August 25.—An agreement as to a case to be presented to the courts in settlement of the question of the legal right of the Brooklyn Rapid Transit Company to charge a 10-cent fare on its Coney Island lines was reached yesterday afternoon at a conference between Stephen C. Baldwin, counsel for Borough President Coler, and ex-Justice Hatch and other counsel of the company. The case will probably come up in the Court of Appeals in October, or early in the term. Mr. Baldwin said that an omnibus case, involving all the lines in the company's system, had been agreed upon. It will probably be well into the winter before a final decision in the matter is reached.

The cooling plant at the Brooklyn Bridge station of the Subway was put in partial operation yesterday, and, while the refrigerating apparatus was not in working order, the fans which have been installed grealy improved the air in that part of the tube. There are four driven wells which furnish the pumps with about 400 gallons of water a minute. This water, when brought up, has a low temperature. There are two cooling coils in the tanks on either side of the tracks, each of which contains about 4½ miles of pipe. They are designed to cool 150,000 cubic feet of air a minute. Then there are four fans which drive this air through the cooling tubes and thence to the sheet-iron ducts, which distribute the refrigerated air over the platform. As the water is used it is discharged into the sewer. Power for the pumps and the fans is furnished from the third rail, and the water costs nothing, so, if the plan proves a success, similar plants will doubtless be installed at other stations. The cost is comparatively small.

The State Board of Railroad Commissioners recommend to the Union Railway Company that not later than 60 days from date the company place an order for 50 new cars, large type, to be delivered as soon as possible; that in addition 100 new cars be purchased each year for the next four years, and that other steps be taken to better the service in Bronx Borough.

It is said that negotiations have just been concluded whereby the United States government, through the Department of Commerce and Labor, will be represented among the exhibitors at the fifth national business show, which will be held in Madison Square Garden, New York city, October 27th to November 3d, this year.

The Proceedings of the eleventh annual convention of the National Association of Manufacturers of the United States of America, recently held in New York, has been published in book form and constitutes a part of the association's regular and permanent means of posting the influential people of the country with regard to the principles and practice of the organization. The book covers a wide range of subjects. Marshall Cushing of this city is secretary. C. I. C.

Southeastern States.

Charlotte, N. C., August 25.—The Atlanta, Griffin and Macon (Ga.) Electrical Railway Company has been granted a charter, capital stock, $100,000, to operate an electric railway between Atlanta and Macon. The charter is for 101 years and the incorporators are N. P. Pratt, W. A. Wimbish and E. P. Ansley of Atlanta, Minter Wimberly of Macon, and others. This line will be one of the longest electric railways in the South.

A charter has been granted to the Concord Realty and Railway Company to build a 21-mile electric railway from Charlotte, N. C., to Concord. The capital is $125,000 and R. A. Brown of Concord heads the incorporators.

The Buckeye Water Company of West Asheville, N. C., has recently perfected an organization with R. P. Hayes, president, and has secured right to operate a power distributing plant and telephone exchange.

The strike of street-railway employes in Macon, Ga., has been peacefully settled, and union men are taking their places on the cars.

The T. A. Gillespie Company, which has the contract for excavating and widening "the Narrows" on Yadkin River, near Salisbury, N. C., at Whitney, is in need of 500 more men to aid in the work. The Whitney Company is spending several millions on its power plants, and the work is regarded as the greatest thing ever undertaken in the South up to this time, at one locality.

A charter has been granted to the Fayetteville Street Railway and Power Company of Fayetteville, N. C., with $100,000 capital, for the purpose of operating electric railways in the town and within a radius of 50 miles of Fayetteville, and also to supply light and power. W. D. McNeill, J. F. Harrison and other Fayetteville capitalists are the incorporators.

It is reported that the Norfolk and Western Railroad will build an electric-light plant at the foot of coal pier No. 7, at Lambert's Point, near Norfolk, Va., to cost $50,000, to furnish light for Norfolk, Berkeley and Portsmouth, Va.

The Bureau of Yards and Docks has awarded the contract to Symond & Mayrant of Charleston, S. C., for the federal power house at that point, the contractors' bid being $140,000.

Surveys are being made for an electric railway to connect the towns of Paducah and Hickman, Ky. Plans will be submitted to prospective backers immediately. At the same time eastern capitalists are planning an electric line to run to Cairo, Ill.

Surveys of routes have been about completed by the Southern Power Company for power transmission to Concord to be used in cotton mills and manufacturing establishments.

Judge T. R. Purnell of the federal court has decided to order at once the sale of the plant of the Cape Fear Power Company, now in receivers' hands, at Buckhorn Shoals near Fayetteville, N. C. The plant is not quite complete and bondholders insisted on the instant sale of the property, while the company and others interested asked for the completion of the plant before sale in order to secure a better price. The court announced that the petition of trustees for sale would be granted, the matter having been postponed several times. L.

Texas.

Austin, August 23.—The Democratic state convention at its recent session adopted a platform which contains a plank requiring that the next Legislature enact a law compelling all telegraph and telephone companies to make wire and business connections with one another at all common points in the state. When this plank was offered in the committee it was strongly opposed by some of the members, but after arguments in its favor had been made it was adopted. United States Senator J. W. Bailey, who was a member of the platform committee, was among those who opposed the adoption of the plank. It was argued by those who opposed the plank that there was no general demand on the part of the people for the proposed legislation and that it would work unnecessary hardship and heavy expense upon the telegraph and telephone companies. Colonel Thomas Campbell, in his speech accepting the nomination for governor, stated that he would see that every platform demand was enacted into law by the Legislature if he had to keep that body in continual session in order to secure that result. This announcement causes the anticipation that the unusual legislation proposed in regard to telegraph and telephone companies may become a reality.

J. E. Farnsworth of Dallas, vice-president and general manager of the Southwestern Telegraph and Telephone Company, which is the opponent of the Independent telephone interests in Texas, says that the enactment of a law which would compel telephone companies to make connection at common points would cause a serious impairment of the services of the good companies. There are scores of towns in Texas where Independent local exchanges are in operation which are cut off from long-distance lines. Such a law as is proposed would add greatly to the value and importance of many of the smaller telephone exchanges and systems of the state.

A law of this kind would also revolutionize the telegraph business in Texas, as the Western Union and Postal would thereby practically become one system. H.

Ohio.

Cleveland, August 25.—The franchise fight in Cleveland seems to be growing more bitter all the time.

The state railroad commission is arranging to investigate all wrecks on traction lines in the state. Officers of the traction companies will be requested to notify the commission of all accidents, and an inspector will then be sent to look into them. The matter of safety devices for traction cars will also be taken up.

The roads running into Columbus will be taxed to their utmost next week by the state fair business. It is understood that the steam roads will refuse to make rates, because of the two-cent-fare bill, and this will give the tractions almost an unlimited amount of business. The fair will continue throughout the week.

M. W. Hissey of Zanesville has consummated a

deal whereby he secures control of the street-railways, Lake Hiawatha park and the plant of the Mt. Vernon Electric Light Company of Mt. Vernon. The deal is said to involve $100,000 and about that much more will be spent in improvements.

An effort is being made to secure rights-of-way for an electric line through Gallipolis, and from there to Point Pleasant on the West Virginia side. It is said that Col. Boone's plans for building roads in that section of the state have been dropped.

It is said that negotiations are pending between the interests represented by George B. Kerper of Cincinnati and Gerry Meeker and associates, by which the Findlay and Marion Railway and Light Company may be taken over by the former.

O. M. C.

Michigan.

Grand Rapids, August 25.—The Grand Rapids Railway Company will not now extend its tracks as this would require the granting of a new franchise, and if the railway company accepts a new franchise it lays itself open to the municipal-ownership clause of the city charter, giving the city the right to take over the lines of the company at the expiration of the franchise. So far only one solution has appeared. It is to amend the charter so as to take out the municipal-ownership clause, then grant a new franchise. The street-railway company has expended $360,000 this year in replacing rails, and has declared a dividend of one per cent. on common stock. This is the first dividend paid on the common stock of the company, which was issued five years ago.

The Boyne River Power Company has been organized with a capitalization of $100,000, all of which has been subscribed. The company will acquire the flowage rights owned by E. A. Stowe and C. C. Folmer of Grand Rapids, and will erect a 32-foot dam three miles east of Boyne City, utilizing the power to light Boyne City, where the company now has a steam plant in operation. Frederick C. Miller will manage the company and headquarters will be at Boyne City.

The Fenton Light and Power Company, recently reorganized to take over the Fenton gas and electric plants, has filed a trust mortgage for $50,000, running to the Detroit Trust Company, to cover an issuance of bonds for improvements.

The Flint Land and Improvement Company is commencing a big dam on the Rifle River north of Standish. This is the first of three or four to be built for electric-light and power purposes for Michigan Central and Lake Shore towns. A belt-line electric railway is planned to encircle the county.

M. J. Hobin, claim agent for the Michigan United Railways Company, has purchased the right-of-way for the Lansing-Jackson electric railway from Lansing to Mason and one-third of the way from Mason to Jackson. Officials say that the rest of the right-of-way has been contracted for and that building will commence in the spring.

E. W. Sparrow has begun suit against the Michigan Power Company at Lansing, the American Trust and Savings Bank of Chicago and Frank H. Jones, trustee. The suit involves water rights on Grand River.

L. W. B.

Indiana.

Indianapolis, August 25.—The Indiana Union Traction Company has awarded a contract to local contractors for the construction of large shops and car barns in North Anderson. The improvement will involve the expenditure of upwards of $100,000.

Within a few days the eleventh interurban line will be opened into Indianapolis, as will also be the extensions on two other lines. The Indianapolis and Danville expects to begin business in a few days, and the Connersville and Greensburg extensions on the Indianapolis and Cincinnati line will also be completed and put in service not later than the first week in September.

W. Kesley Schoepf, head of the Indiana and Ohio traction syndicate, in company with J. D. Foraker, president of the syndicate, spent the greater portion of this week in Indiana inspecting the syndicate's various properties.

The directors of the Winona Interurban Company, at a meeting in a trolley car en route from Warsaw to Goshen, voted unanimously to postpone indefinitely the running of cars on Sunday, and in the meantime not to operate cars on that day. The people say such a course greatly inconveniences the public and may lead to the construction of an opposition line.

The Indiana Railroad Commission has adopted a rule to the effect that hereafter all railroads built in Indiana will be required, when crossing another line, to build under or above the tracks of the existing line. No more crossings at grade will be allowed in this state. The steam roads complain because the ruling does not apply to interurban or electric lines, which are regarded hazardous in grade crossings. The commission replies that it has no jurisdiction over electric lines, but will ask the incoming Legislature to place the interurban under the jurisdiction of the commission.

Articles of incorporation have been filed by the Gary Heat, Light and Water Company, with a capital stock of $100,000. This company proposes to build a combination plant in the new "steel town" now building on Lake Michigan. Thomas J. Hyman, A. F. Knotts and K. K. Knapp are the directors.

The Hays Electric Manufacturing Company of Indianapolis has filed articles of incorporation with a capital stock of $10,000. The formation of this company is the result of an invention for automatic electric signs, which the promoters of the company expect to manufacture. Dr. Franklin Hays, John B. Cockrum and others are directors.

City Attorney Matson has rendered the Board of Public Works of Indianapolis an opinion to the effect that the Indianapolis Light and Heat Company is entitled to damages by reason of the injury it has sustained through the elevation of railroad tracks adjoining its property.

Taxpayers in the city of Muncie have brought suit to set aside the 10-year contract recently entered into between the city and the Muncie Electric Light Company on the ground of collusion between the company and the city officials in awarding the contract. The suit has created a sensation. The contract marked the abandonment of municipal ownership in Muncie and the advocates thereof are greatly displeased.

For the first time since the bureau was organized, the Indiana state statistician has made a thorough investigation of waterworks and electric-light plants and the cost to the cities and towns where furnished by municipally owned plants and private corporations. There are 84 cities in Indiana, and 49 of these own and operate their own waterworks; 33 are supplied by systems owned by private capital and two have no waterworks. The average cost in the 49 cities in which the plants are owned by the municipalities is $15,533 per year, and in the 33 cities where water is supplied by private capital, the cost averages $10,266 per year. Of these cities 32 own their own electric-light plants and 42 are lighted by private capital. The average cost of the first-named cities is $10,010 per year, and to the cities lighted under contract, with private owners, the cost averages $10,966. Therefore, while the cost of lighting the streets is less in cities owned by the municipalities, the cost of water in the same cities is much more.

S. S.

Illinois.

Peoria, August 25.—The Bloomington, Clinton and Decatur Traction Company has changed the location of offices from Springfield to Decatur and changed the name to the Springfield and Eastern Railroad Company.

Emil G. Schmidt, general manager of the Peoria Gas and Electric Company and of the Springfield Railway, Light and Power Companies, has returned from a trip to New York, where he went on business to the office of Hodenpyle, Walbridge & Co., owners of the companies.

The Alton, Jacksonville and Peoria Interurban Railway Company has filed with the county recorder notice of increase of capital stock from $10,000 to $300,000, head offices to be at Jerseyville. The road is to be built in a direct line from Alton to Peoria, with branches to Carlinville and to Grafton. J. M. Page of Jerseyville is president.

Hon. W. B. McKinley has deposited $5,000 with the cities of Streator and Ottawa on behalf of the Peoria, Streator and Ottawa Railway Company, accepting the ordinances recently granted, the line to be in operation by October, 1908.

The Rock Island and Southern Interurban will build a line between the two depots in Monmouth and give local street-car service.

City Electrician C. H. Lyons is busily engaged in pulling the cables and connecting them for the police and fire-alarm wires. The new fire boxes have arrived and he expects to have the lines all underground and in working order in about two weeks. This will leave only the lighting company's wires above ground.

V.

Northwestern States.

Minneapolis, August 25.—The council of East Grand Forks, Minn., has closed a contract with E. L. Healy of Red Lake Falls for supplying electricity for the operation of the municipal lighting system.

The Stillwater (Minn.) Gas and Electric Comanpy has decided to erect a new power plant at that place.

A franchise has been granted at Burlington, Iowa, to St. Louis promoters, who propose to build a trolley line from Muscatine to Davenport.

Bids are being taken for the erection of five brick sub-stations along the line of the Fort Dodge (Iowa), Des Moines and Southern Railway.

The Chippewa Valley Electric Railway Company is securing a right-of-way for the proposed trolley line from Eau Claire (Wis.) to Menominie.

Bonds have been voted at Keosauqua, Iowa, to aid in the construction of an electric railway from Keosauqua to Fairfield.

The White River Power Company has been organized at Rhinelander, Wis., with a capital stock of $300,000 by E. A. Edmonds and associates. The waterpower on White River will be developed and transmitted to Ashland, Washburn and other towns. A 25-foot dam will be built and 1,500 horsepower developed.

The Citizens Railway and Light Company of Muscatine has sold its plant at Muscatine, Iowa, to Child, Hulswit & Co. of Grand Rapids, Mich.

A franchise has been granted to a home company at Belle Plaine, Minn., for an electric-lighting system.

The Missabe Traction Company, which proposes to connect several range towns in Northern Minnesota, has filed articles of incorporation with a capital of $200,000.

L. T. Ball of Crookston, Minn., has taken charge of the electric-light plant at Devil's Lake, N. D.

The Electric Machine Company of Minneapolis will put in an electric-light plant at Eureka, S. D.

The council at Pierre, S. D., is considering the advisability of putting in a municipal incandescent electric-light system.

N. A. Nelson has sold the electric-light plant at Dawson, Minn., to Martin Larson of Hanley Falls, Minn. The plant will be enlarged.

R.

Pacific Slope.

San Francisco, August 23.—The labor situation has been strained for some days between the men and the management of the United Railroads of San Francisco. A sealed reply has been given to the executive committee of the Carmen's Union. The company says it is doing everything possible to relieve the public and the employes, having ordered $1,000,000 worth of additional cars.

The Pacific Illuminating Company has been incorporated at San Francisco with a capital stock of $10,000 by A. F. Salomon, A. C. Wales, B. H. Jones, H. H. Daley and A. H. Elliot.

The Pacific Electric and Manufacturing Company has been incorporated at San Francisco with a capital stock of $25,000 by Walter Maddrill, W. J. Kenney, P. M. Downing, L. R. Jorgensen and Leo H. Susman.

The Northern California Power Company is building a direct line to connect the Kilarc and Volta generating stations; also five new lines to serve new customers. A sub-station is being installed for the Balaklala Consolidated Copper Company's new station at Corona, Cal. Seventy miles of 66,000-volt line has just been completed between the Volta power station and Chino, for the purpose of delivering 5,000 horsepower to the California Gas and Electric Corporation. The installation at Volta is being increased 2,500 horsepower, and new equipment is being added.

It has been announced by President Goode that the Portland Railway, Light and Power Company of Portland, Ore., will place the electric-light and power wires underground at an expense of $500,000. This sum has been appropriated by the directors of the company. This will include all wires in the business district with the exception of the street-car trolley wires. Street arc lights will be suspended from posts and as far as possible street poles will be done away with. When property owners do not object, span wires supporting the trolley wires will be attached to buildings, thus allowing poles to be taken down.

The gravity system of the Western Union in Spokane, Wash., is soon to be changed to the dynamo system, and about 30 dynamo machines are to be installed in the company's new building.

The Eagle River Electric Company is putting in a power plant on Eagle River, Ore., plans having been fully completed. F. W. Paine is president. Construction of the power line from a point near Sanger to Baker City, Ore., a distance of 28 miles, has been commenced. The plant will have a capacity of 2,000 horsepower.

Active work has been commenced on the construction of the new Inland Empire power plant below Nine Mile Bridge, Wash. The contract for the building of the plant has been awarded to Sanderson & Porter of New York city. The estimated cost of the plant is about $850,000.

A. G. Wishon of the Tule River power plant, soon to be erected on the Tule River, Cal., has stated that a temporary plant with a capacity of 150 horsepower will be built for the purpose of furnshing power with which to build the big plant.

The Home Telephone Company of California has been incorporated with a capital stock of $20,000,000 by Mark L. Gerstle, William Thomas, J. E. Schoenfeld, W. H. Smith, Jr., and T. S. Parkhurst. The place of business will be San Francisco.

Pacific States Telephone and Telegraph Company stock continues to advance, 270 shares selling in San Francisco at $100 on August 22d. The steady gain in the strength of this stock is attributed to the rapid restoration of the company buildings and equipment in this city. The business is growing at a rate which, it is said, will warrant the resumption of dividends in October. The denial by President Henry T. Scott that he was to retire from his position, with several other heads of departments, has restored confidence. A decision will soon be made as to the payment of either the October or January dividend, or both.

A.

PERSONAL.

George H. Cole of Marshalltown, Iowa, has been appointed manager of the Iowa Telephone Company's system at Cedar Falls, Iowa.

R. K. Mickey, president of the Novelty Incandescent Lamp Company, St. Marys, Pa., was in Chicago this week in the interests of his company.

J. F. Davis, formerly connected with the Pittsburg organization of the Atlas Engine Works, Indianapolis, has been transferred to the company's offices at Chicago.

L. D. Richardson, general superintendent of the Tri-State Telephone Company, Minneapolis, Minn., has resigned to become manager of the North Dakota Independent company, with headquarters at Fargo.

Mr. John Dale of the Dale Company of New York, sailed Friday, August 24th, for a three-month trip abroad, partly on business and partly for pleasure. He intends to go to London, Paris, Berlin, and then direct to Colombo, Ceylon, to investigate a business there in which he is interested.

J. P. Johnston, for several years past the general sales manager for the Weber Steel Concrete Chimney Company of Chicago, has resigned to become sales manager of the water-tube-boiler department of the Atlas Engine Works, Indianapolis. Mr. Johnston's offices will be at the company's plant in Indianapolis.

R. R. Smith, a member of the Murdock-Marshall syndicate of Indiana, which has recently purchased and taken over the Evansville Street Railway Company and the Evansville and Princeton traction line, has become general manager of the company's property, succeeding H. D. Morgan, who has been general manager for several years. Mr. Smith formerly resided at Providence, R. I., where he had large experience in the management of electric railway property.

James Ross of Montreal has retired from the presidency and directorate of the Mexican Light and Power Company. Sir Geo. A. Drummond, the first vice-president, has been appointed in his stead until the annual meeting. C. H. Cahan, the company's solicitor in Mexico, will occupy the vacant seat on the board of directors. Mr. Ross has disposed of his very large holdings of the bonds of the company, but he still holds the stock secured as bonus when he purchased the bonds.

For the international commission called at the instance of the British government, to meet in London during the month of October next to consider the subject of electrical units and standards, Mr. Ormond Higman of Ottawa, chief of the electrical standard laboratory of the Inland Revenue Department, has been selected as the Canadian government's representative. He has represented the government in a similar capacity on former occasions, namely, at Chicago in 1893, and St. Louis in 1904.

W. L. Benham has retired as head of the United Railways Company at Portland, Ore., and H. St. John Dix, who, together with Mr. Benham negotiated the transfer of the stock from the original owners to the C. E. Loss Company, has also severed his connection with the corporation. This places C. E. Loss in control, and he will probably assume the duties of president. Mr. Loss says that a force of men will be set to work within 60 days to complete the road on Macadam Street, and the Front Street belt line.

Mr. George B. Tripp has resigned his position as general manager of the gas and electric companies of Colorado Springs, Colo., and on September 1st will join the organization of Messrs. Curtis & Hine of that city, engineers and central-station managers. Mr. Tripp is one of the well-known central-station men of the country, and as Messrs. Curtis and Hine have under way several large power projects, in connection with their general central-station work, he will have an ample field for the exercise of his talents.

Mr. A. S. Merrill, formerly of New York, has been placed in charge of the Chicago office of Pass & Seymour, Solvay, N. Y. Mr. Merrill is not new in the electrical field, having for about 10 years represented the Chicago Fuse Wire and Manufacturing Company in the New York territory. For the last two years he has been sales representative of the Appleton Electric Company of Chicago, with headquarters in New York. Mr. Merrill has already taken up his new duties. He is a brother of W. W. Merrill of the Chicago Fuse Wire and Manufacturing Company.

Mr. G. H. Rettew, who has recently joined the forces of the Helios Manufacturing Company of Bridesburg, Philadelphia, in charge of the advertising of that company, is well known among electrical men, particularly in the East and South, who will be much interested to learn of his new connection. In the early part of 1901 Mr. Retttew assumed the management of the Selma (Ala.) Lighting Company, remaining there until January 1, 1905. During this period both the electric and gas plants were almost entirely rebuilt. After the completion of this work Mr. Rettew was transferred to Greenville, S. C., where he assumed the management of the Paris Mountain Water Company, Greenville Gas, Electric Light and Power Company and the Greenville Traction Company. He remained in charge of these interests until about a month ago, when the Helios company secured his services.

James R. Kearney, superintendent of construction of the Topeka Edison Company, is in many ways a remarkable man. Mr. Kearney began his electrical career at the age of 15, when he accepted the position of wiper in the engine room of the old Brush company of Topeka in 1891. He held successively the positions of wiper, helper in the boiler room, fireman, dynamo tender, arc-lamp trimmer and foreman of the arc-lamp department. Shortly after this he was given charge of all the machines and the title of assistant superintendent. In 1895 Mr. Kearney resigned from the Brush company to accept the position of general superintendent of construction for the Overton Construction Company. He installed a plant for the Santa Fe Railroad at Newton, Kan., and another at the Topeka State Insane Asylum. After two years he left the Overton company to accept his present position in the construction department of the Topeka Edison Company. Mr. Kearney undoubtedly owes his success to his ability to find "short cuts" in his work. He has always been an experimenter as well as a student. One of the things that attracted his attention and caused him no small amount of worry and experimenting was the enormous amount of time, labor and material that was necessary in turning a corner with heavy power cables of from No. 000 up to 1,500,000 circular mils. After a year or more of careful experimenting Mr. Kearney perfected a clamping device that eliminated all of this waste. This device, known as the Kearney cable clamp, is patented and is made by W. N. Matthews & Bro., St. Louis. It is said that Mr. Kearney's invention nets him a handsome sum in royalties.

JAMES R. KEARNEY.

ELECTRIC LIGHTING.

W. A. Curtis will install an electric-light plant in Cambridge, Iowa.

S. S. Hough is seeking an electric-light franchise in Aurora, Minn.

The council of Orange, N. J., has decided to build a municipal street-lighting plant to cost $70,000.

J. B. Quigley and J. C. Settle of St. Louis, Mo., have been granted an electric-light franchise in Versailles, Mo.

Independence, Mo., will vote on the proposition of issuing bonds to the amount of $30,000 for an electric-light plant and sewers.

The Enterprise Electric Light, Heating and Power Company of Garner, Iowa, is considering installing storage batteries in its plant.

The Mobile (Ala.) Illuminating Company has been incorporated with a capital of $125,000 for the purpose of manufacturing and distributing electricity. Henry W. Shield heads the directors.

The J. R. Settle Construction Company, Chemical Building, St. Louis, Mo., has the franchise for furnishing electric light and power in Versailles, Mo. A concrete power house will be erected. J. B. Quigley, Suite 1212 Chemical Building, is engineer and architect.

Union City, Tenn., will expend about $3,000 for improvements to electric-light plant and waterworks, installing engine, electrical supplies, etc. John T. Wiker is mayor and Allan Wade is engineer in charge. G. R. Wadleigh, Bemis, Tenn., is consulting engineer.

The West Orange Electric Company of Winter Garden, Fla., has been formed by W. Percy Reames and G. W. Bray, to establish an electric-light plant. A frame building, 16 by 24 by 10 feet, will be erected, and a 15-horsepower boiler, 10-horsepower engine and eight-kilowatt 500-volt 2,400-candlepower generator will be installed.

The Terre Haute (Ind.) Star says that the City Council of Linton, Ind., has voted to accept the proposition of Samuel Parrott of Indianapolis to lease the city electric-light plant for five years. Mr. Parrott will take charge of the plant on September 1st and will operate it at his own expense for the five years.

The Standard Light and Power Company has bought the plant of the Durango (Colo.) Light and Power Company. The Standard is a new company which recently obtained a franchise and intends erecting a new plant to be run by water-power. The new plant will cost $250,000. The new company will operate the old plant until the new one is finished. By the terms of the franchise the Standard company must make a reduction in light and power rates of about 33⅓ per cent. The Durango Light and Power Company has furnished light for Durango for 20 years.

Bids will be received October 1st for the erection and equipment of a municipal electric-lighting plant, on city property in Mobile, Ala., of 450 kilowatts, divided into three units; also 600 arc lamps and pole line complete, together with main station, stack and sub-station. Plans and complete specifications can be had on application to P. J. Lyons, mayor, Mobile, Ala.

ELECTRIC RAILWAYS.

The Springfield, Clear Lake and Rochester Interurban road proposes to extend its lines to New City and Pawnee, Ill.

The Electric Terminal Company of Kansas City, Mo., has been incorporated with a capital stock of $300,000 by John Mayor of Parsons, Kan., W. E. Winner and others.

The Central Kentucky Traction Company of Frankfort, Ky., is preparing to build a large power house to supply electricity to all the interurban electric lines. George McLeod of Versailles, Ky., is the engineer.

The directors of the Springfield-Pana (Ill.) Interurban railway propose to issue $30,000 worth of preferred stock. The company has petitioned for a franchise to use the streets in Pana for an electric railway.

POWER TRANSMISSION.

The Niagara Falls Electrical Transmission Company announces that it has contracted to take 50,000 electrical horsepower from the Electrical Development Company of Ontario. This power will be distributed in Niagara Falls and throughout Western New York, where a large field awaits its coming.

The Little Miami Light, Heat and Power Company of Fremont, Ohio, has been organized and incorporated. The company contemplates the construction of a series of dams in the Little Miami River, between Plainville and Morrow, in order to furnish power for a power plant which is to supply power, light and heat for the neighboring towns.

Work of putting up steel towers for the Grand Rapids-Muskegon Power Company will be commenced soon along the line between Croton and Grand Rapids, Mich. Oregon cedar poles were previously used. The steel towers will not be a great deal more costly than the poles, as they can be placed farther apart. The towers, which will be 60 feet in height, will be set 500 feet apart in concrete bases, which will extend above the ground to prevent rusting at the point where the pole enters the earth. It will require between 450 and 500 of the towers to convey the wire from Croton, a distance of 45 miles. Work on the big dam at Croton is being pushed rapidly.

TRADE NEWS.

Sealed proposals are being invited until September 22d for the construction of an electric subway system at the military academy at West Point. Drawings and specifications can be obtained upon application to the quartermaster, U. S. Military Academy, West Point, N. Y.

The constructing quartermaster is inviting sealed proposals until September 19th for furnishing and installing a complete electric fire-alarm telegraph system at Fort Leavenworth, Kan. Full information and blank proposals will be furnished upon application to Captain J. E. Normoyle, Fort Leavenworth, Kan.

The Bureau of Supplies and Accounts, Navy Department, is inviting sealed proposals until September 18th for furnishing certain western navy yards with transformers, conduit, tape, cable and motors, embraced in schedule 110, obtainable at the Navy Pay Office in San Francisco, or upon application to the bureau at Washington.

The Atlas Engine Works of Indianapolis, whose Chicago sales offices have for several years past been in suites 900-902 Fisher Building, will, upon completion of the new Fisher Building in November, increase its present rather cramped quarters by the addition of several larger offices. Mr. Frank H. Baker, connected with the Atlas company for over twenty years, will continue at the head of its Chicago organization.

Separate tenders will be received at the office of the deputy postmaster-general, Melbourne, Australia, until September 18th for: (1) Five miles of 78-pair lead-covered paper-insulated telephone cable, with 20-pound per mile conductors; (2) 2½ miles of 26-pair lead-covered paper-insulated telephone cable, with 20-pound per mile conductors; (3) 1¼ miles of 26-pair lead-covered paper-insulated telegraph cable, with 25-pound per mile con-

ductors. (The conductors to be insulated with two thicknesses of dry manila paper, the diameter and the capacity of the cable not being limited.) A deposit must be enclosed with each tender, in accordance with the provisions of clause 5 of the General Conditions of Contract.

The De La Vergne Machine Company, foot of East One-hundred-and-thirty-eighth Street, New York city, reports the following among other recent orders received for Hornsby-Akroyd oil engines: Central New England Railway Company, Hartford, Conn., seven-horsepower geared to pump; F. J. Stokes Machine Company, Philadelphia, Pa., 25-horsepower; Hastings Pavement Company, New York city, 16-horsepower; W. F. Norman Sheet Metal Manufacturing Company, Nevada, Mo., 50-horsepower; Union Ballast Company, New York city, one 20-horsepower and one 32-horsepower; D. P. Forst & Co., Trenton, N. J., 13-horsepower; Webb Wire Works, New Brunswick, N. J., 32-horsepower; Messrs. J. W. Lippincott, S. P. Scott and Max Meyer, Little Rock, Ark., 50-horsepower engine to drive a De La Vergne ice machine.

Mr. Henry A. Allen, who until recently has been connected with the Allis-Chalmers Company, has established an office of his own at 1435 First National Bank Building, Chicago, to engage in work as consulting mechanical, electrical and hydraulic engineer. Mr. Allen is well equipped for this work, having a fine technical education, combined with a broad experience of 16 years' actual practice. Shortly after the Chicago World's Fair he accepted a position with Fraser & Chalmers, Chicago, remaining with this company and its successor, Allis-Chalmers Company, until the beginning of the year 1906. While with this company he had the opportunity of designing, making estimates of costs, and drawing up original specifications of many different kinds of machinery, such as hoisting engines, air and gas compressors, pumping engines, boilers, waterwheels, steam stamps, power and mill engines. He has traveled extensively through a large portion of the manufacturing, mining and irrigating districts of this country, and acted in the capacity of consulting engineer for many private and municipal plants. Mr. Allen is a member of a number of engineering societies and is a graduate of the United States Naval Academy.

Sealed proposals will be received at the office of the Board of Public Safety of Cincinnati, Ohio, until noon of Saturday, September 15, 1906, for the manufacture and installation of the necessary switch and protector boards, apparatus, storage batteries and racks, cables, cable shafts, new floor, brass railing, etc., necessary for the complete operation of the fire-alarm telegraph system and the fire department telephone exchange, to be located in the City Hall Building of Cincinnati, Ohio; also 80 fire-alarm boxes used in connection with the same, all in accordance with specifications and detail drawings on file in the office of J. J. Mulvihill, secretary of the board of public safety.

Financial interests comparatively new to the electrical industry are behind a new company—the Novelty Incandescent Lamp Company—which is being organized in St. Marys, Elk County, Pennsylvania, for the manufacture of incandescent lamps. This new company is operated on an entirely independent basis, it is announced, and no understanding nor agreement as to methods or prices will be entered into with any existing association or manufacturers in this field. The product to be marketed will embrace the new "Elk Standard" incandescent lamps, "Novelty" miniature lamps and "Novelty" renewed lamps. For the manufacture of the new types of standard incandescent and miniature lamps the company is now erecting a new building at Emporium, Pa., 21 miles from St. Marys. For handling the department devoted to renewed lamps a two-story brick addition to the plant now occupied at St. Marys is in course of construction. The officers of the company are: President and general manager, R. K. Mickey, St. Marys, Pa.; vice-president, Josiah Howard, Emporium, Pa.; secretary, Joseph Kaye, Emporium, Pa.; treasurer, A. F. Vogt, Emporium, Pa. These gentlemen, together with Mr. Henry Auchu of Emporium, Pa., constitute the principal members of the board of directors. Reference to the First National Bank, Emporium, Pa., and the Farmers and Merchants' Bank, St. Marys, Pa., is given. It is announced that the two plants of the Novelty Incandescent Lamp Company soon will have developed facilities for the production of 10,000 lamps daily.

BUSINESS.

The Central Electric Company of Chicago is sending out to the trade its August price list, applying to its general catalogue No. 24. The prices quoted are the very latest in force, and it is suggested that anyone who has been overlooked in the distribution write the Central Electric Company for a copy.

Mr. Schoenberg of the Sarco Company of 906 Sixth Avenue, New York, says: "At the National Contractors' convention, recently held at Cleveland, I chanced to meet a contractor who has two stores in London and a branch office in Paris. I happened to show him the new pendant switch manufactured by us, and he informed me that in London when an article of this kind is brought out on the market the contractor gives each of his wiremen a sample to carry in his pocket, and when he goes out on a job, either to a private house, store or office, where they have electroliers, cluster lights, banquet lamps, brackets or chandeliers out of reach, the wireman is instructed to show the owner how easily the light can be controlled by a switch in circuit. The average customer would be more interested in a suggestion from the wireman, who is disinterested, than from the boss, who is out to make his profit, the result being the wireman in some instances has sold as high as 12 or 15 pendant switches at a price ranging from $1.50 to $2 apiece, and the wireman gets the commission for the extra work received, which at the same time induces the wireman to keep his eyes open for other extra work."

ILLUSTRATED ELECTRICAL PATENT RECORD.

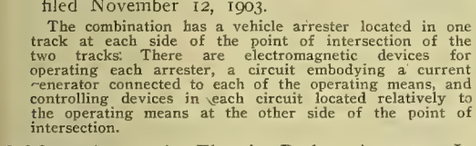
Issued (United States Patent Office) August 21, 1906.

828,871. Apparatus for Preventing Collisions at Railway Crossings. Charles R. Barnes and Alfred Green, Rochester, N. Y. Application filed November 12, 1903.

The combination has a vehicle arrester located in one track at each side of the point of intersection of the two tracks. There are electromagnetic devices for operating each arrester, a circuit embodying a current generator connected to each of the operating means, and controlling devices in each circuit located relatively to the operating means at the other side of the point of intersection.

828,879. Automatic Electric Brake. Augustus L. Duwelius, Cincinnati, Ohio. Application filed May 7, 1904.

The brake consists of a series dynamo, mechanism for driving the dynamo from the traction gear, and an electric translating device consisting of a magnetic clutch actuated from the dynamo and connected with the hand brake rigging of the vehicle, the clutch serving to complete a driving connection between the traction gear and a winding drum for the brake chain. (See cut.)



NO. 928,879.—AUTOMATIC ELECTRIC BRAKE.

828,890. Telegraphy. Charles A. Johnson, Meadville, Pa., assignor of one-half to the Postal Telegraph-cable Company, New York, N. Y. Application filed November 11, 1905.

In combination with a circuit-breaker are a movable contact connected with a main circuit, two fixed contacts connected respectively with sources of electricity of opposite polarity, and three normally open sections of conductor in inductive relation connected to the contacts, respectively.

828,914. Telephone Index. George B. Adams, Chicago, Ill. Application filed December 5, 1905.

An attaching member embodies a pair of gripping elements, one of which terminates in a carrying member provided with a terminal stop, and suitably indexed cards threaded on the carrying member, the outer one of which is provided with means for engaging the stop.

828,945. Portable Electric Drilling Machine. John Maclean, Ilford, England. Application filed January 12, 1906.

A portable electric drill comprises a frame, a fixed shaft in the frame, a magnet on the shaft, an armature arranged externally of the magnet, a commutator, and an inclosing cylinder or framework, the cylinder or framework being driven by gear from the armature and being adapted to rotate the drill.

828,966. Selective Signaling System. Sylvanus A. Reed, New York, N. Y. Application filed October 26, 1905.

A circuit has oppositely biased electromagnetic annunciators therein and condensers in series with the annunciators. There are means of impressing upon the circuit an alternating current which has its potential changes in attaining its maximum positive potential different from its changes in attaining its maximum negative potential, only the changes in attaining one of the two maximum potentials causing a current in the annunciators capable of overcoming their bias tensions.

828,980. Electric Circuit and Apparatus for Railway Signaling. Henry W. Spang, New York, N. Y., assignor to Charles H. Ketcham, Yonkers, N. Y. Application filed August 21, 1902.

A guard circuit for controlling a signal upon a locomotive is described and comprises a portion thereof upon the rolling equipment containing a controlling relay or electromagnet and terminating in wheels of the equipment, insulated from one another, and a portion thereof upon the permanent way containing a battery connected at one end of a track section with its two lines of rails and terminating in insulated rails or sections of rail of a preceding section, which when bridged by the wheels complete the guard circuit.

828,983. Elevator Brake. August Sundh, Yonkers, N. Y., assignor to the Otis Elevator Company, Jersey City, N. J. Application filed January 11, 1905.

The brake is associated with a rotary member and is movable in the direction of rotation of the member. There is a second rotary member, a brake associated therewith, means for moving the second brake into operative relation with the second member by the impressed movement of the first brake due to its frictional engagement with the first member, and electromagnetic means for increasing the braking effect of the second brake. (See cut.)

829,015. Electric Machine. William A. Johnson, Toronto, Canada. Application filed January 13, 1905.

One claim covers a magnetic field or armature comprising four identical plates adjacently placed on planes perpendicular to the axis of rotation and parallel to the face of the field, the two outer plates being formed with arc-shaped recesses between which extend the pole pieces having inwardly extending and abutting outer ends, the plates being also arranged with the inwardly extending annuli peripherally within the pole pieces and two inner plates having their plain faces abutting each other on the central line of the field perpendicular to the axis of rotation and parallel to the face of the field.

829,026. Ceiling Block and Electric Cut-out for Incandescent Lamps. James A. Mebane, South Boston, Va. Application filed June 29, 1905.

A base has oppositely disposed, outwardly projecting lugs, a centrally disposed projecting stud, a pair of channels concentric with the stud, and longitudinal recesses in the inner sides of the lugs. A cap has a socket to receive the stud and center the cap with reference to the base.

829,032. Power Brake. Louis Pfingst, Boston, Mass., assignor to the Pfingst Electric Manufacturing Company, Kittery, Me. Application filed November 4, 1904. Renewed February 19, 1906.

Combined are a motor clutch and gear-driven brake spindle, an electric motor, a rotatable electric motor armature shaft, automatic means for closing the motor circuit to rotate the armature shaft, and automatic means for transmitting power from the armature shaft to the brake spindle for rotating the spindle and independent for the motor circuit-closing means.

829,043. Cut-out. Frank T. Wheeler, Southington, Conn., assignor to the Trumbull Electric Manufacturing Company, Plainville, Conn. Application filed October 22, 1904.

A rosette having contacts borne on the base and cap and arranged to be interengaged and disengaged upon partial relative rotation of the parts is specified.

829,055. Lightning Arrester. John E. Brelsford and John W. Lutz, Dayton, Ohio. Application filed January 30, 1905.

An arrester having, in combination, an electrode for electrical connection with the line conductor having a flat terminal surface, and an opposed electrode for electrical connection with the ground, the latter electrode comprising a hollow rod or tube having its terminal furnished with points in proximity to but out of contact with the flat surface.

829,057. Means for Hoisting and Conveying Two-rope Grab Buckets. Alexander E. Brown, Cleveland, Ohio, assignor to the Brown Hoisting Machinery Company, Cleveland, Ohio. Application filed February 10, 1906.

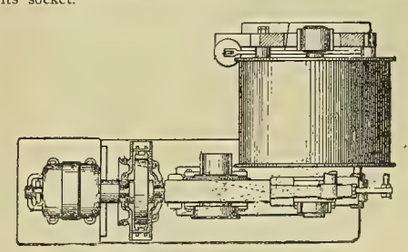
Mechanical features and electrical operation of a double drum hoisting and conveying device are set forth.

829,073. Trolley Wheel. James M. King, Danville, Va., assignor of one-half to H. S. Lanier, Danville, Va. Application filed May 31, 1906.

A trolley wheel having a central oil well and a circular oil passage around the well and concentric with the center of the wheel is the basis of the patent.

829,092. Telephone Switchboard Lamp. Joseph L. Wright, Washington, D. C., assignor to the National Engineering Corporation, Washington, D. C. Application filed May 10, 1905.

An incandescent lamp is described having means independent of the bulb for facilitating its removal from its socket.



NO. 828,983.—ELEVATOR BRAKE.

829,109. Trolleywheel Fork. Edward W. Keating, Terre Haute, Ind. Application filed February 3, 1906.

The patent covers a two-pronged fork consisting of a shank, two hangers supported by the prongs of the fork and a shaft adapted to support the trolley wheel.

829,122. Combined Battery and Bell. Jules A. Ny and Frederick Meadows, Oakland, Cal. Application filed August 23, 1905.

In combination are an electromagnetic bell device, a box secured to the device and having binding posts thereon, the posts being connected in circuit with the magnets of the device, a contact connected with one of

the posts, a battery slidably and removably arranged in the box and having a contact adapted to engage the contact on the post when the battery is in place, means holding the battery against accidental displacement and forming a terminal for the circuit, and manually operated means for making and breaking the circuit.

829,132. Electric Semaphore. Jean F. Webb, Denver, Colo. Application filed August 22, 1905. Renewed June 25, 1906.

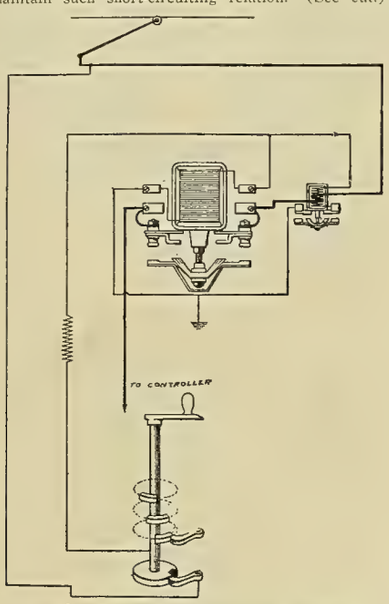
A semaphore mechanism comprises supports, a shaft fulcrumed thereon, a counterweight and a semaphore blade secured to the shaft, means directly connected to the shaft for locking it from rotation, electromagnetic trip devices for releasing the locking means, and a circuit closer controlled by the trip devices for closing an electric signaling circuit.

829,133. Means for Controlling Self-exciting Generators. Ernst F. W. Alexanderson, Schenectady, N. Y., assignor to the General Electric Company. Application filed July 20, 1905.

In combination with a self-exciting generator are a resistance connected in the field circuit of the generator in normal operation, means for cutting the resistance out of circuit at starting, and means for automatically moving the cutting-out means when released to cut the resistance into the field circuit again.

829,135. Motor-control System. Charles E. Bennett, New York, N. Y., assignor of one-half to Rosenbaum & Stockbridge, New York, N. Y. Application filed December 28, 1905.

A circuit-breaking magnet is located in a separate circuit between the potential sources or terminals, and there are means whereby the circuit is broken whenever the controller arm is moved to zero or off position. A supplemental magnet is arranged to short-circuit the circuit-breaking magnet whenever the current through the motors exceeds a predetermined value, the supplemental magnet having an additional winding acting to maintain such short-circuiting relation. (See cut.)



NO. 829,135.—MOTOR-CONTROL SYSTEM.

829,138. Register. Frank C. Carroll, Painesville, Ohio. Application filed December 21, 1905.

The combination consists of an oscillating indicator-segment, a series of stops thereon, a corresponding series of independently movable devices adapted to be severally moved into the path of the respective stops, keys controlling the position of the movable devices, and mechanisms by which the operation of the keys causes the movement of the segment to the initial point and in the reversing direction to bring a stop thereon into contact with the movable devices corresponding with the key so operated.

829,139. Single-pilot-wire Control System. Charles M. Clark, Summit, N. J., assignor of one-half to Henry M. Harding, New York, N. Y. Application filed May 16, 1906.

In a control system are a number of governing relays in a special circuit, resistance connections from the power terminals to such circuit, and variable connections at another point of the circuit for controlling the strength of current therein.

829,142. Railway Traffic Controlling System. Clarence W. Coleman, Westfield, N. J., assignor to the Hall Signal Company. Application filed February 15, 1904

The combination includes electrically controllable railway signal-indicating apparatus differentially responsive to different current characteristics, and means for supplying electricity having a number of current characteristics, including a periodic alternation, such means for supplying electricity being governable by movement of a railway vehicle along the railway line and being in controlling relation to the signal-indicating apparatus through suitable current-transmitting means including a conductor common to the different current characteristics.

829,144. Electric Motor Control. Maxwell W Day, Schenectady, N. Y., assignor to the General Electric Company. Application filed June 27, 1904.

In combination are two motors connected in series, a resistance adapted for connection in the field circuit of the motors, a speed-controlling switch adapted to connect varying portions of the resistance in the field circuit, cut-out switches for the motors, and means for preventing the speed-controlling switch from connecting resistance in the field circuit when one motor is cut out.

829,148. Rheostat. Arthur L. Hadley, Fort Wayne, Ind., assignor to the General Electric Company, Schenectady, N. Y. Application filed December 16, 1904.

The combination consists of the separately excited circuit of a dynamo-electric machine, a branch circuit derived therefrom including the exciter field of the machine, a resistance, means for including a variable portion of the resistance in the main circuit, and a contact to which one terminal of the exciter-field circuit is connected movable over the resistance to include a variable portion of the same resistance in the latter circuit.

829,151. Motor-starting Rheostat. John L. Hall and William C. Yates, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed August 23, 1904.

Included are a number of switches for varying the speed of the motor, an actuating coil upon each switch for operating the same, auxiliary contacts associated with each switch for deenergizing its actuating coil upon the operation of the switch, and means for holding each switch in the operative position and maintaining the deenergized condition of the actuating coil.

829,161. Water-level Indicator. Lawrence Kjerulff, Kansas City, Mo. Application filed July 6, 1905.

An apparatus for indicating the height of a body of water consists of insulated lugs secured respectively at the bed of the water and above the same, pins carried by the lugs, a resistance coil secured to and extending between the pins, a grounded generator, a meter, and electrical connections between the generator and the meter, and between the meter and the upper pin.

829,162. Circuit-maker and Breaker. Charles J. Klein, New York, N. Y., assignor to Ralph A. Schoenberg, New York, N. Y. Application filed August 6, 1904.

A tension member consisting of an elongated spring is operatively connected at its ends respectively with a contact member and an actuating member adjacent to the points of pivotal support of the contact and actuating members, the spring being permanently buckled and arranged to be buckled oppositely by the actuating member to force the contact member into varied pivotal positions.

829,164. Telephone Trunking System. Jacob W. Lattig, Wyncote, and Charles L. Goodrum, Philadelphia, Pa., assignors to the Eastern Telephone Manufacturing Company, West Chester, Pa. Application filed October 22, 1903.

Two switchboard sections or stations each comprise the following instrumentalities: Subscribers' line terminals, plugs and cord circuits for interconnecting the same, supervisory-signal devices connected to the cord circuits, a source of current and connections whereby the supervisory-signal devices may be operated thereby; together with a trunk circuit interconnecting the switchboard sections or stations, and means whereby in making a connection through the trunk from one station to the other, the supervisory signals of the cord circuit at one station will be operated by the current from the source at the other station.

829,174. Resistance Unit. Ernest Schattner, Schenectady, N. Y., assignor to the General Electric Company. Application filed March 31, 1904.

A self-reducing resistance unit consisting of pulverized magnetite combined with a pulverized conductor of the second class is described.

829,192. Electrical Signaling Device. Clinton M. Allen, Bay City, Mich., assignor of three-fourths to Franklin A. Benson and Charles F. Braman, Bay City, Mich. Application filed October 23, 1905.

The patent covers a railway signaling device which is actuated by the movement of the cars.

829,241. Railway Signal System. Robert O. Turner, Barre, Vt., assignor of one-fourth to Lyman J. Mead, Barre, Vt. Application filed February 5, 1906.

Two pairs of contact bars are connected to circuit wires and arranged near the track. Contact brushes are carried by the locomotive or car, whereby signals can be sent by engagement with the contact bars.

829,263. Apparatus for the Telegraphic Transmission of Written Characters. Adolf Franke, Gross Lichterfelde, Germany. Application filed October 17, 1902.

Means are provided to be operated by a current impulse in one direction and arranged to charge a condenser apportioned exclusively to a particular group of characters. There are means operated by a second current impulse and arranged to discharge the condenser at a given moment, and means for selecting thereby from the group a certain character.

829,269. Time Gas-valve Controlling Mechanism. John Gunning, Bournemouth, England. Application filed June 2, 1904.

An apparatus for communicating angular movement to a movable piece at predetermined times comprises mechanism for opening and closing electric switches at predetermined times in which the timing mechanism and the opening and closing mechanism are actuated by independent motors. A pair of pivoted levers is arranged to act alternately as stops to arrest the switch at the open and closed positions respectively.

829,272. Motor-starting Rheostat. Dugald C. Jackson, Madison, Wis. Application filed May 21, 1906.

One claim combines an electromagnet to retain the starting lever in the final or "on" position, the magnet being responsive to the failure or abnormal decrease of current in the circuit to release the lever, an electromagnetic device responsive to an overload or abnormal increase of current to release the overload lever, and a locking device to prevent closing the starting lever until the overload lever is closed. (See cut.)

829,308. Process of Electrolytically Treating Milk. Charles T. Willson, Amenia, N. Y., assignor of one-third to William H. Sheffield, Hobart, N. Y., and one-third to Louis C. Raegener, New York, N. Y. Application filed January 30, 1906.

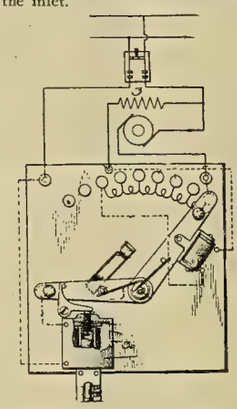
The process consists in passing a direct current of electricity through the milk, thereby separating the albuminoids, casein and albumen therefrom.

829,309. Automatic Railway Block Signal. Harry M. Abernethy, Cleveland, Ohio, assignor to the American Railway Signal Company, Cleveland, Ohio. Application filed January 25, 1906.

The patent covers an electrically operated block-signal system equipped with the usual semaphore arms.

829,318. Electric Heater. Axel H. Carlson, Philadelphia, Pa., assignor of one-half to Richard Graham, Philadelphia, Pa. Application filed June 30, 1905.

The device comprises the air-heating chamber provided with an extended air-heating passage defined by plates in contact with the upper and lower walls of the chamber, heating coils in conductive relation to the lower wall of the chamber and an air-forcing device connected with the inlet.



NO. 829,272.—MOTOR-STARTING RHEOSTAT.

829,319. Electric Fan. Harry D. Cessna, San Francisco, Cal. Application filed April 27, 1905.

One claim reads: The combination of a carriage, motor mechanism mounted thereupon, a fan member connected with the motor mechanism and actuated thereby, the movement of the fan being always in the same direction, gearing connected with the motor mechanism, track wheels connected with the gearing for the purpose of propelling the carriage bodily along the track, and means controllable at will for the direction of rotation of the track wheels.

829,334. Electric Brake. Charles G. Hardie, Buffalo, N. Y. Application filed January 27, 1905.

The combination consists of an electric motor, a shaft and support having a bracket projecting therefrom, a magnet the casing of which rests upon the bracket, bolts securing the casing to the support, an armature mounted upon the bolts, springs mounted on the bolts and controlling the armature, and a disk mounted upon the shaft of the motor, the armature being forced by the springs against the disk when the current ceases to flow in the coils of the magnet.

829,340. Starting Device for Electric Motors. Martin Kallmann, Berlin, Germany. Application filed August 22, 1905.

A conductor is composed of thin iron wires surrounded by non-oxidizing gases and is arranged in separate sections connected in series and in series with the motor, and there are means for cutting out the iron conductor by sections.

829,371. Overload Safety Apparatus. Philip J. Darlington, Glenridge, N. J., assignor to the Sprague Electric Company. Application filed April 26, 1904.

In an electrically operated hoisting apparatus, combined with an electric motor, are means to stop the application of the power of the motor to the load.

829,373. Electrical Ballast Mount. Claude D. Enochs, La Crosse, Wis. Application filed August 3, 1905.

A mount for ballast conductors consists of a stem threaded to receive the conductor and an inclosing chamber on which the stem is mounted. The stem is of glass or other suitable material, and a ballast conductor is wound around the stem.

PATENTS THAT HAVE EXPIRED.

Following is a list of electrical patents (issued by the United States Patent Office) that expired on August 27, 1906:

409,675. Electric Signal-Receiving Instrument. S. D. Field, Stockbridge, Mass.
409,714. Induction Coil. E. Thompson, Lynn, Mass.
409,736. Telephone Receiving Instrument. R. D'Unger, Chicago, Ill.
409,752. System of Electrical Distribution for Railways. W. J. McElroy, Pittsburg, Pa.
409,755. Station Box for Watchmen's Electric Time Detectors. J. E. Richards, Cedar Keys, Fla.
409,756. Electric Railway Crossing. E. E. Ries, Baltimore, Md.
409,775. Electric Railway. S. Z. de Ferranti, Hampstead, England.
409,815. Electrically Propelled Vehicle. R. N. Allen, Cleveland, Ohio.
409,852. Bracket for Electric Lamps. J. S. Merrill, Columbus, Ohio.
409,891. Electric Recording Gage. J. Wills, Nashville, Tenn.
409,926. Cable or Electric Street Railway. L. M. Clement, Oakland, and G. C. Watriss, San Francisco, Cal.
409,929. Incandescent Electric Lamp Socket. J. W. Collier, New York, N. Y.
409,996. Thermometric Indicator. M. Meyer, New York, N. Y.
410,007. Secondary-Battery Electrode. J. F. McLaughlin, Philadelphia, Pa.
410,013. Electric Pendulum Clock. A. L. Parcelle, New York, N. Y.
410,037. Electrode for Secondary Batteries. F. H. Smith, Baltimore, Md.
410,054. Containing Cell for Secondary Batteries. C. F. Waldron, Boston, Mass.
410,111. Apparatus for Charging Secondary Batteries. W. P. Kookogey, Brooklyn, N. Y.
410,136. Electrode for Secondary Batteries. C. H. Carter, Brooklyn, N. Y.

WESTERN ELECTRICIAN

EVERY SATURDAY

Vol. XXXIX. CHICAGO, SEPTEMBER 8, 1906 No. 10

Power and Lighting Features of a Large Lounge Factory.

Just beyond the western suburbs of Chicago in the little city of Naperville, Ill., is located the largest lounge factory in the world, owned by the Naperville Lounge Company. The business has grown to its present proportions from a very small beginning, and it was soon realized that electric lights would be necessary. Consequently the buildings were wired and current for lighting was taken from the municipal alternating-current lighting plant. This service proved satisfactory except that on dark days and frequently in the early winter evenings the company found itself without light when it was greatly needed, owing to the fact that the city plant did not have sufficient demand to warrant a 24-hour service.

It was then decided to install an isolated plant for the factory lighting. Mr. P. E. Kroehler, president and manager of the company, who has been the moving spirit almost from the beginning, laid the plans for the plant. At first it was thought to install a plant for lighting only, but being desirous of testing the practicability of electric motors to drive the various machines in the factory a direct-current plant was installed of sufficient size to operate a number of machines besides furnishing current for the lights. The electric plant is not large, but it is well built, has given excellent service and has proved (if proof were needed) the economy and desirability of motor drive for a factory of this kind. The use of motors is to be extended in the factory, and the power plant will probably be enlarged soon.

The main factory building, located alongside the Chicago, Burlington and Quincy railroad tracks, is 666 feet long, 50 feet wide and four stories high, with a basement. The power house, located near the center of the building, and about 10 feet away, is a one-story brick structure, divided by a brick wall into boiler room and engine room. Two 100-horsepower tubular boilers are in use in the boiler room. They were installed by the Erie City Iron Works of Erie, Pa., and are 66 inches by 16 feet, constructed for a 125-pound working pressure.

An interesting feature of the boiler plant is the fact that nearly all fuel required is furnished by the waste lumber, shavings, sawdust, etc., produced by the factory. A large blower system, shown on the roof of the power house, connects all the machines in the factory. By a fan arrangement driven from the main shaft in the machine department the smaller waste material from all parts of the plant is drawn into galvanized-iron tubes and delivered direct into the firebox of one of the boilers. The larger pieces of waste lumber are carried to the boiler room and fed to the fire by hand. Although the plant has been in full operation, no fuel except the waste mentioned has been used since March 15th.

The Power House.

In the engine room are located the engine, generator, switchboard, feed-water heater, pump, etc. The engine was supplied by the Erie City Iron Works, being a 14 by 21 four-valve engine nominally rated at 153 horsepower, but having a capacity of 195 horsepower.

A 200-horsepower counter-current feed-water heater and a six by four by six-inch duplex boiler-feed pump are not shown in the view of the engine room.

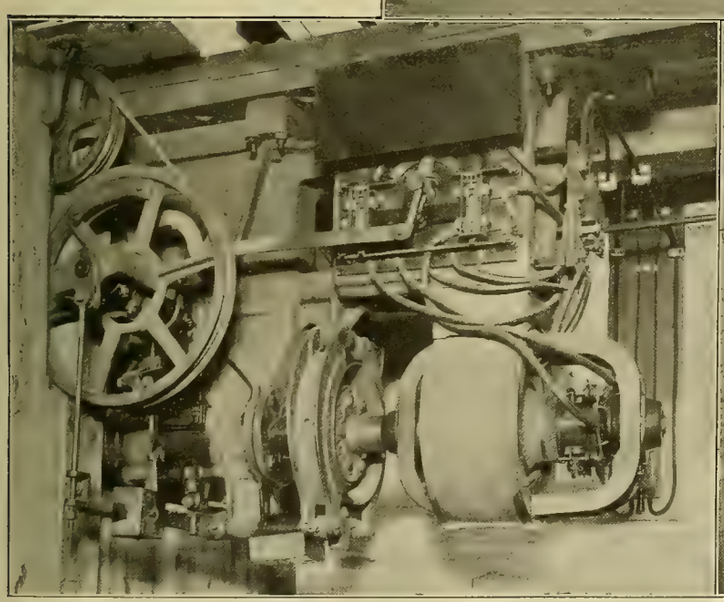
As shown in the picture, the generator is belt-connected to the engine. It is a 65-kilowatt 110-volt direct-current machine, operating at 900 revolutions per minute. It was made by the Keystone Electric Company of Erie, Pa. This generator supplies the lights and all the motors at present installed. Besides driving the generator, the engine also runs the main line shaft, from which most of the machines are operated in the factory.

As 110-volt direct current is used, it is possible to throw on the city's 110-volt alternating-current system for lighting when necessary. About 500 incandescent 16-candlepower lamps are installed in the various buildings of the factory. These are fed direct from the power house over four circuits. Occasionally it is necessary to work nights in departments where no power is needed. In this case the city current is used. To use this current it is only necessary to throw over the large double-throw switch at the bottom of the switchboard. The city circuits lead direct to the switchboard through a 300-light transformer shown on the side of the power house. The meter for measuring this current is shown to the left and back of the switchboard. The direct current for the factory lighting is brought from the generator to the same double-throw switch previously mentioned.

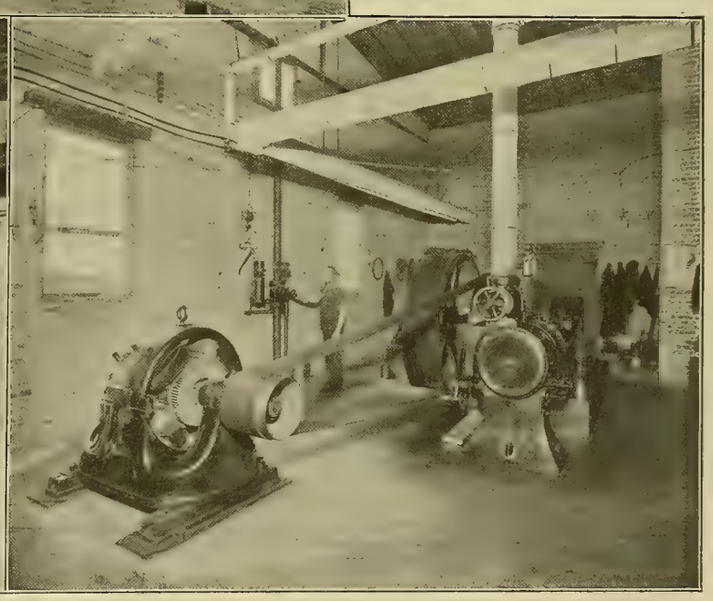
The switchboard of the factory plant is located in a corner of the engine room. It was built by Lounsbury, Eaton & Co. of Chicago. It is of white marble and is equipped with Westinghouse ammeter and voltmeter, voltage regulator and the necessary switches. Besides the large switch already mentioned, the first switch in the row of six controls a 12-horsepower motor in the tow shed and the elevator motor. The tow-shed motor is suspended from the ceiling and is belted to a shaft which operates a tow tedder and an excelsior tedder.

The second switch controls the lights in the extreme west end of the building. The third controls the office and power-house lights; the fourth the mill and cabinet rooms on the second and third floors; the fifth the lights in the finishing room and storeroom, and the sixth controls the motors in the mill.

In the mill two large jointers are operated by a 12-horsepower motor. The motor is suspended from the ceiling in the basement, and operates the machines above by belts. One of the jointers is shown in one of the pictures. Further on in the



Electric Elevator Mechanism.

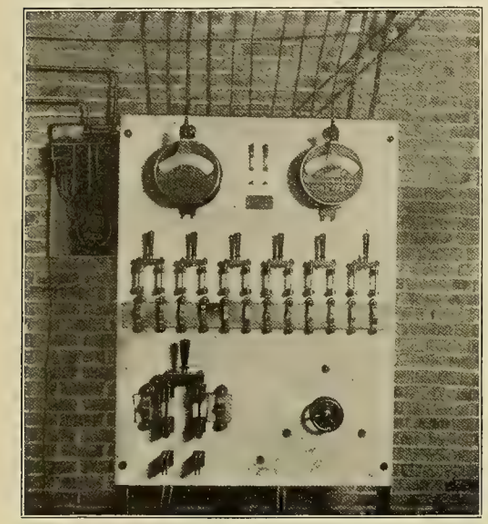


Interior of Power Plant.

LIGHTING AND POWER EQUIPMENT OF A LARGE LOUNGE FACTORY.

basement another motor of 20 horsepower is suspended from the ceiling and is belted through the floor to a planer and a rip saw. A small carving machine in the mill is direct coupled to a one-horsepower motor.

There are three elevators in the factory. One is operated by an eight-horsepower motor, another is run by belts from the main shaft and the third is being equipped for electric drive. In one of the pictures is shown the motor and operating mechanism of the elevator now run by electricity. It was built and installed by the J. W. Reedy Elevator Manufacturing Company of Chicago. The entire winding mechanism, motor and controller is hung from the ceiling of the first floor and takes up very little room. The motor operates

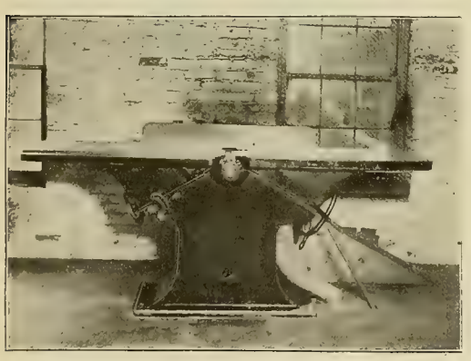


SWITCHBOARD IN POWER HOUSE OF LOUNGE FACTORY.

in either direction and is known as the direct-connected ceiling machine. The elevator will raise 3,000 pounds 75 feet a minute. Movement is controlled from the elevator, and as soon as it is brought to a stop the current is entirely cut off.

About 60 machines of 18 varieties are operated in the factory. The economy of operation, the saving in floor space and the exceptional convenience of electric operation have been so well exemplified in the dozen or less machines now operated by motors that it is probable that the greater number of machines will be electrically operated before long.

The factory is well managed, and the company is doing a large business—amounting to $1,000,000



JOINTER IN LOUNGE FACTORY DRIVEN BY MOTOR ON FLOOR BENEATH.

the last year. About 400 people are employed. The entire plant is protected from fire by an automatic sprinkler system. Water for this system is taken from a large tank which is supplied from the city mains. Feed water for the boilers is taken from the railroad tank, the water being pumped from the river, a half mile distant. The electrical wiring was done by Dieter & Getz of Naperville. H. F. Jordan is the engineer in charge of the plant.

Following the recent announcement that Lawrence Jones of Louisville, Ky., had secured a franchise for lighting in Louisville, the Kentucky Electric Company of that city has been incorporated with capital stock of $500,000 by Mr. Jones, Sanders P. Jones and Donald McDonald to build and operate the electric plant for supplying electricity for lighting and power purposes. The establishment of a plant to supply steam for heating and power is also contemplated

How Electricity Played Its Part in the Sinking of the Merrimac—An Interview with Hobson.

By Frank L. Perry.

It was my good fortune a few weeks ago, on a railroad journey, to encounter Captain Richmond Pearson Hobson, who, during the Spanish-American war, while serving as a lieutenant in the United States Navy, caused the country to ring with his name from one end to the other by his gallant exploit of sinking the steamship Merrimac in the tortuous channel of the harbor of Santiago, Cuba. Captain Hobson consented to explain in some detail the electrical features of that accomplishment, and I shall endeavor faithfully to transcribe for the benefit of the readers of the Western Electrician what was to me a most interesting interview.

"The sinking of that big iron vessel all in a moment, or with a minimum of delay, was," said Captain Hobson, "a task that kept us awake the entire night before the day we equipped the ship. Of course we never for an instant considered any other method of firing our explosives than the electrical, for the simple reason there is no other means for such a purpose worth thinking of. But only when face to face with the problem did we fully realize all the difficulties of the job—the undertaking the quick sinking of so big a vessel as the Merrimac with one blow, one stroke; and to do this, too, when the psychological moment came in one fell sweep, as it were, or at least as nearly that as possible, and with absolute certainty. The greatest thing, then, was not so much how to fire the torpedoes, but where to place them and the electrical firing apparatus so that the former would strike the most effective blows on the vessel and the batteries would not be smashed by the first shower of lead and iron that I feared would come only too quickly, and which, as you know," said Captain Hobson, "did come with a vengeance.

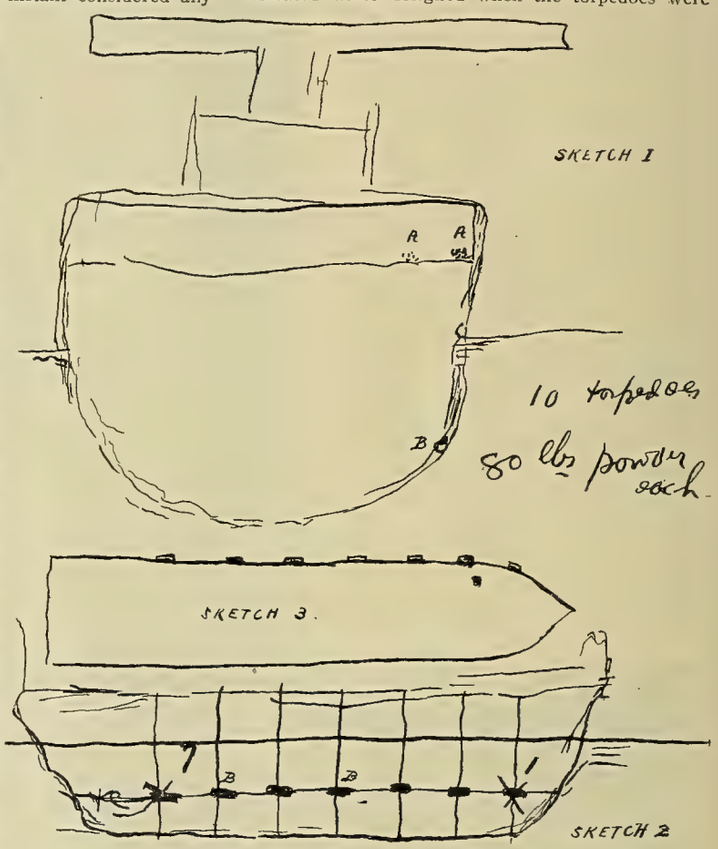
"Speaking of the battery cells, we had no easy time finding our electrical equipment. We first scoured all the vessels of Sampson's fleet, hoping to find a number of these small electrical firing machines so well known to all engineers and electricians of the navy, but these proved a scarce article. My final resort was to a conglomeration of wet and dry batteries culled from all over the fleet. Why, do you know, we had even to dismantle the electric bells of the fleet to get each outfit's battery to add to the lot required for this service. We finally got together a sufficient number; we needed quite a lot, and I'll show you in a moment how we placed them—what we did with them."

Here Captain Hobson took a pencil and made sketch 1 in Fig. 1 (reproduced directly from his rough pencil diagram, inked over). "This diagram," continued the captain, "is a rough idea of the section of the Merrimac, showing first the bridge of the ship, the upper line of the bulwarks, the deck line, and the water line. Here we placed most of our batteries," pointing to (A) (A) in sketch 1; "that is, on the deck in these corners and in other out-of-the-way places, also near the masts.

"Before going further, though, I should tell you how we attached the torpedoes. Look at this diagram (sketch 2) of the side of the Merrimac and imagine you are seeing through the ship. You will note at a line, which was actually 12 feet below the water line, a row of seven black spots. These spots, only seven in the sketch, represent really 10 specially built and primed torpedoes, each one intended for individual electrical explosion by its own separate and distinct battery of dry or wet cells. Our great difficulty in planning, as I said before, was the locating of the torpedoes, and after the plans were decided upon we found even greater difficulty in their execution.

"Referring to Fig. 1, sketch 2, the horizontal line running through the torpedoes represents a heavy rope; the perpendicular lines, seven in number, passing up through the torpedoes and across the horizontal rope, represent also ropes with which the horizontal line and each of the 10 torpedoes were bound to the side of the Merrimac and strong enough to hold surely at the speed we intended to give the Merrimac."

Stripped of technicalities, Captain Hobson's explanation as to how this roping was done was about as follows: A heavy rope was laid along the Merrimac's bulwarks from bow to stern. At regular intervals along this line was attached each of the 10 torpedoes. These torpedoes had been carefully fitted with electric primers and were especially prepared by the aid of paraffin and other means so that they were thoroughly watertight. Attached to each one was a set of insulated wires designed when the torpedoes were



(Facsimile of a Rough Sketch by Captain Hobson.)

FIG. 1. DIAGRAMS ILLUSTRATING THE MANNER OF SINKING THE MERRIMAC IN SANTIAGO HARBOR.

in place to extend up over the ship's side to each torpedo's battery. Across a horizontal rope laid along the bulwark, and to which the torpedoes had been attached, were run perpendicularly 10 other lines of length sufficient to be passed down over the side and brought each one around under the Merrimac's keel and up again over the bulwarks on the opposite side of the ship.

These 12 lines were attached to the horizontal rope at each torpedo, as indicated, and the entire system of roping and torpedoes was pulled down over the side of the Merrimac to a point about 12 feet below the water line. The perpendicular binding ropes were then each one securely fastened.

In this manner, as will be seen from Fig. 1, the torpedoes, when the horizontal line had been firmly fastened at bow and stern, were firmly lashed to the side of the Merrimac.

With the torpedoes thus lashed to the side of the vessel the 10 sets of wires extended upward over the side of the vessel, one from each torpedo to its group of cells, as at (A) (A) in Fig. 1. In sketch 1 the line of torpedoes shows at (B).

Right here Captain Hobson was asked this question, "Why was it that you located all the torpedoes on one side of the Merrimac?"

"Simply for the reason," answered Captain Hobson, "that our object was to cause the Merrimac to list to one side, thus assisting the entrance of the water into the gaps that the torpedoes would make in the sides of the vessel, and thus the quicker cause it to sink."

Continuing he said: "With the 10 torpedoes in

place, each one containing 80 pounds of powder, 800 pounds in all, the wires were next run up over the ship's side and rail and thence to the batteries that had been variously stowed away in the safer places on deck. My first idea had been to have one big battery and take current for all the torpedoes from this one unit. However, we finally made each torpedo a separate and distinct unit with its own battery of cells. It was most providential that we did this, for, as it afterward turned out, only two out of the numerous battery units survived the hail of shot and shell that was showered down on the poor old Merrimac. None of us can understand why we men escaped unharmed while so much damage was done to the electrical equipment that we stowed away, really, so much more carefully than we did ourselves."

(Facsimile of Rough Sketch by Captain Hobson.)

FIG. 2. MAP OF SANTIAGO HARBOR SHOWING VARIOUS POSITIONS OF THE MERRIMAC.

"What, if any, were your electrical instructions to your men?"

"Only this," gravely answered Captain Hobson; "my men were all volunteers, and as such, of course knew that we had little or no chance of escaping unharmed from such an undertaking. Each man of the several that had been ordered to the duty of making the electrical contacts that would fire the torpedoes was bluntly told that there was every chance that he would be shot—wounded, more or less seriously. He was told that if a contact was ordered to make it, even if he had to do it with his mouth, his teeth, or with any part of his body that was alive and could be moved. You know we did not use buttons for contacts, or switches; we arranged the simplest and what was deemed the surest sort of connection—the bared ends of the insulated wires—which could be quickly and securely twisted together."

Fig. 2 is most interesting, as it is a reproduction of the sketch made by Captain Hobson to illustrate the manner in which the Merrimac was steered into the channel (see arrow), how she passed over a submarine mine, and how, due to the fact that both forward and aft steering gear and anchor had been disabled or shot away, the old hulk drifted and swung from about (K) to (L) to (M), that is on past the point at which it had been planned she should be sunk.

In passing this point the feelings of the officer in command of the Merrimac may be better imagined than described. "But still," said he "our failure to sink the Merrimac where it had been planned to drop it was without doubt the providential happening that led directly to the ending of the Spanish war. The Merrimac, sinking as it did, over to one side of the channel, left the channel open enough so that the Spanish pilots gave Cervera's ships permission to take the chance at least to pass out single file. You know how at last we 'got them' single file!"

Captain Hobson was now asked: "If you had it all to do over again, would you change your plan? What new electrical apparatus would you use, or what new ideas would you embody in the scheme?"

"None, except," was his quick answer, "that I would, without doubt, employ firing machines instead of the batteries, and these because the electric cells proved so fragile and easily destroyed in action. I would have plenty of these firing machines. Of course we recognize that these also could be injured, but not so easily as the batteries."

And here came that hackneyed but always interesting layman's inquiry: "But tell us, what did you think—what were your emotions when you were in the midst of the hail of shot and projectiles poured down on the Merrimac?"

Hobson smiled at this and his answer was characteristic. "Really, we were too busy to think of anything but what we had to do."

Captain Hobson's career since he left the navy is that of a public man. Recently he fought and won a good political fight in Alabama and was elected to Congress from the Sixth congressional district. Since leaving the navy he has been steadily lecturing in the interest of peace and justice, and with splendid success. Some 277 cities and 36 states have adopted his resolutions to the effect that general treaties of arbitration should be negotiated by the United States granting jurisdiction to the International Court at The Hague; that the United States should declare in favor of a permanent international congress, and that present conditions call for the immediate adoption of a progressive naval programme that will give the United States "a navy capable of performing its duty."

Strike Stops Traffic on San Francisco Street Railways.

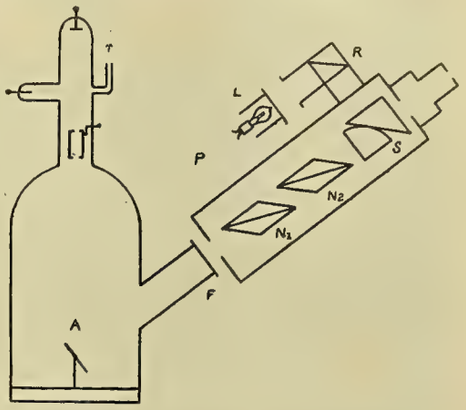
The strike of the employes of the United Railroads of San Francisco has resulted in a complete "tie-up" of all the company's street-railway lines, wrote the Western Electrician's correspondent on August 30th. The general public is now forced to walk through the miles of ruins in the burned district to and from the new business centers. Within 24 hours after the arrival of President Patrick Calhoun in San Francisco on August 26th a train load of strike breakers was dispatched from New York, and since then several other trains have left the East for San Francisco with platform men, linemen and car repairers under rush orders. No settlement is in sight at present.

The California Street Cable Railway Company with only eight cars is doing its best to take care of the traffic up the hills. Its cars are badly overcrowded until they stop at 7 p. m.

Public sentiment thus far is largely with the carmen, who are holding out for a wage of $3 a day, and are willing to return to work at such an advance and leave the question of eight hours and minor points of difference to arbitration. Patrick Calhoun, speaking for the company, refuses to treat with the union since it has broken its two-year agreement, which does not expire until next May, unless its members will first return to work. He will then offer them better conditions which he at present refuses to disclose.

Cathode-ray Experiments.

A new series of researches have been undertaken by A. Pochettino, an Italian scientist, upon the luminescence of crystals when acted upon by the cathode rays. The phenomena of luminescence



APPARATUS OF POCHETTINO FOR CATHODE-RAY EXPERIMENT.

are presented by a great number of crystals under the action of the rays. It is found that the character of the light given off by the crystals in this case is quite variable, according to the kind of crystal which is used, but on the other hand it is nearly constant for the same kind of mineral species. The light is not the same for the different faces of the same crystal, and depends upon the structure of the latter. Again, the light is partly polarized and sometimes almost entirely so, and this also depends upon the crystalline direction of the specimen.

The accompanying diagram shows a new apparatus which has been designed by Mr. Pochettino for making observations upon the crystals. It consists of a Crookes tube of special design, in which the crystal cut in a thin plate is placed at (A), where it is in the path of the cathode rays coming from the upper part of the tube. A branch tube allows of observing the crystal in an oblique direction through the opening (F). The light from the crystal is received in the apparatus (P), which is a specially designed photometer. It contains a curved total reflection prism (S), and below it are placed two Nicolls prisms (N_1) (N_2). An outside light (L) is compared in the photometer with the light from the crystal, this being brought into the chamber by the reflecting prism (R). By regulating the Nicolls prisms and thus obtaining an equal intensity of light from the two sources, one can easily find the proportion of light which is polarized in a given plane. The equalization of the tint is obtained by placing colored glass screens in front of the lamp (L). Among the crystals which were observed in the apparatus are scheelite, phosgenite, zircon, anatase, apatite, beryl, diopside and others. These give results which accord well with previous researches.

Contrary to Maskelyne's results, Mr. Pochettino finds that augite, apatite and chrysoberyl show a luminescence which is clearly polarized, and on the contrary topaz, tourmaline, olivine and andalousite show no trace of polarization. One of the most curious results is that diopside gives on one plane an orange yellow fluorescence which is not very intense and is but slightly polarized, while on another face it shows a vivid scarlet fluorescence very strongly polarized.

Electrical Exports for July.

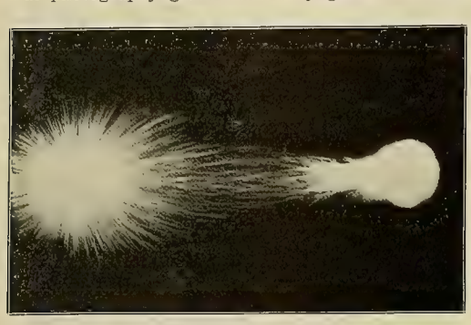
Electrical exports from the United States for the month of July amounted to a total value of $1,208,789, compared with $970,674 for July, 1905. Goods classified as electrical appliances show the larger gain as compared with electrical machinery, although both show good advances. The figures in detail are: Electrical appliances—July, 1905, $37},191; July, 1906, $577,084. Electrical machinery—July, 1905, $597,483; July, 1906, $631,705.

Under the head of electrical machinery the following countries were the principal buyers from the United States in July, the value of the purchases of each country being given: British North America, $122,173; Mexico, $109,752; United Kingdom, $85,815; France, $58,329; Brazil, $42,698; Cuba, $38,337; Japan $34,632; British East Indies, $32,286; British Australasia, $24,770; Argentina, $16,414; British Africa, $5,896; Germany, $4,321.

Photographic Investigation of Electric Discharges.

By A. de Courcy.

A number of interesting experiments relating to the photography of electric discharges have been made by Dr. Stéphane Leduc of Nantes, France, and an improved method which he uses has enabled him to secure results of a novel character. These may throw some light upon our knowledge of electric phenomena. Numerous attempts have been made to obtain permanent records of the electric field, in the same way as we have for the magnetic field by means of iron filings, but these have not been very successful. But photography gives some very good records of

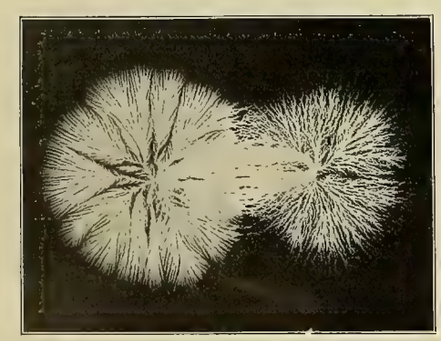


Electric Field between Two Poles of Opposite Sign.
FIG. 1. PHOTOGRAPHY OF ELECTRIC DISCHARGES.

the field, and we have made some improvements in the method of operating which lead to remarkable results.

The first experiments were made by placing a photographic plate upon a sheet of metal foil, connected with one coating of a Leyden jar, while above the plate is placed a metal point. A single point thus gives the record of a positive or a negative discharge. In Fig. 1 is shown the result which is obtained with two points of opposite sign, held vertically upon the plate. With a single point, a round spot, such as is seen to the left of the picture, is obtained, with radiating streaks. These preliminary experiments were followed by others which are of much greater interest and which I will briefly describe.

In spite of the fact that the electric spark is one of the phenomena which is longest known



Discharge (without Halation) between Two Points Perpendicular to the Plate.
FIG. 2. PHOTOGRAPHY OF ELECTRIC DISCHARGES.

and the most frequently observed, our knowledge of its characteristics and its formation is but slight. The spark is too rapid and the details of its lines are too fine to allow the eye to observe them. Up to the present, the photographic plate has been unable to reveal the fine details of the spark, as these are quite effaced by the fog which is produced on the plate by the light of the heavier lines. We have found the means of avoiding this fog, and of producing the most delicate details along with the heavier parts The photographs which are thus obtained are valuable in giving precise indications upon some much-discussed points.

In order to prevent the fogging of the photographic plate, non-halation plates are used, but this is not sufficient. We go farther, by burying the plate and making the discharge in compressed red oxide of mercury. In this way we obtained some very curious figures, one of which is shown in Fig. 2. It is the image formed between two points perpendicular to the surface of the plate. This gives a new figure of the electric discharge, and shows it to be formed of three parts. Around each point is a halo, which is characteristic of the positive or negative sign of the point, then a series of lines going from one point to the other. The particles which trace the halos act differently from the ones which form the connecting lines, and no doubt these particles are in different electric conditions. The halos seem to be formed by molecules of air which are attracted by each point. They are formed of radiating lines and come in contact with each other without seeming to be affected by this fact.

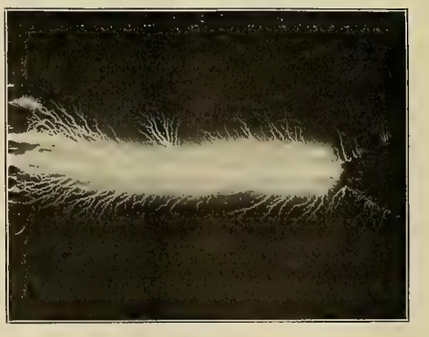
While the horizontal connecting lines only depend upon the difference of potential between the two points, the halos, on the contrary, depend upon the difference between the potential of the point and that of the surrounding air. If the discharge is made under the same tension, but one point now being placed to earth, the halo of this latter point is much reduced in size. The other halo is increased in the same proportions. The lines passing from one point to the other are evidently traced by the electrified particles, by the ions, and, as I shall show farther on, these particles seem to form a double current which acts quite differently from that by which we represent the progress of the ions in electrolysis.

In Fig. 3 we have a spark of horizontal form between two points which are placed opposite each other. This spark is accompanied by its halo, and we now have the characteristics and the details of the latter photographed for the first time. The halo is different in each half of the spark, both in aspect and in the direction of its lines. It is seen that the lines of the halo are in each case inclined so as to represent an arrow point directed toward the rod from which the discharge takes place. This phenomenon of the spark and its halo must be interpreted. If we admit that

Sparking between Horizontally Disposed Points.
FIG. 3. PHOTOGRAPHY OF ELECTRIC DISCHARGES.

the line is traced by particles which took electric charges of the same sign as the point when in contact with the latter and were then repelled by this point and attracted by the other, these particles, on account of their charge, attract neutral molecules to them, which, in directing their course toward the point, trace the lines of the halo. If we remark that at the middle of the spark there is a neutral zone without halo, and again that in each half the direction of the lines of the halo is quite different and characteristic of the sign of the electric charge, we must admit that at the middle of the spark the particles of the two halves projected against each other with contrary charges neutralized each other, and thus we have a blank space.

If we form one of the electrodes by a point and the other by a plate we may obtain a dis-



Positive Effect.
FIG. 4. PHOTOGRAPHY OF ELECTRIC DISCHARGES.

charge which goes only in one direction from point to plate. Here we find that the halo shows all along the spark the characteristics of the same sign, either positive or negative. In Fig. 4 is seen the positive effect, while the negative is shown in Fig. 5.

Thus photography serves to explain the dynamic and kinetic phenomena of the spark, and the natural interpretation of these has the advantage of being quite in accord with the general laws of electricity. One point to be noted is that in order to obtain the photographs we require to have a metal plate placed under the photographic plate on the glass side. The influence of this plate is not quite clear and seems not to be explained by the well-known facts of electricity. The action of the electrostatic field between two contrary poles upon light bodies and molecules of the air is quite different from the action of the magnetic field in an analogous way upon iron filings. This latter effect is only a directive action on the par-

Negative Effect.
FIG. 5. PHOTOGRAPHY OF ELECTRIC DISCHARGES.

ticles, while the electrostatic field gives rise to movements of attraction and repulsion. This difference is well shown in Fig. 2, which may be compared to three magnetic fields superposed. The halo around each point is comparable to a single-pole magnetic field exerting an attracton on the iron filings. The lines connecting the two points are analogous to a bipolar magnetic field between two contrary poles.

The remaining views (Fig. 6) show a series of

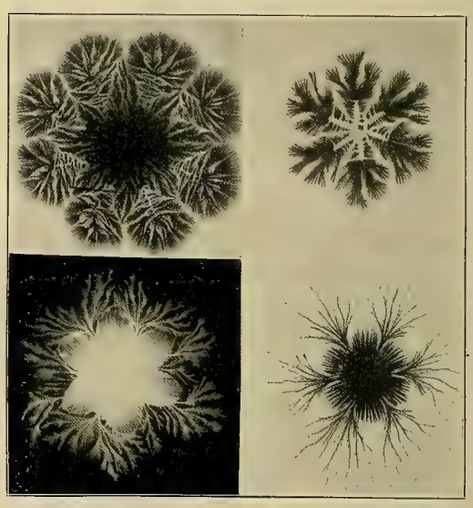


FIG. 6. PHOTOGRAPHY OF ELECTRIC DISCHARGES.—ORNAMENTAL FORMS.

ornamental figures which can be obtained by protography, and these may be utilized in designing decorative motifs, as they rival the figures of the kaleidoscope. Operating by ruby light, we place a suitable mask upon the plate, cut to the required design. We then dust fine powder, starch or metallic oxide on the plate from a sieve and then remove the mask, leaving the design formed by the powder. This can be complicated by placing metallic conductors regularly around the design. Below the plate is a sheet of metal foil and above is a point held on to the surface. A screen should be used to shield the plate from the light of the spark. The foil is connected to one coating of a Leyden jar of a Wimshurst machine and the point to the other. On developing the plate we have a design which depends upon the metallic conductors, the powdering, the state of the air, etc., and the unexpected results are one of the interesting features of the process. Some of the figures thus obtained are given.

The Nashville (Tenn.) Railway and Light Company is completing improvements to cost $500,000. The betterments in the electric power house include the installation of 12 new boilers of 600 horsepower each, mechanical stokers, etc. A pump chamber is being installed on the river side of the power house.

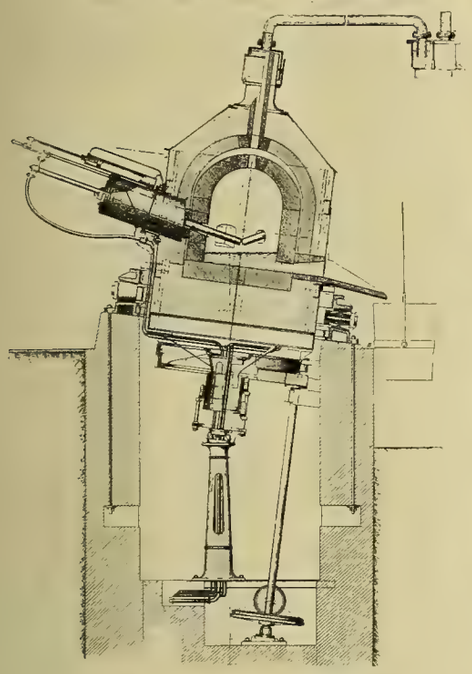
A New and Unique Italian Electric Furnace.

By Frank C. Perkins.

The accompanying illustrations and drawings show the details of construction of a new electric furnace installed at Turin, Italy, and operated by the artillery construction works of the Italian War Office. The furnace was designed by Ernesto Stassano, director of the Forni Termoelettrici Stassano Company. The electric furnace installed at Turin absorbs 140 kilowatts of electrical energy, a polyphase current being employed with 80 volts pressure between each phase. This electric furnace is employed for refining pig iron and melting scrap, and is charged with 200 kilograms of pig-iron turnings, together with sufficient ore to supply what oxygen is necessary for removing the impurities of the pig iron; also a proper proportion of lime for the slag. From 200 to 300 kilograms of iron and steel scrap is employed, as well as some ferromanganese and ferro-silicon, in the proper proportion to dioxidize the charge and to introduce the required amount of manganese.

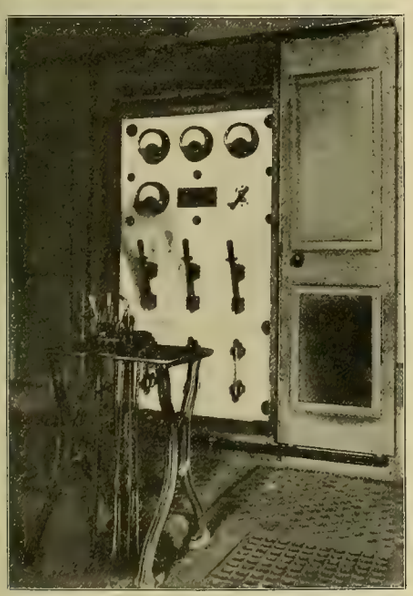
The following interesting data are given by Col. Corbetto, director of the War Office plant.

The Stassano rotary electric furnace erected in



VERTICAL SECTION OF ITALIAN ROTARY ELECTRIC FURNACE.

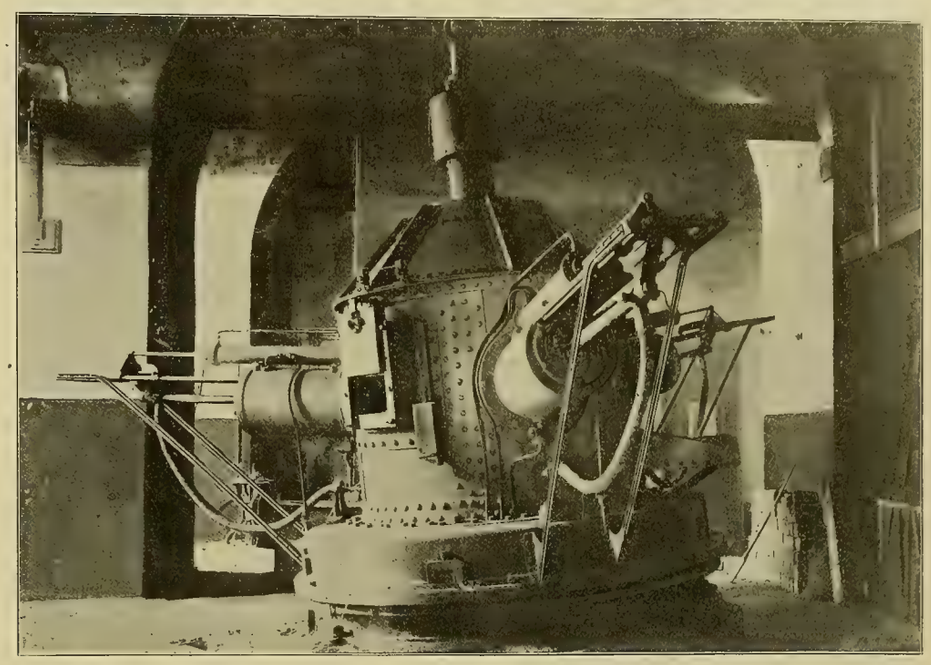
the works of the army board is capable of producing a good quality of shot steel by utilizing broken iron and steel and iron and steel turnings, such as produced by the ordinary working in military shops. The War Office has decided to work the furnace for the regular production of shot steel as the result of the report of delivery and tests of steel produced at this plant. The furnace installed is capable of producing "2,500 kilo-



SWITCHBOARD AND ELECTRODE-CONTROLLING VALVES FOR ITALIAN ELECTRIC FURNACE.

grams of steel every 24 hours in four discharges, consuming for each discharge about 850 kilowatt-hours of electric energy in the form of three-phase current at a potential of 80 volts between one phase and the next."

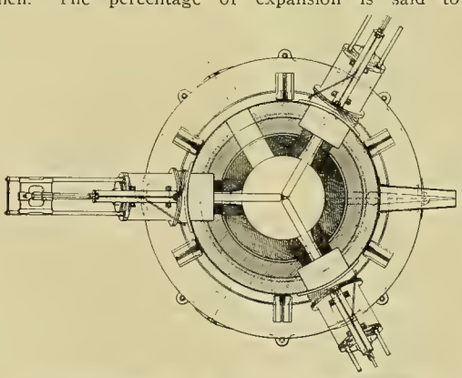
The product made by the Stassano electric furnace is steel to be used for artillery projectiles,



A NEW ITALIAN ROTARY ELECTRIC FURNACE.

containing from 0.3 to 0.4 per cent. of carbon, about the same percentage of phosphorus, and from 1.2 to 1.5 per cent. of manganese. It is stated that high grades of steel other than the above may be easily made with this electric furnace, either hard or soft grades being produced with facility.

It is stated that the samples taken from the projectiles made as above mentioned by the electric furnace of Ernesto Stassano have been tested as to tensile strength, and it was found that the breaking stress was 90 to 95 kilograms per square millimeter, which is from 57 to 60 tons per square inch. The percentage of expansion is said to



HORIZONTAL SECTION OF ITALIAN ROTARY ELECTRIC FURNACE.

have been from 12 to 14 on a length of 150 millimeters.

During the process of electric smelting it is asserted that the loss in weight is very little, while the consumption of electrodes is less than five kilograms per ton of steel. It is maintained that the consumption of electric energy is less than 1.3 kilowatt-hours per kilogram of steel produced.

The refractory covering of the furnace is said to last about a month, while the cost of renewal is about 10 francs. The electric furnaces of the Stassano design are of both rotary and fixed types. The fixed electric furnaces for copper ores are said to have given excellent satisfaction.

The Stassano rotary furnace comprises a metal armor mantle of cylindrical shape, terminating at the top in a truncated cone, internally lined with fireproof material, into which opens the melting chamber of circular cylindrical form, terminating at the top in a cupola vault. There are in the refractory wall openings provided to give passage to the electrodes extending to the interior of the melting chamber and meeting one another in the center.

The voltaic arc is thus produced at a convenient height above the bottom of the furnace. A current of water is caused to circulate in the double wall of the cylinders in which the carbons are placed, thus maintaining a comparatively low temperature in the coupling between the metallic part of the carbon-holder and the electrode.

A hydraulic cylinder is connected above each of the cylinders with a piston, the rod of which is located in the plane passing through the axis of the carbon-holding cylinder and is connected to the end of the rod. There is a strong gear wheel connected below the base plane of the armor. By gearing with a shaft, a rotary movement is given to the whole furnace. There are groups of brushes with a metallic support arranged at the center of the chamber below the furnace, bearing on rings, and conducting current from the electric generators to the electrodes, and forming a continuous contact between the furnace electrodes and the source of electric current, whether the furnace is at rest or rotating.

In this rotating furnace the active agitation of the molten material is of great value in favoring the chemical reactions which take place. The time necessary for these reactions to take place is greatly reduced, and the furnace may be worked under full load, obtaining the highest economy in utilizing the electric current.

The fixed electric furnace of the Stassano type is so designed that the molten material in the upper part of the bottom, which is the hottest part, may remain for a long time in the subsequent decantation chamber, allowing of complete separation of the cinder from the matte or useful part in the case of copper. It is necessary in the treatment of copper ores to keep the material in a molten condition for a long time, in order to allow the metallic part to separate by density from the cinder. It is contended that the electric process is far superior to the ordinary coal processes, and that the electric furnace can be utilized to advantage for all metallurgical purposes.

A Question of Nerve or Nerves.

All things are more or less hard to do, and work only will do them. Get a right idea of work. Don't trust to cleverness. It is worthy, but it will not do your work. Accomplishment demands singleness of purpose and concentration. All exterior forces tend to diversion from these essentials. Here you come in again to show your triumph of personality over environment. No matter what you do, from the humblest incidental thing of the moment to the consummation of your greatest ambition, the same principles of human activity apply. All will be clear sailing until you meet resistance, and sometimes you will run against it hard. Then you will find whether you have nerve or nerves. No one can help you much. Your measure is being taken, and you win or lose upon the cumulative ability which you can muster as the total assemblage of native talent and all that has become a part of you through all the influences that ever entered your life. See to it that they all shape one way. You will meet some disappointments through your own faults and some because the world is not exactly just, but whoever gets approximate justice in the world is doing very well. The perfectionist has a hard time. He meets continual diappointment, especially if he is chiefly worried about the imperfections of others.—From address delivered to the class of '06 of Staten Island Academy by Walter Craig Kerr, president of Westinghouse, Church, Kerr & Co.

WESTERN ELECTRICIAN

EVERY SATURDAY.

PUBLICATION OFFICES:

507 Marquette Building, - CHICAGO.

TELEPHONE, MAIN 1746.

Eastern Office, 150 Nassau Street, New York.

Telephone, 8220 Beekman.

Trade Supplied by Western News Co.

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DATES AHEAD.

Colorado Electric Light, Power and Railway Association (annual convention), Denver, September 18th to 20th.

Illinois State Electric Association (annual convention), Springfield, Ill., September 19th and 20th.

Central Electric Railway Association (outing), Robinson Park, near Fort Wayne, Ind., September 26th.

Old Time Telegraphers and Historical Association, and United States Military Telegraphers (annual meeting), Arlington Hotel, Washington, D. C., October 9th, 10th and 11th.

American Street and Interurban Railway Association (annual convention), Columbus, O., October 15th to 19th.

GAS-ENGINE competition in power work is felt by many a central-station manager, and therefore the paper on the subject by Mr. Wolls, presented elsewhere in this issue, will be read with attention. The author has prepared a good, practical paper, based on actual experience, and gives several useful hints.

IN THE CONSTANT effort to make the Western Electrician of more practical technical value to its readers (of which another evidence will be given next week, when a two-part or three-part exposition of "The Handling of Boilers in Power Plants" will be begun), the presentation of the news of electrical interest has not been forgotten. This is shown by the valuable "Correspondence" department, in which a letter from Paris, relating to Continental Europe, has regularly appeared for several issues, and which we hope will prove a regular feature. In connection with our weekly letter from Great Britain, readers of this journal will find the important electrical development of Europe set before them with promptness and accuracy by regular correspondents of the Western Electrician.

BIG PROJECTS are not confined to the United States by any means. Thus, according to reliable authority, Arnold Lupton, member of Parliament for one of the Lincolnshire districts, has conceived a great idea, of which the result would be to rid London of its smoke-fog and make it one of the sunniest cities on the globe. Mr. Lupton is quoted as confident that it "would be the most beautiful city in the world." Mr. Lupton's plan contemplates the use of electricity for power, lighting, heating and cooking in London and bringing the electric energy from the coal fields of the Midlands, thus doing away with the smoke producers in the metropolis. It is stated that Mr. Lupton "took an active part in the preparation of a plan for harnessing the waters of Niagara to the extent of 120,000 horsepower," and that his present project is backed by engineers of distinction. He estimates that the smoke nuisance damages London every year fully $10,000,000, not to mention the personal discomfort which it causes. The success of his project would not only abate this intolerable nuisance, but would also, it is calculated, furnish a cheap substitute for the present source of light, heat and power. It is proposed to construct a plant as a beginning to be enlarged when needed, to cost about $17,000,000. The steam railroads may oppose the project, for it would mean a heavy annual loss to them in freight receipts from carrying coal to London.

But Mr. Lupton does not consider this opposition insuperable. He is thus quoted: "What I propose is to use a high-tension current of 60,000 volts and to bring the electric energy from the Midland coal fields, 120 miles away. If London were supplied with electric generators of, say, 1,000,000 kilowatts average load, the greater part of the railways, tramways and factories could get their electric lighting and power and the bulk of the houses be warmed and the cooking done by electric energy. The current could be delivered in London in bulk at one farthing (half a cent) per unit, and therefore it could be sold at one penny (two cents), and even less for large quantities."

Perhaps the M. P. is misquoted in relation to the size of his generators. Machines having a capacity of 12,000 or possibly 15,000 kilowatts are the largest now built, and to jump from that to a million kilowatts is rather too great a step even for the imagination of the most sanguine electrical man. But in considering the project Mr. Lupton's apparent lack of technical information is of little importance. If that gentleman will only finance the scheme and secure the requisite authority to carry it into execution, the engineers will do the rest. Careful calculations may very likely show that the plan is impracticable in a commercial sense, although, by driving the pit's-mouth generators by gas engines, sufficient efficiency might be attained to justify the 120-mile transmission. But this is doubtful. Long electrical transmissions up to this time have been invariably of cheap waterpower. Probably in transforming the energy of the coal first into electric power in an engine-driven plant and then transmitting it 120 miles the losses would be too great to make the scheme practicable. But the idea (which, by the way, is not particularly new) is worthy of attention with the development of the art, and is not to be dismissed with a contemptuous smile. Mr. Lupton and his friends should retain engineering experts to make a careful series of estimates.

WHAT MAY prove, perhaps, to be a patent decision of great importance was handed down about two weeks ago by Judge Seaman in Milwaukee. It relates to agricultural machinery—straw stackers—and as such is of no specific interest to readers of the Western Electrician, but a broad principle is involved which may have far-reaching consequences to all owners and licensees of patents. That principle may be expressed by the question, "When, if ever, does the organization of a group of licensees under a patent overstep the terms of the Sherman Anti-trust Act by creating an unlawful monopoly in restraint of trade?" In the particular case in question the court finds that the contract entered into by the owner and licensee of a patent did violate this law, and therefore the complainant's bill to enforce his alleged rights under the contract is dismissed. The judge sets forth the reasons for his decision in an accompanying opinion, from which extracts are given elsewhere in this issue of the Western Electrician. He says that unless the patent monopoly protects it, the contract in question clearly violates the express terms of the Sherman Anti-trust Act. But a patent does, of course, create a monopoly. The question then is whether licensing under a patent lawfully extends the monopoly in the manner desired by those who establish the group of licensees. This question is examined at length by Judge Seaman, and he finds that, in the case before him, the patent-licensing agreement does violate the Sherman law, notwithstanding the conceded monopoly granted to the owner of the patent or patents on which the agreement is based. This is manifestly a delicate point. Referring to a patent-license monopoly, the judge thus expresses himself:

"I am satisfied that monopoly thus secured, to be immune from the Anti-trust Act, must be referable solely to the inventions under the patents, and that a combination of licensees formed thereunder may create a monopoly which exceeds the legitimate scope of the patent privileges, not within the contemplation of the provisions for the grant, and thus violate the general act referred to, with or without intentional co-operation on the part of the licensor."

And further:

"While such plan of cumulative ownership of patents, for the purpose of obtaining royalty alone under the protection of all, is sanctioned by the authorities—notably Bement v. National Harrow Co., 186 U. S., 70—as between licensor and a licensee, I am of opinion that this combination of all manufacturers, under the plan of acquisition and for the purposes above outlined, is without such sanction, so that no escape appears from the conclusion that it violates the Anti-trust Act, if not the common law. It is unmistakably a combination of manufacturers, to restrain competition in the make and sale of their products, with merger of the patents in one ownership as a means employed for that purpose, and thus not entitled to the beneficent rule of the patent law which intends protection only of monopoly of the use of specific invention—not to foster combinations of patentees and manufacturers for general monopoly."

The rule is, as conceived by Judge Seaman, that "without the domain of monopoly for each individual invention the [patent] owner stands on an equality with all other property owners, and is equally amenable to the general law against confederation with others, tending to create another kind of monopoly, through concerted action of the confederation."

Obviously, this decision may prove of great importance, for if it is upheld, the licensing of manufacturers under patents, which is now done to a wide extent, will be carefully examined and very likely sharply restricted. Of course the case will be appealed to the United States Circuit Court of Appeals, and equally of course many able patent lawyers disagree with the learned judge. But the point is one of great consequence in many industries based largely on patents, and the final decision will be anxiously awaited.

Patent Licensees and the Sherman Anti-trust Law.

Patent lawyers, and indeed all owners and licensees of patents, are deeply interested in a very important decision of the United States Circuit Court, Eastern District of Wisconsin, handed down, with an opinion, by Judge W. H. Seaman in Milwaukee on August 22d. The case is that of the Indiana Manufacturing Company against the J. I. Case Threshing Machine Company, and is a complicated one, in which eminent counsel are employed, including Peirce & Fisher of Chicago, retained for the defendant, to which the judge gave the decision. The case will, however, undoubtedly be appealed.

The bill was filed to enforce the alleged rights of the complainant, the Indiana Manufacturing Company, under certain patents for improvements in straw stackers, and also to enforce contracts with the defendant for the manufacture and sale under these patents of certain "pneumatic straw stackers." The court declared that the relief sought was plainly in the nature of specific performance of a contract. The patents of themselves are not particularly interesting to the readers of the Western Electrician; but that part of the decision relating to the granting or withholding of licenses under patents in possible violation of the Sherman Anti-trust Law is of very broad application and may prove of great importance in all industries largely affected by patent protection. The judge holds, as the Western Electrician gathers his meaning, that while a patent is a lawful monopoly, a license under a patent is not necessarily so, and, under some circumstances, will form no exemption from the provisions of the Sherman Anti-trust Law directed against a monopoly in restraint of trade.

In his opinion the judge says that the determination of the validity of the licensee contract is imperative to a decision of the case. Referring to the inquiry into the validity of the contract, he continues:

"Were it questionable, in any view of the subject matter of the bill, whether it was open to such inquiry, doubt would be set at rest by these express allegations thereof; that like contracts were made with other manufacturers to the extent of embracing in the 'license system' thereof 'substantially all manufacturers of threshing machinery on this continent,' and all pneumatic straw stackers made in the United States and Canada; that violations by the defendant—sale at less than the price fixed being one of the charges—endanger the entire system, leading 'to dissatisfaction and unrest on the part of the other licensees' and encouraging like violations.

"Whether the system thus referred to may not be within the lawful exercise of patent privileges is, of course, another question—dependent in each case upon the facts which enter into the arrangement—but it cannot be doubted that the contracts which make up the system are open to challenge, either for monopoly not authorized by the patent law, or for other taint. Equity is not content to enforce an agreement upon its form alone, but will search beyond its terms to ascertain the true object, when the issue of legitimacy is raised. I am satisfied that such issue is presented here and must be determined under the evidence. The question of the lawfulness of the monopoly created by the contracts and license system in suit is one of mixed law and fact. The substantial facts are well established, if not conceded, and the inferences of fact impress me as free from difficulty, unless it be in reference to the nature of invention in one or more of the patents, which enters into the ultimate inquiry of the effect of the combination.

"Laying out of view the feature of property in patents (owned or to be acquired) involved in the argument, the doctrine is settled that the monopoly in trade created by the agreement violates the express terms of the Act of Congress (3 U. S. Comp. St., p. 3200) known as the 'Sherman Anti-trust Act' (as well as the common law), so that the contract cannot be upheld unless saved from invalidity by the element of patent license referred to. (Bement v. National Harrow Co., 186 U. S., 70, 92; Northern Securities Co. v. United States, 193 U. S., 197.)

"On the other hand, the grant of a patent creates a lawful monopoly, for the term of the grant, in use of the invention, and the right of the owner (patentee or assignee) is well recognized, to parcel out, restrict or withhold such use, at will; and he may fix the price at which the patented article or product shall be marketed. With the aggregation of patents embraced in this combination agreement, however, the question of applicability in all phases of the one and the other of the above-mentioned rules is not, as I believe, settled by the authorities. The decisions are not harmonious in cases which seem to be analogous in certain features, so that the question, broadly stated, remains at large, to be determined upon general principles which are settled—both in reference to the public policy of the laws respectively which restrain general monopolies, and those which confer a limited monopoly for inventions and literary productions—and in the light of the leading opinions cited. Nor can the conclusions yield to the influence (suggested in argument) of the grave interests which may be affected upon the one side, or of privity or alleged misconduct or inconsistent acts of the other party."

The court then examines the specific license contracts or agreements, and later makes this important statement:

"Upon these premises alone—of numerous patents covering various inventions in the ownership of a single purchaser, and license issued thereunder for exclusive use of the inventions by licensees upon the terms specified—the rule is assumed (for the present consideration) to be settled that monopoly of such inventions is within the objects of the grants, and that the transactions do not, prima facie, violate the general provisions of law against combinations in restraint of trade. (Bement v. National Harrow Company, 186 U. S., 70, 93.) Nevertheless, I am satisfied that monopoly thus secured, to be immune from the anti-trust act, must be referable solely to the inventions under the patents, and that a combination of licensees formed thereunder may create a monopoly which exceeds the legitimate scope of the patent privileges, not within the contemplation of the provisions for the grant, and thus violate the general act referred to—with or without intentional co-operation on the part of the licensor.

"In other words, while exercise of the right which the authorities concede to be inherent in the grant, of obtaining several patents by purchase and combining them in a license, results, in a sense, in combination of licensor and licensees to uphold monopoly of the inventions, which may be lawful, I am of opinion that such combination must be limited to the express policy and object of the patent grant—monopoly in beneficial use of a specific invention—and when extended beyond that purpose by concert of action, may thus be brought within the inhibition of the general law; that this right to assemble and hold patent properties, alike with the instance in the Northern Securities case, may be abused—may be the means and guise for creating what has been aptly termed a 'conspiracy of monopolists'—so that the act, which is otherwise innocent and within individual rights, becomes unlawful, as opposed to public policy, in the methods employed; and that the transaction must be proved, under the issue, beyond the license terms, to ascertain the true objects sought and obtained by this combination."

Reviewing the testimony, Judge Seaman has, among other things, this to say of the threshing-machine combination:

"The contract 'A' in suit is one of the series uniting the threshing-machine manufacturers—for other kindred manufacturers were ultimately included as joint licensees—and each licensee entered the system with full understanding of and patent privileges, not within the contemplation of therefore, the promoter of a two-fold combination of numerous patent properties and of all manufacturers of threshing machines, whereby great interests were affected—unquestionably within the language (if not the scope) of the Anti-trust Act as 'in restraint of trade or commerce among the several states, or with foreign nations' (Sec. 1), or 'to monopolize any part of the trade' thereof (Sec. 2)."

The judge then considers at some length the monopoly in restraint of trade of the complainant, giving several citations. He proceeds:

"While such plan of cumulative ownership of patents, for the purpose of obtaining royalty alone under the protection of all, is sanctioned by the authorities—notably Bement v. National Harrow Company, 186 U. S., 70—as between licensor and a licensee, I am of opinion that this combination of all manufacturers under the plan of acquisition and for the purposes above outlined, is without such sanction, so that no escape appears from the conclusion that it violates the Anti-trust Act, if not the common law. It is unmistakably a combination of manufacturers to restrain competition in the make and sale of their products, with merger of the patents in one ownership as a means employed for that purpose, and thus not entitled to the beneficent rule of the patent law which intends protection only of monopoly of the use of specific invention—not to foster combinations of patentees and manufacturers for general monopoly."

Continuing his reasoning along this line, Judge Seaman concludes his opinion as follows:

"The settled rule in reference to the privileges vested in patent property is not overlooked in this view. As tersely stated in the opinion by Judge Baker, speaking for the Circuit Court of Appeals, in Victor Talking Machine v. The Fair, 123 Fed., 424, 426: 'Without applying to the Patent Office, one may make and use and sell the device that embodies his invention. That is his natural right. Within his domain the patentee is czar. The people must take the invention on the terms he dictates or let it alone for 17 years. * * * Cries of restraint of trade and impairment of the freedom of sales are unavailing because, for the promotion of the useful arts, the constitution and statutes authorize this very monopoly.'

"Nor do I overlook the recognized right (as before mentioned) of the patent owner, as such czar 'within his domain,' either to suppress his own or prescribe the terms of its use by others, or to own and enforce monopoly under several patents. Nevertheless, as I conceive the rule, without the domain of monopoly for each individual invention, the owner stands on an equality with all other property owners and is equally amenable to the general law against confederation with others tending to create another kind of monopoly through concerted action of the confederates.

"The patent privilege is granted by the government by excluding others from its use, unless licensed by the patentee as owner; and this exclusive use is strictly enforced by the courts; and if properly termed a monopoly—a definition not accepted by all the authorities—it is readily distinguishable from that of the common law. It requires neither other patent privileges nor the concurrence of third parties for its enforcement; nor can combination with other patents lend aid to its judicial enforcement. The right of the owner to purchase and enjoy other patent privileges by way of investment or increase of royalties, together with all other recognized property rights therein, except the exclusive use of each invention conferred by the grants, are held alike with the common rights of other property owners to make them profitable. So the nature of the privilege confers no immunity to combine with other patentees or under other patents in a confederation of users, when such combination is prohibited generally, as in the terms of the Anti-trust Act. While purchase alone of the outstanding patents, interfering or noninterfering, by the complainant, might be within its rights, the combination which was entered into, with that as one of its means, as I believe, violated the law. The arrangement was not within the rule, which is of general application, that differences may be composed and litigation settled between the parties by bona-fide compromises. Nor was the foreclosure which it contemplated, of all questions as to the validity or value of any patent enlisted, justifiable under the circumstances, and I am of the opinion it was opposed to public policy.

"With the contracts thus viewed, neither is enforceable in equity, and the bill must be dismissed."

Death of E. Rosewater.

Edward Rosewater of Omaha, Neb., died suddenly on August 31st from an attack of heart disease while alone in an office in the Bee Building, Omaha. He was founder and editor of the Omaha Daily Bee and was one of the most unique personalities in western business and political life. Mr. Rosewater was well known to electrical men, having himself given much attention to electrical matters.

He was born in Bohemia in 1841 and settled in Cleveland, Ohio, in 1854. At the age of 16 he learned the telegraph code, and in 1862 and 1863 he was a telegraph operator attached to the Union army, and later at the War Department. He was vice-president of the Society of the Military Telegraph Corps during one term and was president of the Old Time Telegraphers' Association in 1862. From 1864 until 1871 he was manager of the Western Union at Omaha, and in the latter year founded the Daily Bee. He was for many years a member of the Republican national committee. As a private citizen Mr. Rosewater was public spirited to a high degree. He built the Bee Building at a cost of $800,000. He was the original promoter of the Transmississippi Exposition. In a special issue of the Bee last year Mr. Rosewater published an interesting article entitled "Personal Recollections of Some of the World-famed Electricians." This article can be found in the Western Electrician of May 5th. The funeral services were held in the rotunda of the Bee Building on September 3d and were attended by many prominent men.

German Electrical Working Agreement.

Under date of August 17th the Berlin correspondent of the London Times Engineering Supplement writes:

"The arrangement for the redistribution of capital among the three great electrical undertakings—the Allgemeine Elektricitäts Gesellschaft, Siemens-Schuckert and the Lahmeyer group—has recently undergone certain modifications, in that mutual agreements have been concluded for the adoption of a protective cartel, in accordance with which the three rival concerns will merge their conflicting interests. The object of this intimate form of fusion will be to safeguard each of the allied firms in submitting tenders for work for the execution of which, in consequence of previous business relations, any one of them would possess paramount claims. This will be effected by engagements on the part of the two other firms in the cartel to make their tenders in such cases higher than that of their rival. Firms not in the combine are either individually too feeble to oppose effectually the vast united interests ranged against them, or, on the other hand, their undertakings are too diverse in character to enable them successfully to attempt any joint resistance to the trust."

THE SMALL CENTRAL STATION.

Practical Hints on Its Construction and Operation.

CHAPTER IX. (*Continued.*)

ELECTRICAL EQUIPMENT.

The inductor-type alternator has its field in modern practice, although that field is getting more and more limited and will in all probability cease to exist in the next decade. Few manufacturers are at present building this type of machine, and several have ceased to build it entirely. Engineers as a rule do not recommend its installation.

Direct-current arc machines are better built today than ever before. They are wound for voltages as high as 13,000 and will operate up to 170 enclosed-arc lamps or 220 open-arc lamps. The current supplied varies from four amperes for enclosed lamps to 9.6 amperes for open lamps. These generators are supplied with regulators which will automatically care for from one to four circuits and give a satisfactory regulation from no load to full load. Arc generators will play little part in plants of the size under consideration.

For further data and prices on generators see the accompanying tables:

ARC GENERATORS FOR ENCLOSED ARC LAMPS.

5 Amperes.		6.5 Amperes.				
Volts.	No. of Lamps.	Volts.	No. of Lamps.	R. P. M.	Horse-power to Drive.	Price.
1,500	20	1,125	15	1,075	13	$ 625
2,400	30	2,000	25	1,000	20	725
3,600	45	2,800	35	925	30	1,025
5,200	65	4,400	55	900	42	1,225
6,800	85	6,000	75	875	56	1,650
8,800	110	7,200	90	800	75	2,050

Switchboards.—A switchboard should be so designed and built that it will require little or no expert electrical knowledge to operate. The switches should be so mounted as to be easily reached from the floor and should be certain of operation. Employ as few switches as will do the work required. In laying out the circuits on the back of the board, use common sense and avoid complicated wiring. You may want to make repairs in quick time. Avoid crossing circuits where possible to do otherwise. Mount fuses where they can be reached quickly and without danger. Mount your station transformers on iron brackets properly insulated and securely fastened. Do not place the transformers or rheostats where they will interfere with your replacing burnt-out fuses or with the reaching of switch lugs.

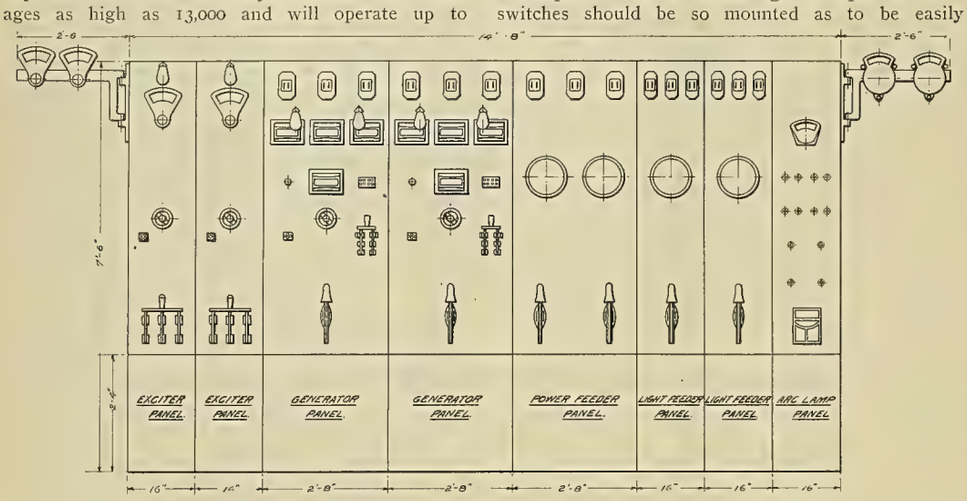


FIG. 19. THREE-PHASE ALTERNATING-CURRENT SWITCHBOARD.

On 2,300-volt circuits or those of a higher potential employ only oil-break switches. Quick-break air switches are dangerous and do not wear well, owing to the peculiar requirements of their design and construction. They are also uncertain of operation.

The front of the board should be sightly, and all instruments to be read often should be so mounted as to receive plenty of light. Do not crowd a panel with instruments, when by purchasing one a trifle larger there will be plenty of room.

Install the switchboard in the generator room so that the machine leads will be short and direct. Leave at least a three-foot space between the wall and the board, and have this space closed in by gates or by a similar protection.

The general arrangement of panels is as follows:

Exciter panel or panels at one end, generator panels next and feeder panel or panels at the other end.

This arrangement will allow additions to be made at either end and still maintain a uniform scheme of wiring on the back of the board, besides making it possible to keep switches used for the same purpose near each other.

To add a generator panel one should move the exciter panel or panels out and set the new panel in place alongside of those already used for machine service. Then put the exciter panel back in place at the end of the board. Extensions at the opposite end of the board will always be feeder panels, and so long as this arrangement is maintained there will be no limit to the additions that may be made without complications arising.

Fig. 19 shows a three-phase alternating-current switchboard which is in daily operation. The panel seen at the right end of the three-phase board is a feeder panel for series alternating arc lamps. Should an additional power or light panel be installed, the arc-lamp panel should be moved out and retained at the end of the board. This will make it possible to keep all similar feeder panels together and keep the odd panel of the board by itself. Fig. 20 is a wiring diagram for three-phase alternating-current switchboard.

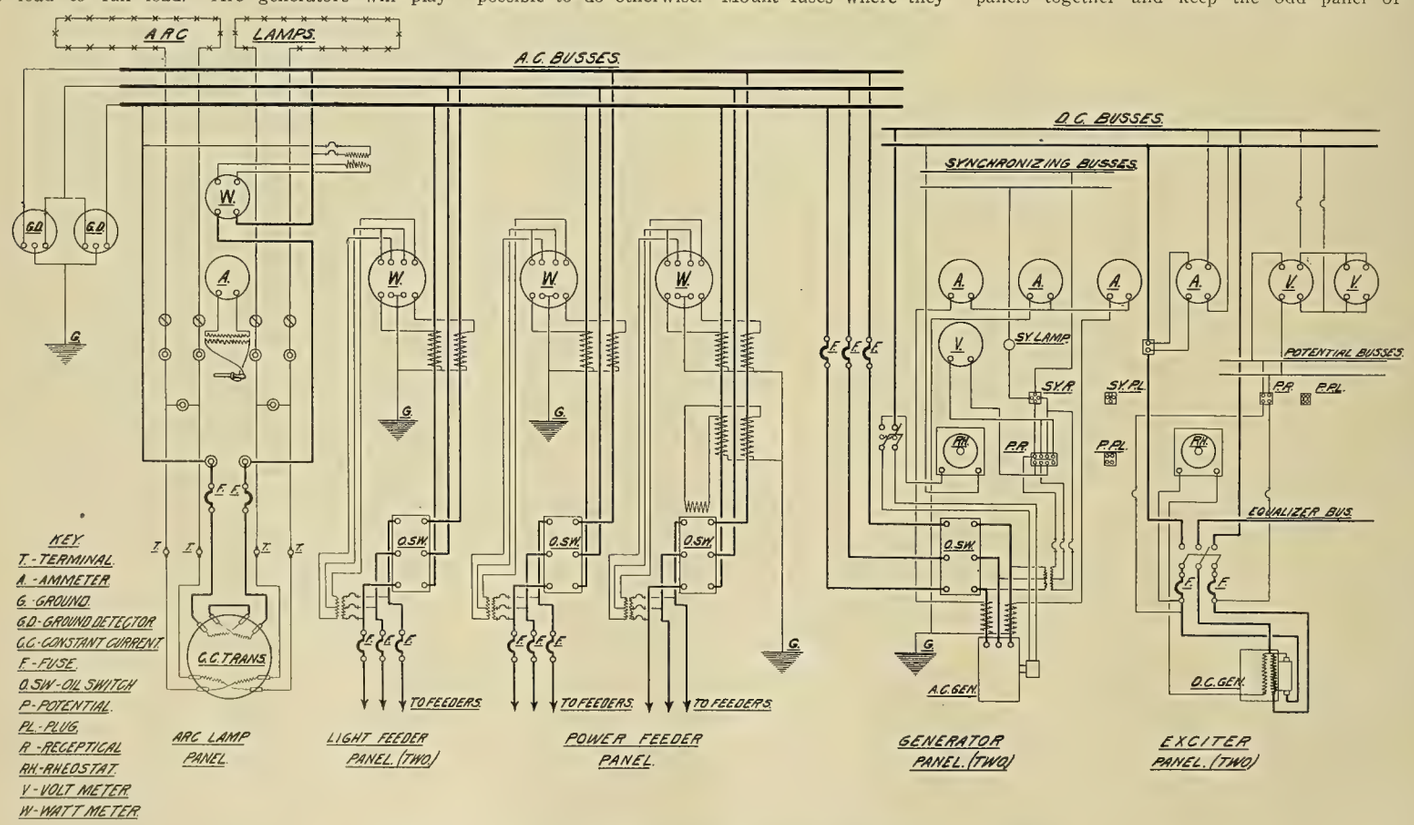


FIG. 20. WIRING DIAGRAM FOR THREE-PHASE ALTERNATING CURRENT SWITCHBOARD.

The single-phase switchboard follows the scheme already described and hence requires no further explanation.

ALTERNATING-CURRENT GENERATORS, 60 CYCLES, SINGLE PHASE, BELTED TYPE.

Capacity in Kilowatts	30	15	60	75	90	100	120	150	180	200
Volts	2,300	2,300	2,300	2,300	2,300	2,300	2,300	2,300	2,300	2,300
Revolutions per Minute	900	900	900	600	600	600	600	600	450	450
Price	$ 750	$1,000	$1,250	$1,500	$1,650	$1,750	$1,980	$2,450	$2,900	$3,200

Price includes slide-rails or base frame, exciter, exciter rheostat and generator-field rheostat.
Add 50 per cent. for direct-connected type apparatus.
Add 10 per cent. up to and including 90-kilowatt size for three-phase apparatus. Above 90 kilowatts, add 5 per cent.

CHAPTER X.

ARC AND INCANDESCENT LAMPS.

Arc Lamps.—The more satisfactory service derived from the use of the enclosed type of arc lamp has become so apparent to the general public that one now seldom finds the open arc in-

stalled for any purpose whatsoever. With the open arc it was necessary to re-carbon each lamp once in every nine or 12 hours. With the enclosed-type lamp the life of the carbon is increased to from 80 to 125 hours, depending upon the quality and length of the carbons employed With central stations this is an important factor in operative costs, since under the old regime a number of trimmers were kept continually busy doing the same work that now can be performed in a greatly reduced period of time by one man. Besides this important feature of the enclosed lamp there are a number of others worthy of mention, such as the entire exclusion of all possibility of fire from sparks, more uniform distribution of light, the use of arc lamps for inside illumination and the production of an illuminating effect more nearly approximating that of the sun.

Both alternating and continuous-current arc lamps are built of the enclosed type and so designed as to operate either in series or parallel, the mechanisms being arranged to suit the conditions of service desired.

A distinctive feature in the operation of an alternating arc lamp is the manner in which the carbons burn. Both carbons assume a conical shape at the arc and would be consumed equally, provided carbons of the same density were employed. This is not the case, however, since these lamps are invariably operated with one "cored" and one solid carbon. The "cored" carbon is naturally consumed more rapidly than the solid carbon. The "cored" carbon tends to maintain steadiness in the arc. In trimming, the carbon once used in the upper holder may be transferred to the lower holder and a new carbon inserted above. Never have two "cored" or two solid carbons in an alternating lamp at the same time. In ordering carbons for alternating arc lamps, specify an equal number of each kind, due to the possibility of employing the once used upper carbon for the lower holder.

The continuous-current arc forms a crater in the end of the upper carbon and a cone on the end of the lower one. This formation of the carbons necessarily throws most of the light down, thereby producing an extremely bright spot in close proximity to the lamp. Naturally all objects outside of this bright area seem dark and shaded by contrast. Enclosing globes, of course, remove much of this effect, but cannot destroy it entirely. For this reason the alternating arc lamp affords the best means of general illumination where large areas are being considered.

In purchasing arc lamps select a type having as few moving parts and as simple an operating mechanism as consistent with the conditions under which you desire the lamp to operate. Having selected a type and make of lamp satisfactory in operation, do not change. A number of different makes of lamps necessitates an equal number of different repair parts and insures trouble and loss of time.

For use in the lamp, purchase the best carbons to be obtained, as the successful and economical operation of an arc lamp greatly depends upon this point. When ordering your carbons accept the size recommended by the lamp manufacturer. He knows more about his own product than you do.

Always keep your lamps in good operative condition, and clean both the inner and outer globes at each trimming. See to it that the gas caps covering the top of the inner globe are kept free from dirt and rust, since the free admission of air to the arc will cause it to consume your carbons at a rapid rate and will produce unsteadiness in the light furnished. Never use oil about the feeder mechanism of a lamp. If these few simple suggestions are treated with consideration in the care and operation of arc lamps, they will give no more trouble than incandescent lamps.

Good, substantially constructed arc lamps cost from $16 to $20 each, depending upon trimmings, globes, etc. Most lamps for street use are furnished with opalescent inner and clear outer globes, although there is a difference of opinion on this point. Hoods and special shades or globes cost extra.

[*To be continued.*]

Newspaper dispatches from San Francisco say that the Southern Pacific Railroad is considering the use of electric power to take the heavy freight and passenger trains over the steep grades of the Sierra Nevada Mountains. Electric power can be easily installed, according to the preliminary reports, to do the work, with an increase over the present speed of the trains of about 100 per cent.

A Unique Electric Motor Installation.

There are many mills, especially in New England, which depend on two sources of power for their operations, either using water under ordinary conditions, or having an auxiliary steam plant to carry the load when the water fails during the dry season. An interesting adaptation of electricity as an auxiliary motive power under these conditions is to be seen at the mills of the Joslyn Manufacturing Company, South Scituate and Hope, R. I. This company operates three mills for the manufacture of shoe-laces and corset strings—the Richmond Mill, on the Ponogansett River, the Ponogansett Mill, two miles above the first on the same stream, and the Rockland Mill, situated about three-quarters of a mile west of the Ponogansett Mill.

The scheme in which electricity is used to adjust the differences between steam and water is highly interesting. The idea throughout the mills is to get along without using the steam engines. The Rockland Mill, located between the other two of the series, contains a small power house in which is installed a waterwheel-driven 200-kilowatt 2,300-volt three-phase General Electric generator, with switchboard. The mill is driven by a 175-horsepower induction motor supplied from this generator. The steam engine with which the mill was equipped as a reserve, is retained for that purpose, but will probably never be used, as at dry periods all of the available water is utilized by this mill alone, the pond near the Ponogansett Mill serving as a storage basin against the droughts. The electrical equipment in the Rockland Mill thus supplies power to operate that mill and assists, as well, to operate the other mills throughout the year.

The Richmond Mill, the second mill of the three, operating 24 hours per day, ordinarily uses the waterpower of the Ponogansett River, but has a steam-engine auxiliary for emergency. Here the electrical unit consists of a 75-kilowatt machine which can be operated either as a generator or synchronous motor, according to the following schedule: When the plant is operated by waterpower this unit is belted to the line shaft and runs as a generator in multiple with the 200-kilowatt generator at the Rockland Mill, taking its share of the load. When the water is low the unit is used as a motor, drawing current over the transmission lines from the Rockland Mill generator. The Richmond Mill engine is therefore seldom, if ever, used.

At the third mill, the Ponogansett, there is a 10-hour working day, and waterpower is depended upon entirely for operating the machinery. In this mill a 60-horsepower motor is used to drive the line shafting, while a 100-kilowatt synchronous unit operates either as a motor or generator in a similar way as in the Richmond Mill.

Both the Richmond and the Ponogansett mills are lighted by electricity, taking current through transformers from the transmission line.

In addition to this ingenious method of obtaining the most economical operation, the installation is further noteworthy because of the use of high-voltage motors within the mills. The transmission line enters each mill in rubber-insulated lead-covered cables, laid in galvanized-iron loricated conduit with the sheath grounded. The motor frames are likewise connected to earth, so that all danger of fire or shock is eliminated. The electrical equipment was furnished by the General Electric Company.

Audible System of Train Signaling in England.

Frank W. Mahin, consul at Nottingham, England, reports that the Great Western Railway has successfully experimented with and just installed on a branch line a method of audible signaling as a substitute for the familiar semaphore system which it is believed will be entirely displaced in course of time. The new system is electrically worked. The engine as it travels comes into contact with an apparatus fixed to the track, which is worked from the signal box, and sets in motion a form of mechanism on the engine. Instead of the engineer having to look out for his signals, they declare themselves to his ear unmistakably. "Line clear" is expressed by the blowing of a whistle, which continues until the engineer with his own hand turns it off. The new system is of particular importance in a country so fog afflicted as England.

QUESTIONS AND ANSWERS.

Large or Small Lamps for Signs.

QUESTION.

J. A. B., Chicago: A has a 50-candlepower lamp with a reflector arrangement for a sign. B, his neighbor, has a nearby sign in which 12 four-candlepower lamps are arranged as a border. Other things being equal, which sign will show the greater economy in current consumption?

ANSWER.

The question seems to be resolved down to whether the small or the large incandescent is the better. Assuming that the "other things being equal" means that both signs would be satisfactory from the viewpoint of utility of the light, that the lamps are of the same quality and give their rated candlepower, that the voltage fluctuation is the same in both circuits, there are left two differences.

First, there is a difference in favor of the smaller lamps of two candlepower. There is a difference against the small lamps, in that it is probable they would not give as good efficiency as the larger lamp. A test might give the following:

One 50-candlepower lamp at 3½ watts per candle = 175 watts.

On 110-volt circuit the current is 1.59 amperes.

Twelve four-candlepower lamps at 3.8 watts per candle = 1.66 amperes.

Two-wattmeter Measurement.

QUESTION.

M. L. K., Chicago: Can the power in a two-phase unbalanced system with common return be meased by the two-wattmeter method?

ANSWER.

Yes. The wattmeters, when connected as shown, give the true power. The power in such a system is $E_1I_1 \cos \alpha + E_2I_2 \cos \alpha$, where E and I represent voltage and current, respectively, and β and β the angles of lag in the two phases.

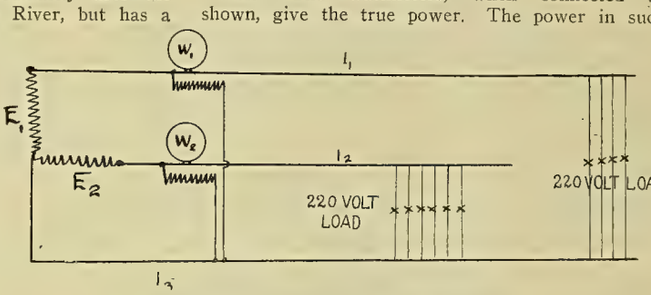


DIAGRAM OF TWO-WATTMETER MEASUREMENT.

Wattmeter (W_1) gives $E_1I_1 \cos \alpha$ and wattmeter (W_2) gives $E_2I_2 \cos \beta$. The sum of the wattmeter readings is therefore $E_1I_1 \cos \alpha + E_2I_2 \cos \beta$, or the power to be measured.

Standardization Considered by the British Association.

The report of the British Association committee on practical standards for electrical measurements makes reference to a conference of representatives of standardizing laboratories in Berlin last October, which was attended by representatives from America, Austria, Belgium, England, France and Germany. It was at this conference that a resolution was passed expressing the opinion that an international commission be appointed in order to bring about an agreement in the laws of different countries in relation to electrical units. As is now known, this commission met in London during the visit of foreign engineers there in July, but unfortunately its proceedings were not made public, and until some official report is published not much information is likely to be forthcoming. The American representatives were Dr. F. B. Crocker, Dr. A. E. Kennelly and Mr. C. O. Mailloux, while Canada's delegates were Dr. R. B. Owens and Mr. L. A. Herdt.

The British Association committee referred to above recommends that the international ohm, defined by the resistance of a column of mercury, and the international ampere, defined by the deposition of silver, should be taken as the fundamental electrical units. Further, that the international volt be the electromotive force which produces an electric current of one international ampere in a conductor whose resistance is one international ohm, and that the Weston cadmium cell be adopted as the standard cell. These recommendations were laid before the International Commission which met in London.

The Edison System of Southern California.[1]

By R. H. Ballard.

From the spring of 1895 to the spring of 1896 there was operated, first just outside of the city limits of Los Angeles, and later just inside (by reason of the extension of the corporate limits of the city), what might be called a miniature electric-lighting plant. During this time efforts were being constantly made to secure a regular city franchise for this plant, but not until the spring of 1896 was this accomplished. At that time, after a franchise had been twice refused, an old one turned up and was promptly purchased by the owners of this little plant. This franchise had never been used and would lapse in just two weeks' time unless light were furnished to the City Hall. By an almost superhuman effort, and with the assistance of one of the street-railway companies (on whose poles lighting wires were strung), one cluster of lights was turned on in the City Hall on the night before the day on which the franchise would have lapsed. Thereupon the West Side Lighting Company was incorporated, with a capitalization of $500,000 and an authorized bond issue of $300,000, and the more serious troubles of finance and the securing of business began, as the fight was then against a financially and politically well-entrenched company. The legality of the franchise was attacked, rates were cut, obstacles were put in the way of financing, and other troubles, large and small, constantly appearing, the building up of the business was no small task. The fight was carried on fiercely, but on account of the never-despair attitude of the West Side lighting people, a foothold was secured. Later a third company entered the field, and the fight was reopened, this time on a three-cornered basis, in a more severe manner than the original one.

The wonderful growth of Southern California has helped materially in building up the present extensive system from this small beginning, and with the careful handling of the business, from a financial and operating viewpoint, capital was interested in sufficient amounts to take care of the increasing business and to acquire many other properties by purchase and consolidation. In the 10 years between 1896 and 1906 the business has expanded to such an extent that at present electric current is being furnished to 22 separate cities and towns, and gas to 11. All of the properties have been consolidated into the present Edison Electric Company, with a capital of $10,000,000 and an authorized bond issue in the same amount.

The Waterpower Beginning.

One of the companies taken over by the Edison Electric Company through consolidation was the Redlands Electric Light and Power Company, which was organized in July, 1892. At that time electric transmission of power was certainly in its infancy, if it could be said to have been born. The market demand for this power was so located as to render necessary the installation of a plant capable of transmitting power varying distances of from five to 20 miles, and equally well adapted for use in incandescent lighting, arc lighting and alternating-current motor service. The directors of the Redlands company were informed by their engineer that to make the plant a commercial success they should install a tri-phase system then in experimental use in Tivoli, near Rome. The first attempt to get the large manufacturing corporations to bid on this type of apparatus was unsuccessful, all claiming that the idea was too far in advance of practice for them to undertake it; but after a number of months' correspondence the General Electric and Westinghouse companies were induced to bid on specifications drawn by the Redlands engineer, and the apparatus was finally built by the General Electric Company. This plant, which goes under the title of "Mill Creek No. 1," on the Edison system, began operation in October, 1893, and is still in regular daily use, operating in synchronism with all waterpower and steam plants on the Edison system. As a legacy from this first plant, the company has still in use the first three-phase generator, the first synchronous motor and the first induction motor ever put into commercial use by the General Electric Company.

The development of high-head waterpower on the Pacific Slope in 1892 was in as experimental a condition as the transmission of electric power, and the promoters of the Redlands company installed their plant at the head of the valley without entering the canyon, as has since been the Edison company's universal custom. The power was generated by diverting the stream of Mill Creek into a steel pipe 30 inches inside diameter, 7,250 feet long, and having a pressure head of 360 feet. Later, this pipe was extended 3,000 feet further up the valley to the mouth of the canyon, giving a total net available head of 510 feet, under which the plant is now operating.

Three 250-kilowatt generators were finally installed in this station, current being generated at 2,200 volts, stepped up through transformers to 10,000 volts, and transmitted to Riverside, a distance of 28 miles, taps being made from Redlands and Highlands from the same line. Later, the voltage was raised to 33,000. The appliances, both hydraulic and electric, in use at that time were extremely crude as compared with the highly specialized types of construction in use today, and naturally the difficulties to be overcome were numerous. Nevertheless, while the plant is not as efficient as other plants on our system, it has furnished us in the past and is still furnishing us with a considerable amount of power, and since the first experimental stage was over, the cost of operation and maintenance of the plant has been small.

Later Power Development.

While the development of a market for the power from the Mill Creek No. 1 plant was slow, each year showed the possibilities of electric power transmission, and in 1896 surveys were begun for the construction of a waterpower plant in the Santa Ana Canyon, using the water of Santa Ana River, on the other side of the mountains in which the Mill Creek plant is located. It was expected that the plant would transmit approximately 4,000 kilowatts to Los Angeles, a distance of 80 miles. This plant was subsequently built and began operation in 1898, being what is now termed "Santa Ana River No. 1" plant of the Edison system. The type of hydraulic construction since adopted by the company was first used in this plant. Water is conveyed through a series of tunnels along the canyon walls, on a grade of approximately 10 feet to the mile, to the head of a pressure main consisting of two steel pipes, each 30 inches inside diameter, 2,200 feet long, with a net effective head of 728 feet. The effectiveness of this type of construction has been thoroughly demonstrated by the fact that since the water has been turned into the tunnels it has never been turned off for any fault of the canal system, nor has any money whatever been expended thereon for repairs. The total length of canal line is approximately three miles, three-fourths of the way being driven through solid granite mountains. There are four three-phase 750-kilowatt generators installed, and the current is stepped up through air-blast transformers to 33,000 volts.

The growth of the business necessitating additional power, during the succeeding years several plants were constructed in the immediate vicinity of the first installation. Proceeding up the Mill Creek stream, the No. 2 plant, with a canal line of 3½ miles, a water head of 620 feet and a capacity of 750 kilowatts, was the next plant put in operation.

"Mill Creek No. 3" was next constructed, with 1,960 feet head, seven miles of canal and a capacity of 3,000 kilowatts.

Then followed "Santa Ana River No. 2" and "Lytle Creek" plants, both having 560 feet head and capacity of 2,000 and 1,000 kilowatts, respectively. The current is stepped up from all of these plants to 33,000 volts.

Transmission System.

Everything on the system is connected in Y with the neutral grounded through two circuits of No. 0 hard-drawn copper wire. Some of the plants are located five or six miles from the main line. Plants are also on extreme ends.

The pole line carries two circuits of No. 0 copper a distance of about 80 miles to Los Angeles.

Sub-stations are installed all along the line, in which the current is transformed and sent out on different circuits of 2,200, 10,000 and 15,000 volts. From the general distributing station in Los Angeles circuits are sent out to various sub-stations located in and around the several beach towns; consequently we are delivering power from the mountains over a distance of 129 miles, almost in a straight line to the ocean, with numerous branches all along the line. The present transmission line figures a total length in 33,000 volts of 110 miles; in double-circuit 10,000 and 15,000-volt transmission, 300 miles, and the 2,200-volt distributing systems in the several towns in which we are operating aggregate 750 miles. A great many difficulties have been encountered and overcome in perfecting this transmission system, an important one being the great distance we are from centers of manufacture. The growth of the business has been so rapid that it has seemed physically impossible to estimate the needs quite far enough ahead. This growth may in a way be noted from the fact that last year the peak load of the entire system increased 94 per cent. over the peak load of the previous year. Insulator troubles have come up more or less frequently; an insulator good for 35,000 volts in the mountains would not stand up at 15,000 volts on the coast.

Steam Plants.

In the general Los Angeles distributing station is installed 4,000 kilowatts in steam turbines, and we are just now installing an additional unit of 7,500 kilowatts, making a total of 11,500 kilowatts for the station. These machines have proven good for a 50 per cent. overload. The installation at this station is of the very best, comprising remote-control switchboard, motor-driven switches, all-concrete construction, and provision has been made for the distribution of 2,200 and 15,000-volt circuits and for the receiving of incoming circuits from the power plants, 33,000 and 66,000 volts. The 66,000-volt lines will be those of our new 20,000-kilowatt Kern River plant, which is nearing completion. In other parts of the system there are installed a number of small units feeding into the general transmission line, whose aggregate rated capacity is 4,000 kilowatts, good for some overload. All of the steam equipment is used as auxiliary for helping over the peak and for reserve in case of shorts or breakdowns along the line.

General Operating Conditions.

The six hydraulic and seven steam plants, varying from an ordinary, old-fashioned Wheelock simple engine to a Curtis turbine, are run in multiple, feeding into the one general transmission system. A great many comments have been made and some wonderment expressed upon the surety of our service, operating under these conditions, but no serious disadvantages have so far been experienced.

The speed of the hydraulic plants is set at two per cent. above normal, which guarantees their handling maximum load before any steam plants that are floating on the line cut in.

From six in the morning until midnight one of the 2,000-kilowatt turbines at Los Angeles is rotated as a motor, for the purpose of correcting the power factor, and to cut in in case of trouble.

The success of this multiple operation depends first on the proper construction of the plants, and then on a thorough organization of the working forces, with fixed rules to govern fixed conditions. All stations are interconnected with a private telephone system.

The natural trend of the country suggests high-head power plants, as the streams, while containing comparatively small amounts of water, have natural falls of from 200 to 300 feet to the mile. All of these plants are, as noted, high-head, but having in operation the Mill Creek No. 3 plant, with its 1,960 feet fall, the lesser ones suffer in comparison.

Other than the use of extra care in devices at the intake for straining out all solid matter, the operation of a plant with 840 pounds pressure does not differ materially from that of 300 pounds pressure. When we consider that the spouting velocity of the water discharging through the pipe line of the No. 3 plant is 22,000 feet per minute, the necessity for this extreme care is apparent.

The low cost of operating waterpower plants and the all-day load picked up in the vast area covered by the lines by reason of our ability to furnish power on very low rates, more than justify the extra investment in steam plants to insure the day service and carry the lighting load over the peak.

In many respects Southern California may be considered an ideal country for electric transmission and distribution. There is no doubt that the comparative freedom from windstorms, frost and sleet, with certain atmospheric conditions, helps materially. At the same time, there are few places in America where within a distance of 20 miles energy will be passing over lines enveloped in a snowstorm and through orchards covered with orange blossoms and surrounded with roses.

Kern River.

Work is rapidly nearing completion on our first Kern River plant, designed to generate 20,000 kilowatts and transmit same at 75,000 volts a distance of 120 miles to Los Angeles receiving station. It is expected that within a few weeks the plant will be in operation. In this plant the hydraulic construction work consists of a masonry dam 36 feet high, anchored on bed rock, which forms a small lake or settling basin, from which the water is turned into the canal, the flow being regulated by gates operated hydraulically. The canal consists of a series of 19 tunnels 8½ miles in length, nine feet by nine feet in cross-sections, drilled through solid granite, and lined along either side with a cement wall six inches in thickness, smoothly plastered and troweled, to give increased carrying capacity. These tunnels have a grade of 6.8 feet per mile and a water-carrying capacity of 450 second-feet. The water is discharged from the end of the tunnel into a small forebay, to which is connected the intake of the pressure main. The pressure main consists of a circular inclined tunnel, having a slope of approximately 76 degrees to a point 200 feet from the power house, where it changes to the same grade as the canal. This inclined tunnel has a riveted steel lining, 7.5 feet interior diameter, solidly backed with concrete between the lining and the outer walls of the tunnel. The lining terminates where it leaves the tunnel at its lower end in 10 branch pipes necessary for delivering water to the four generators and two exciters, under a net effective head of 865 feet.

In the concrete power house will be installed four 5,000-kilowatt rated capacity three-phase generators, with extended shaft, carrying on each end one waterwheel. The combined output of the two wheels at each generator is 10,750 horsepower, capable of delivering from generator to switchboard a 50 per cent. overload of the rated capacity of each generator. In addition, there are two exciters, each 250 kilowatts rated capacity, equipped with waterwheels. The four banks of transformers will step the current up from 2,400 to 75,000 volts.

The 120-mile transmission line consists of a line

1. A paper read before the National Electric Light Association at Atlantic City, June 8, 1906. Mr. Ballard is assistant secretary of the Edison Electric Company of Los Angeles.

of steel towers, designed to carry three circuits of No. 0000 wire, erected on a private right-of-way 100 feet wide. The two circuits will be used to carry the output of this first plant, the third to be strung later for carrying the output of a second plant immediately above the one now approaching completion.

The wide right-of-way will permit of the erection of an additional line of towers to transmit the output of other proposed plants on the Kern and Kings rivers.

The towers are constructed of angle iron, being 12 feet square at the base and varying in height from 30 to 60 feet, according to the nature of the country traversed. Both cross-arms are of 10-inch channel iron, the upper one being 24 feet long and the lower one 18 feet. These towers are spaced, on an average, 700 feet apart on the level, and vary from that distance to 300 feet in hilly country. They are designed to stand the greatest strain that can be put upon them, and are both strong and graceful in appearance.

Future Power Plants.

The plans of the company contemplate the eventual construction along the Kern River of four waterpower plants, in addition to the one now approaching completion. These plants are numbered on our records in order proceeding up the canyon, and with the several intervals between the intake of one plant and the power house of the one above it, the plants will utilize the fall of the river for about 80 miles. The water head will vary from 340 to 1,200 feet, and will give a total output of 50,000 kilowatts at the ordinary low-water flow of the stream. The type of construction adopted for the No. 1 plant, with slight variations to meet the conditions of each particular plant, will be carried on throughout the work.

In addition to the Kern River, the company controls water rights, on which some little work has been done, for an extensive system of waterpower plants on Kings River, and other smaller plants on the Santa Ana River. After the completion of the Kern River plants it is probable that work will be proceeded with on these plants, and an additional capacity of nearly 60,000 kilowatts added to the system.

Gas Plants.

From time to time we have acquired, by construction and purchase, the gas plants in 11 of the districts in which we handle the electric-lighting and power business. Primarily, the idea of our controlling the gas situation is for protection of the electric, as with our power facilities for the furnishing of electric lighting we do not ordinarily push the gas-lighting business to any extent, confining the operation of these plants as far as possible to the selling of gas for heating purposes. The ownership of a gas plant in a town in which we are operating electrically is often helpful in the settling of municipal questions, and in case of competition we have two weapons with which to harass the competing company. At the same time, gas operation is not confined strictly to the helping of the electric business, as, owing to climatic conditions and the low price of crude oil from which the gas is made, as compared with coal or other eastern fuel, we are able to sell gas to our consumers for $1 a thousand cubic feet in most of our gas districts, and still make a little money from the operation.

The Market.

Light.—Climatic conditions give us a large floating population, both winter and summer, and this class wants the best that can be obtained that will produce the least amount of daily and hourly labor. Being, as a rule, possessed of a goodly share of this world's riches, they are free spenders, and the constant daily association has its effect on the whole community. It is said that one can live as economically in Southern California as in any part of the country, but one does not do it.

This has its bearing on the demand for electric lighting, both in business and residence sections. The merchant must advertise freely, and under these circumstances there is no better advertising than a well-illuminated store equipped with electric signs. Seldom is a residence built without electric wiring, and, in addition to the modern lighting equipment controlled by convenient switches, many are fitted with electric appliances for heating and minor cooking. In a large way this accounts for the fact that while California ranks as the twenty-first state in population, it occupies fifth place in producing income from electricity for lighting purposes and second in the use of electricity for power purposes.

Particular attention has been paid to the business of sign lighting, and as a result of our attendance at the Denver convention last year we have recently adopted a successful policy of supplying the sign and taking care of it on a flat-rate basis.

Electric laundry irons are good income producers. During a period of 18 months several thousand of these were put out in laundries and private residences, and a carefully prepared record of the results obtained induced us recently to take up this class of business in a wholesale way by furnishing irons free to consumers.

Power.—Southern California does not rank as a manufacturing center; consequently the demand for current in large units for manufacturing purposes must necessarily be limited. However, the amount of power used by electric railways, railway shops, ice and cold-storage plants, brickyards, planing mills, machine shops, etc., is very considerable, as all of these take part in the construction of buildings and the development of the country.

As the backbone of successful waterpower operation is naturally the handling of a good day load, we have aggressively and persistently kept at this line of the business, until it is safe to say that the present percentage of power users having electrically driven machinery is larger than the percentage of those using other motive power, notwithstanding the fact that the natural fuel of the country is oil, which can be obtained at a low figure. In order to induce many of the consumers to make the change, we have had to buy up steam and gasoline plants aggregating hundreds of horsepower. These plants have been sold again, principally to mining camps and other places inaccessible from an electric distributing-system standpoint.

By this policy the load curve up to the peak is being straightened, but more business is still necessary to bring this curve to a straight line, starting and ending with the figure representing the total installed capacity of waterpower plants.

There is a certain kind of power business which is perhaps peculiar to Southern California, and this is of importance, owing to the conditions under which the power is required. Owing to the fact that for six months in the year no rain falls, it is necessary to do a large amount of irrigating. Only a small proportion of the water needed has a natural flow, and as a consequence the requirements of the country have largely to be met by pumping water from beneath the surface. The pumping season usually lasts from the first of May until the end of October; fortunately, just at the time of the year when we have the least demand for electricity for lighting purposes. As a rule, the pumping plants are operated during the day hours only, and the very great number of these plants that we are operating in all our districts is a considerable factor in the building up of our day load.

In the campaign of obtaining business careful attention has been paid to four important factors—advertising, soliciting, care of the business and courteous treatment of consumers.

Advertising is good; soliciting is better; a combination of both is excellent. By care of the business we mean prompt attention to the consumer's every want, adjusting troubles, be they his fault or ours. Courteous treatment under all circumstances makes friends who advertise for us.

Organization.

The officers of the company comprise president, three vice-presidents, general manager, secretary, treasurer, superintendent and general agent.

Subsidiary departments are in charge of these officers, the responsibility being divided sufficiently to obtain the best results through the work of specialists along different lines.

The power-development department, under the supervision of Vice-president H. H. Sinclair, builds all power plants and turns them over to the operating department, ready for operation.

In handling the operation of the properties and the additions thereto, the superintendent divides responsibility under three heads, viz., electric generation, electric distribution and gas manufacture and distribution, with assistant superintendents in charge.

Responsibility for commercial and financial matters is divided between the other officers reporting to the general manager.

The president, Mr. John B. Miller, takes an active part in the direction of the business, keeping in touch with all important transactions, and receiving reports from the several department heads, through the general manager.

The system is divided into 14 districts, in charge of district agents or local managers. In each we have also a district foreman, who is a technical man, receiving instruction from the superintendent, through the agent.

It is the custom to hold weekly meetings of department heads for general discussion of the business as a whole, and bi-monthly general meetings of all district agents, in which papers are read and questions on which agents may be in doubt are brought up for discussion in the form of question boxes. Quarterly the foremen of the system meet with the superintendent for general discussion of the handling of the technical side of the business.

A large part of the success the company has enjoyed is due to the enthusiasm and loyalty of everyone connected with the business. These features are very much in evidence throughout the company, from president to office boy.

I am indebted to Messrs. Sinclair, Selig, Pearson and Kennedy of our company for assistance in preparing this paper.

Considerable new machinery and apparatus is to be installed by the Florida East Coast Electric Light and Water Company of Miami, Fla., which intends to increase its capacity. J. A. Macgingle is superintendent.

Apprenticeship Course as a Preparation for Engineering Activity.

Before the engineering apprentices of the Allis-Chalmers Company at its Cincinnati works, on August 30th, Prof. V. Karapetoff of Cornell University delivered an instructive address. He said that there are three essential conditions for a successful engineer—professional knowledge, knowledge of business forms and of human relations, and a strong character. Following is an outline of the lecture under these three headings.

I. Professional Knowledge.

1. While in the works you learn the construction of machinery, the manufacturing operations and testing without a particular effort. However, the question "why" is of decided importance; do not be satisfied with "how." Get into the habit of analyzing. To get full benefit from the factory work:
   a. Keep regular notes on your work.
   b. Make sketches.
   c. Keep on a separate sheet your doubts, to be straightened out at a future opportunity.
   d. Make rough check calculations on machines you are working with.

The above is not sufficient by any means; you must devote part of your evenings to systematic study, namely:

2. Read at least one electrical magazine regularly and keep some kind of an index of information on at least one subject in which you are particularly interested.

3. Go over your college books and notes and see that you are sure in fundamentals. A few things that you must be absolutely sure of are: Ohm's law, general law of induction and its application to machinery, the law of electrical energy. Besides, you ought to know the general theory of direct-current and alternating-current machinery and transformers.

4. Gradually get familiar with the standard electrical books; go from time to time to the public library and see if there is anything new in your specialty.

5. Select some one branch of electrical engineering and devote all your extra time to it.

6. Do not miss a chance to make an original investigation whenever you have an opportunity.

II. Study of Human Relations and Business Forms.

You naturally expect some day to occupy responsible positions with this company or some other. This is impossible without a knowledge of human relations and business forms.

1. Observe the characters of men you are working with, in particular:
   a. Influence of age.
   b. Education.
   c. Nationality, etc.
2. Things that make them successful:
   Things that are an impediment in their work.
   Things that they would like to have.
   Things that make them happy and unhappy.
   Betterment work that they would appreciate.
3. Observe the foremen and their ways of conducting their departments.

Make clear to yourself what you would consider an ideal foreman.

Do not judge the foremen by the way they treat you.

4. Observe the general factory system as far as you can. In particular, gradually find out:
   a. General subdivision of duties of the executive officers; the management, commercial, engineering, manufacturing, erecting, selling department, etc.
   b. Arrangement of factory buildings and the general idea of this arrangement.
   c. Orders, cost, accounting, etc.
   d. Causes of waste of time and materials and possible remedies.

5. Get a thorough understanding of the significance of co-operation in modern industry.

6. Do not get rusty in regard to general life questions; continue reading books on philosophy, economics, history, etc. This will make human relations clearer to you. Besides, a man in a responsible position must be a well educated man; he should be posted on many general things and ought to be able to speak about them.

III. Training of the Character.

Engineering and business knowledge are the necessary conditions for usefulness ("success" and usefulness are not always the same), but the proper development of the character is the third necessary condition.

What is the use of having a profound engineering knowledge if you have not the necessary perseverance to achieve results? Or to have a knowledge of business forms and relations, if your temper is such that nobody cares to be associated with you in business?

Practice daily the qualities of the character that you find essential for a good citizen and good business man.

1. Work patiently on any problem until a result is achieved. If it should be impossible to get satisfactory results, at least make clear to yourself the causes and limitations.

2. Be honest in all things. Do not be afraid to

confess your mistake or ignorance. Train your character by doing over your work cheerfully.

3. Keep down your selfish personality and ambition. Do not let them interfere with your business. The highest form of personality and ambition is to have your part of the work done in the most ideal way.

4. Be generous, polite and considerate to others; there are no circumstances where you would be justified in breaking this rule. Remain dignified even under unjust reproof.

5. Remember that you work for the future; shape it aright now, and it will come as you expect it to be.

Comparison of Gas and Electric Lighting.[1]

Because of its rapid development, electric lighting has already been placed in sharp competition with other means of artificial illumination, and with one of these, namely, that depending upon the manufacture of gas, it can be compared. The gas industry in the United States is nearly a century old, dating from 1806, whereas central electric stations have been in existence only about 25 years, or since 1879, when two or three were to be found in limited operation. The latest available comparative census statistics for the two industries are shown in the following statement:

Comparative Summary of Central Electric Stations and Gas Plants.

	Central Electric Stations, 1902.	Gas Plants, 1900.
Number of establishments	3,620	877
Cost of construction and equipment	$504,740,352	*$567,000,506
Cost of supplies, materials and fuel	$ 22,915,932	$ 20,605,356
Salaried officials and clerks:		
Number	6,996	5,904
Salaries	$ 5,663,580	5,273,500
Wage earners:		
Average number	23,330	22,459
Wages	$ 14,083,112	$ 12,436,296
Income	$ 85,700,605	†$ 75,716,693

*Capital. †Value of products.

While these statistics for the two industries do not cover the same year the periods reported correspond sufficiently for a general comparison. The totals shown for central electric stations exceed those for the manufacture of gas in all the items except the "cost of construction and equipment," which is compared with the capital required for the gas companies. The capital stock and funded debt reported for the 2,049 central stations owned by corporations amounted to $627,515,875, and would possibly be the better total to compare with the capital reported for gas companies, namely, $567,000,506.

The income for the central electric stations was $85,700,605, while the value of the gas products was $75,716,693.

It is true that in order to give full credit to the electric-lighting industry it would be necessary to include the figures for isolated plants, which are usually assumed to be about equal to the central stations as regards extensiveness of equipment. These stations, however, would be offset by a large and unknown number of isolated gas plants. It is contended by authorities in the gas-lighting field that these statistics as shown are not so complete a demonstration of commercial parallelism between the two industries as they are assumed to be. According to Brown's Directory of American Gas Companies there were in the United States in 1903 about 950 gas companies making coal gas and water gas; over 400 natural gas plants supplying towns, and about 150 plants lighting towns by means of acetylene gas or gasoline. Therefore, for 1903-4 there would be about 1,500 gas-lighting plants for towns in this country, although all of them could not be designated as producers of manufactured gas. The natural-gas companies, moreover, are highly capitalized, the Philadelphia Company of Pittsburg, for example, having a capital of over $45,000,000. In connection with the investments it may also be pointed out that the dividends paid by central stations averaged 1.7 per cent., and the interest on bonds 4.7 per cent., while for the gas companies the rates were 4.2 per cent. on stocks and 4.9 per cent. on bonds.

The following table gives the relative distribution of the central electric stations and gas plants in cities of different population, and is very interesting in its revelation of the wider spread of electric stations:

Number of Central Electric Stations and Gas Plants in Places Classified by Size.

Population of Places in Which Located.	Central Electric Stations, 1902.	Gas Plants, 1900.
Total	3,620	877
Under 5,000	2,714	200
5,000 but under 25,000	675	484
25,000 but under 100,000	128	124
100,000 but under 500,000	73	39
500,000 and over	30	30

In connection with this table it may be stated that in the United States in 1900 there were 827 cities and towns in which one or more gas plants were in operation, while in 1902 there were central electric stations in operation in all but 153 of these places. It will be observed from the table that 75 per cent. of the central electric stations and 22.8 per cent. of the gas plants were in places of less than 5,000 inhabitants. This, however, does not reveal the full extent of the benefit conferred by electric methods, the area of distribution from gasworks being necessarily limited by physical and economic considerations, so that one gas plant cannot supply more than three or four communities, while the electric-lighting station can and often does supply light, heat and power to many towns and villages scattered over many square miles of territory.

In many cities the competition of the gas and electric industries is undoubtedly as keen now as it was at any time during the last 25 years. On the other hand, in several hundred towns and cities the gas and electric-lighting interests have been brought together and consolidated, very often on the initiative of the older gas interests, which have thus remained in control of the entire private lighting from a central source. There is a decided tendency toward this form of consolidation. In some places it already embraces also the street railways and the water-supply service, while one or two instances could be quoted where the telephone systems have also been taken into the combination. The most conspicuous instance of united ownership of gas plants and central stations is to be found in New York city, where the entire system of electric lighting is under the absolute control of the Consolidated Gas Company of New York.

This tendency toward combination has been stimulated frequently by the insensate competition between the managements of the two methods of illumination, but is also due in large measure to the recognition of the fact that electricity, as it emerged from the earlier stages of experimentation, gave every promise of becoming a stable and lucrative industry which could be operated quite advantageously along the lines already proved best in the development of gas lighting.

1. From "Central Electric Light and Power Stations, 1902"—a part of the Special Report of the United States Bureau of the Census on "Electrical Industries, 1902," just published. The text of the report was prepared under the supervision of Mr. W. M. Steuart, chief statistician for manufactures, by Mr. Thomas Commerford Martin, expert special agent.

Electric Motors in Competition with Gas Engines.[1]

By William Wolls.

It is not the writer's intention to enter into the theoretical details of this subject, but to make a comparison of the application and operation of the electric motor, gas and gasoline engine for commercial power purposes.

At the present day, there being much attention paid to the acquisition of new business, the most essential thing for the operating company to keep in mind is the fact that it is necessary for the business to be apparent in the first place, and in the second to be able to deliver the service to the customer to his entire satisfaction, and without interruption. It is generally a struggle to secure a power customer in the face of the keen competition of today with both gas and steam; but it is a matter of satisfaction to the engineer who is negotiating a commercial power deal to know that if he closes the contract and the customer's building or factory is equipped with motors the service supplied will be non-intermittent with pressure commercially constant, as there is no better reference than a satisfied customer.

There is not a shadow of doubt that the electric motor has many advantages over any other source of power in equipping a shop or factory for power, no matter whether the individual or group drive system is used. In the case of individual drive machines can be located irrespective of any main line shaft; the use of quarter-turn belts or angle drive, where they would be required, are eliminated, which reduces friction losses to a minimum. Another advantage in the motor drive is the fact that a new shop starting up, after all machines have been set and put in operation, can be rearranged in 90 per cent. of the installations by the person in charge of the factory, as he can see where a saving could be made, and possibly an increase in the output of the plant by changing machines to a more advantageous position for the work. But where the factory is being operated by a single prime mover with one main shaft, it is very difficult to move machines any great distance from the main shaft. However, in the case of the individual motor, the machines can be located any place and in any position, where there is room, regardless of the position of the prime mover and shafting; and the cost of making such changes is nominal compared with the shaft and belting methods. The absence of shafting and belts also makes possible the installation of cranes where required.

The electric motor is well adapted for use in pumping plants. To the writer's knowledge, in the last year in this city and its suburbs there have been a number of gas-engine pumping plants displaced by direct-connected motor-driven outfits. The advantages are in the reliability of service, the automatic control, and maintenance of the water level in a compression or open tank. The attendance required by the motor-driven pump is practically nothing, while with the gas engine it is necessary to fill oil cups and note the condition of the water-jacketing, guarding against freezing during the winter, and the general operation of the unit. In the failure to start much valuable time is generally wasted. Another point in the suburban plant that has been worked out in this vicinity is the feature of fire protection. The pump discharge is so arranged that it is possible to cut out the tank under fire conditions and pump direct to the fire main. Where these installations are made, as above, it is usual to try them out at least once or twice a week to ascertain their condition for emergency work, and in these cases so far on record they have not failed to be ready for service when needed.

The average gas engine that is installed for commercial power use is of the explosion impulse type, and gives a very perceptible variation in angular velocity which unfits it for use where constant torque or pull is desired, and the effect is very telling on the upkeep of the shop equipment of shafting, hangers, belts and the alignment of same.

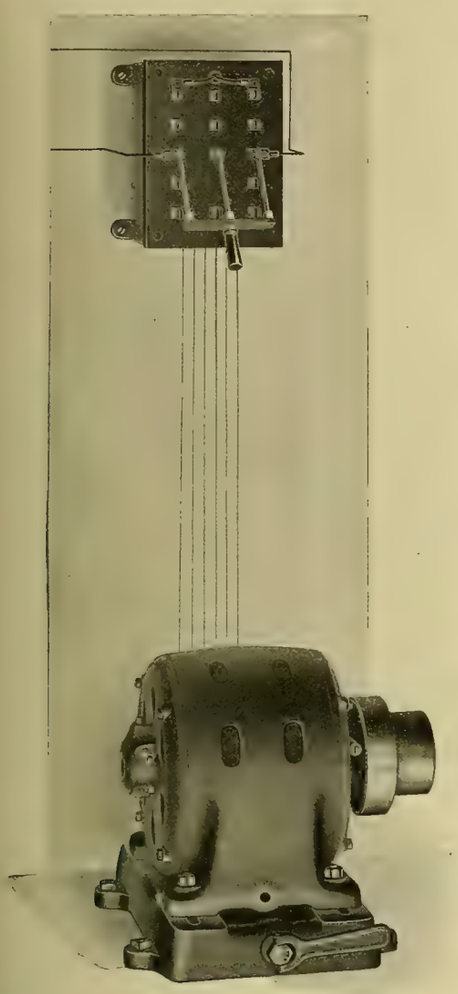
An instance illustrating the above point came under the writer's observation, where a factory had in use two 54-horsepower single-cylinder four-cycle gas engines, one of which was connected through lines and countershafts to two large grinding machines for surfacing circular saws. The grindstones, when new, were five to six feet in diameter, with 4½-inch face, and maintained a peripheral velocity of from 2,000 to 2,100 feet a minute by means of changing pulleys on the shaft as the stones became smaller in diameter. Considerable trouble was experienced with the flywheels on engines working loose and in coming entirely off, and apparently the only remedy in sight was a new set of wheels. After some time it was impossible to run the engines continuously for a half day without shutting down to push the wheels into place and tighten the bolts in the hubs. After looking over the outfit it was very plain to one of experience that the trouble was in the nature of the load the engine was driving, as the equipment consisted of very heavy shafting, wide paper or wood pulleys, also a good grade of heavy belting, making a very efficient system as regards loss of power from slipping, but it, together with the inertia of the grindstones, was responsible for the trouble at the engine, as there was no flexible agent to receive shocks of the engine impulse, and it was a common thing to break belts between grindstone and its driving shaft. The manager of the factory said that the engine originally cost $1,200, and to date $900 had been spent for repairs, the engine having been in operation about three years.

The merits of electric-motor drive were explained to the manager; also the best method of adapting it to meet the requirements of their factory, and the central-station representative agreed to loan and install a motor on one grinding machine. When a 15-horsepower motor was suggested the saw manufacturer said that if a 54-horsepower gas engine could not drive two machines without working such disaster to itself, as was apparent in their case, no 15-horsepower motor could drive one machine. After explaining that the failure of the 15-horsepower motor to do the work would not effect a loss of any kind to him or his company, he agreed to let the work proceed, but it was apparent that it was his belief that the representative of the power company did not know what he was doing. One 1,150-revolution 500-volt shunt-wound 15-horsepower motor was used and belted direct to the pulley on the grindstone. The pressure of the stone on the saw being ground was controlled manually by means of a hand-wheel and screw, and the maximum observed horsepower was 21, at which time the operator of the machine stated he was giving the motor all the load possible. A run was made for a total of 346 hours, with a kilowatt consumption of 2,301, giving an average of 8.9 horsepower per hour. The manager said that they were getting out about 15 per cent. more work each day and the motor giving no trouble whatever, all belts running perfectly quiet, which showed a constant torque, whereas before belts were continuously flopping and otherwise uneasy. The expression used by the manager in this case was that he did not think it was possible and would not have believed it had he not seen it himself. The fact is that he has been made a strong advocate of the electric-motor drive.

Another instance of gas-engine failure came to the writer's notice at a park in this city, where there had been constructed a large swimming pool, it being necessary to have at all times a large quantity of fresh water. There were two wells drilled on the premises for the purpose of obtaining the necessary water supply, and at each well was installed one pump, which was operated 24 hours a day. There was installed and belted direct to each pump one five-horsepower vertical gas engine of a well-known manufacture. The operation of the engines and pumps was good for about one week, at the end of which time it gradually became necessary for a man to be in attendance to replace parts that would become loose and drop from the engines and to keep the same in operation, and at the end of the second week the final break occurred which put the two engines out of commission. At the time the equipment was contemplated the representative of the power company tried to interest the park management in the

1. A paper read before the Ohio Electric Light Association at Put-in-Bay Island, August 22, 1906. Mr. Wolls is connected with the Columbus (O.) Railway and Light Company.

installation of motors for the pumps, but they would not consider them, having been informed by the gas-engine salesman that the cost of operation would be excessive compared to engines, they not being able to see the loss to the park by the failure in the operation of engines which meant the suspension of business, and the supposed cheap method was adopted. The power company's representative, knowing what would be the fate of such an installation, had been keeping close account of the operation, and was on hand at the



SINGLE-PHASE INDUCTION MOTOR WITH STARTING BOX.

time of need with the remedy, the result being the installation of one three-horsepower motor on each pump (the gas engines were five horsepower), which were run continuously for 2½ months without giving any trouble, and were in good condition at the end of the park season, the gas engines being disposed of by weight.

In the above instances and in many others of a similar nature, where the gas engine was discarded and electric motors installed, the change has invariably been considered a betterment by the customer.

The writer, however, does not wish to go on record as even intimating that all gas engines are liable to failure, such as the foregoing cases show, as there are many engines which have been operated for a number of years successfully.

There are of course many conditions under which the application of the gas engine could not be considered. One of these is the driving of large newspaper printing-presses.

The cost of power alone should not be the determining factor in the choice of motive power. A comparison as to the first cost, weight, floor space occupied, cleanliness, noiselessness, ease of manipulation, freedom from repairs and reliability of operation shows every point to be in favor of the electric motor. Furthermore, the gas engine has no overload capacity; consequently it is necessary to install an engine to meet maximum demands, which, in many cases, will be entirely too large for average operating conditions, seriously affecting the efficiency at such load. It is also necessary to put in a heavy foundation upon which to mount the gas engine, while the motor is usually placed upon the floor or mounted out of the way on the side wall or ceiling. The gas engine is not self-starting; hence a loose pulley or clutch device must be used to enable the machine to reach full speed before taking the load.

By adding the increased first cost of a gas engine over an electric motor, the heavy annual cost of repairs and depreciation, the claim of low fuel consumption is somewhat discounted, and even more important is the loss of time due to frequent and annoying shutdowns, as the efficiency of a shop or factory depends upon the continuity of operation.

There is no doubt that the gas engine of today, operating under the supervision of an expert, is a success as to the economical use of fuel, but for the commercial operation of shops and factories the electric motor is well capable of maintaining its position.

It is, of course, necessary that the solicitor of power business have an engineer's training, as each prospective installation calls for most careful consideration of details, and it is seldom that similar conditions prevail in any two plants. It is usually upon his judgment that the success of the installation and satisfaction of the customer depend.

Single-phase Induction Motors.

The field for the use of single-phase motors of moderate capacity is constantly growing by reason of the increasing tendency of central stations to generate polyphase current and feed a large portion of the lighting load through single-phase distribution. Power is frequently required near such circuits for the operation of light machinery, and it is conveniently furnished by the installation of the General Electric Company's type IS, form KG single-phase motors.

The new motors are of the same simple, sturdy design as the General Electric Company's polyphase induction motors and are also similar in appearance. The frames are cylindrical in form with removable end shields, the position of which can be shifted 90 or 180 degrees for wall or ceiling suspension, respectively. The fields are made up of a large number of thin punchings of the best quality of soft steel assembled under heavy pressure between the end frames.

The armatures are of the high-resistance squirrel-cage type, consisting of a number of slotted soft-steel disks assembled upon a shaft and carrying in the slots copper bar windings which extend beyond the core at each end and are permanently connected to short-circuiting rings. The windings are similar to those of a three-phase motor, consisting of a large number of coils placed progressively in the slots. Some of the motors are fitted with three terminals, while the others have six terminals. The feet of the one-quarter and one-half-horsepower motors are slotted to facilitate tightening the belt. With the larger motors iron sliding bases are provided for this purpose, although motors can be supplied without bases if so desired. All bases are designed for supporting motors when installed on floor, side wall or ceiling. Motors of one horsepower and larger are fitted with clutch pulleys so that they can be started under full load while drawing only two to 2½ times full-load current. The clutch is so arranged that pulleys of various diameters may be substituted for the ones ordinarily supplied. This is accomplished by the use of a sleeve in connection with the moving member of the clutch on which the pulley itself is carried. The sleeve is slotted and arranged to take standard pulleys, which are held in place by a key and set-screw. Should it become necessary to change the pulley it can be readily removed and replaced by one of the desired diameter or by a pinion.

The motors are rendered self-starting by means of a starting box containing a resistance and reactance and a double-throw switch. This is first thrown to the starting position, and when the armature has attained almost full speed it is quickly thrown over to the running position, the object being first to throw the resistance reactance in circuit with the motor and later to disconnect it.

In the case of motors provided with six leads, the winding connections are changed through the starting box at the time of throwing over the switch from Y to delta connection. By this arrangement a starting torque of approximately 150 per cent. is obtained with 200 per cent. of full-load current. The small motors without clutch pulleys develop a starting torque of approximately 125 per cent. of full-load torque. The speed of an induction motor is regulated by the frequency of the supply circuit and is not materially affected by variations of voltage, so that the motors will operate at full load at from two per cent. to five per cent. less than synchronous speed.

The standard motors are wound for 110 or 220 volts, 60 cycles, in sizes from one-quarter to five horsepower inclusive. The standard winding for larger motors is 220 volts. Satisfactory operation can be expected over a range of voltage or frequency considered together of 15 per cent. either above or below normal.

It is said that when these motors are operated from the regular lighting circuits no appreciable effect is produced upon the lamps, providing the circuits are well laid out and supplied with sufficient transformer capacity; or, if preferred, they can be placed upon separate transformers. In either case, one kilowatt of transformer capacity should be allowed per horsepower of motors installed.

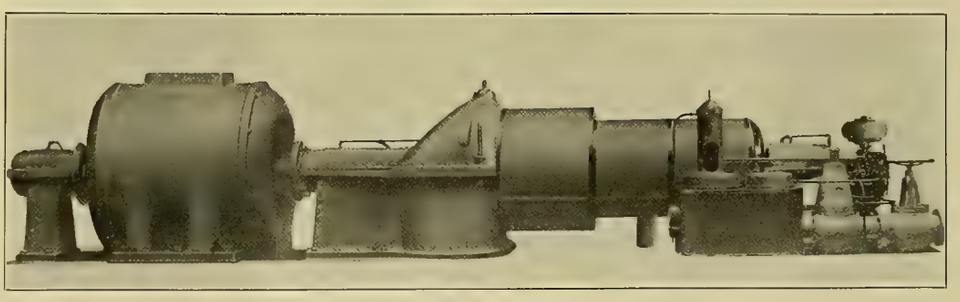
Allis-Chalmers Steam Turbine.

Steam turbines are divided into two general types, the "impulse" and the "reaction," by the Allis-Chalmers Company, in a recent bulletin. In the impulse type, quoting from this authority, the steam, before doing any useful work, is expanded in nozzles of various shapes, its pressure being considerably reduced, while it acquires a high velocity before acting upon the revolving buckets or blades. In some constructions there is only one row or ring of revolving buckets, and the turbine runs at a very high speed proportionate to that of the steam, thus necessitating the employment of gearing to reduce the speed to workable limits. In other constructions two or more rows of buckets are used, each of which rows absorbs a part of the high steam velocity, thereby reducing the turbine speed. For the purpose of obtaining a better economy, in the newer impulse turbines the steam is passed through several successive sets of nozzles and their subsequent rows of buckets, necessitating a very careful adjustment of the pressures and velocities by the accurate proportioning of nozzles, buckets and turbine speed.

In the reaction type the steam acts directly upon the blades without initial reduction in pressure, except such as may be effected by the governor in securing speed regulation. The steam flows through a large number of rows of blades, alternately stationary and revolving. Guided by the stationary blades upon the revolving ones, the steam expands continuously throughout the length of the turbines, alternately gaining velocity and imparting it to the rows of blades, partly by impulse, but to a greater extent by the reaction, as it issues from the revolving blades. There is no violent change in pressure at any time; the reduction seldom exceeds three pounds at any one row of blades, and the velocities are therefore comparatively small.

Having been offered patent rights for turbines of both types, the company mentioned says that it finally decided upon the reaction type as the one which would give the best all-around satisfaction and which could be considered a fit companion to the high-class reciprocating engine with which the company has been identified. The accompanying cut shows a 1,500-kilowatt Allis-Chalmers steam turbine and generator.

In the horizontal type adopted the whole of the apparatus, turbine and generator, can be taken apart and reassembled in a comparatively short time, and the turbine and generator can be worked upon simultaneously by different gangs of men.



1,500-KILOWATT STANDARD ALLIS-CHALMERS TURBO-GENERATOR UNIT.

Electric Power for Scotch Steel Smelting.

An important development in the Scotch steel-smelting industry is contemplated. A wealthy London and Glasgow syndicate has decided to seek parliamentary powers to utilize the fishing waters of Loch Awe in the western highlands of Scotland for the purposes of electrical generation. It is said that steel smelting upon a large scale and by a hitherto unknown process in Scotland will be entered upon, if the application to Parliament be successful.

The city of Dalny in Northern China, which came into the possession of Japan with the fall of Port Arthur, will soon be opened for commerce as a free port. Since the city was turned over to the Japanese they have renamed it "Dairen." The city was known as the model city of Russia in the Far East. It has electric light and power, telephones, etc.

Lightning Arresters.

[From the Question Box of the National Electric Light Association.]

QUESTION.

What is the best practice in caring for lightning arresters and keeping records of lightning storms and effects?

ANSWER.

E. C. Deal, Public Service Corporation of New Jersey, Hackensack, N. J.: If arresters are properly located and are of good design, it will only be necessary to have them inspected once a year. This should be done in the spring, just before the storm season comes on. Have the most important arresters, such as station and junction-pole arresters, inspected after each storm. I do not consider records of lightning storms of any value. I think your transformer history, if you have one, will tell the tale.

QUESTION.

How many lightning arresters should be used per mile on an alternating-current circuit of 2,200 volts?

ANSWERS.

A. W. Zahm, Brice Gas and Electric Company, Mason City, Iowa: This depends upon conditions. Always place the arresters at the highest point in the line, have them properly grounded and have not less than two per mile.

E. C. Deal, Public Service Corporation of New Jersey, Hackensack, N. J.: Have good installation of arresters on each feeder leaving the power house and a set on a pole one span from each transformer connected; that is all that is necessary. If you have a five-mile run of 2,200-volt line between which points you have no apparatus connected, it is only necessary to install arresters on each end of the line.

Beacon Light Company, Chester, Pa.: Some districts are much more open to atmospheric disturbances than others, consequently a very liberal installation of arresters is absolutely necessary.

Ralph R. Laxton, Apalache Water and Power Plant, Grears, S. C.: I prefer grouping arresters near station on purely transmission lines having no branches. Am using, on a 12,000-foot 2,300-volt line connecting steam and waterpower plants, a bank of arresters in each station and another bank on nearest pole to each station, and expect to put choke coils between last arresters and switchboard at each end of line. On distribution lines the arrangement of arresters should be such as to protect each branch and its transformers. Probably a half-mile between banks of arresters is not too much in average practice, but this depends upon the number of transformers, etc., to be protected.

QUESTION.

What make of lightning arrester would be the best on construction carrying 1,000 volts? How many are necessary per mile, and what method would be considered best to properly install ground wire from same? Formation of soil is stony.

ANSWERS.

A. W. Zahm, Brice Gas and Electric Company, Mason City, Iowa: The General Electric Company and the Westinghouse Company both make satisfactory lightning arresters for this purpose. Have not less than two per mile. Where formation of soil is stony, have an extra large ground plate made in the following manner: Dig a trench at least two feet wide and six feet long to a depth of not less than five feet. Fill the bottom of hole with fine-crushed coke. Place ground plate, consisting of a sheet of copper about 18 inches wide and six feet long, on top of this coke. Add coke to the depth of at least six inches and tamp thoroughly. The addition of a quantity of salt will maintain moisture and add to the value of the ground plate. The ground wire should be thoroughly attached to the plate throughout its entire length.

E. C. Deal, Public Service Corporation of New Jersey, Hackensack, N. J.: There are several makes of good lightning arresters for 1,000-volt lines. I have had experience with those of the General Electric and the Westinghouse companies and find them very good. Attach ground wire, if possible, to a near-by water pipe or trolley rail. If this cannot be done, attach ground wire to a copper plate not less than 18 inches square, which should be buried sufficiently deep to insure its being surrounded by moist soil at all times. Better still, bury it in a bed of fine and well-tamped coke. Another method that I consider very good in connection with new work is to put down a galvanized iron pipe from four to six feet in the bottom of post hole before throwing in the pole. Attach ground wire to the galvanized-iron pipe, and coil several feet of the wire in the bottom of the hole. Chuck pole on top of the pipe and coil of wire. Then carry wire up the pole to the arrester.

QUESTION.

Give good plan for grounding lightning arresters.

ANSWERS.

Edison Illuminating Company of West Chester, West Chester, Pa.: Our experience in connection with the grounding of lightning arresters has shown that the grounding of copper plates in coke, so often recommended, is not satisfactory. We have dug up copper plates that had been one year in a bed of coke in damp ground that were very badly corroded. We have, therefore, abandoned the use of coke. Now drive 1.25-inch galvanized-iron pipe as deeply into the ground as possible, placing beside it a copper plate 36 inches long, planted just deep enough that the top will be exposed above the surface. We have observed that, in nearly all lightning storms, the shower of rain which precedes the severe lightning will wet the surface and thereby give us a ground of some value at the top of the plate, should the earth be very dry beneath the surface.

D. L. Ott, the Wilmington City Electric Company, Wilmington, Del.: The standard bolted made-up junction devices, in seasons of heavy load, were depended upon to handle as high as 700 amperes each. Contact surface too small, nuts becoming loose and fuses shearing off on account of wind strains on joints almost annually disrupted service at critical time. The equipment was replaced two years ago by substantial soldered lugs mounted on fiber centers bolted securely. Have handled two seasons' peak load without one interruption.

Indiana Telephone Items.

A long-distance telephone and telegraph line combined is being constructed from Terre Haute to Louisville, Ky., by the Independent telephone interests. The line is being constructed on the line of the old "State Road," passing through the southwestern part of Clay County, by way of Howesville. At present only two wires are being suspended, but the poles have a capacity of forty wires. The line is to be extended northward from Terre Haute to Chicago.

The New Long-Distance Telephone Company has just completed new circuits from Indianapolis to Thorntown, Tipton, Elwood, Logansport, Bedford and Gosport, a total of 385 miles. Within another month additional circuits will be completed from Indianapolis to Wabash, South Bend, Huntington, Fort Wayne, Muncie, Kokomo and Anderson.

The State Board of Tax Commissioners has successfully resisted the suit of the Western Union Telegraph Company for injunction to restrain the board from certifying to the county auditors of the state the assessments as fixed at $69 a mile. The company insisted on the board reducing the amount to $32 a mile. Judge Baker refused the injunction and the cause was dismissed.

The Indianapolis Telephone Company will make another effort to secure an amendment to its present franchise to allow the company to increase its rates. The company is encouraged by a recent Maryland Supreme Court decision to the effect that a municipality may not legally restrict a public utility company in the matter of rates, if the rates promulgated are reasonable.

As a result of a citizens committee of Richmond, which visited Columbus, Ohio, to inspect the automatic telephone system there, the Richmond Home Telephone Company made the announcement on August 29th that it would install an automatic telephone system of the latest type. The committee gave the system at Columbus a thorough test and voted unanimously to advise the local company to install an automatic system.

The Citizens Telephone Company of Kokomo had a guy wire anchored in Warren Fellows' yard. Mr. Fellows said he gave the company 300 days' notice to remove it. Failing to comply, he cut the wire, which caused the wires to sag and they came in contact with a trolley wire and were burned in two. Mr. Fellows was arrested for malicious trespass under the Indiana statute and was fined, his being the first case brought under the new law, and has attracted considerable attention.

The Milan Telephone Company of Milan is completing a new exchange. One hundred and fifty copper metallic lines comes into the exchange through lead cables, and in addition all toll lines entering the town will be accommodated. The new switchboard is of the Stromberg-Carlson bridging type and of the latest improved pattern. S.

Ohio Telephone Notes.

The National Telephone Company of Wheeling, W. Va., has arranged with the United States Telephone Company to build a line from Wheeling to Cambridge, Ohio, which will give the West Virginia companies direct communication with Columbus and Toledo. The United States Telephone Company is also at work on its new lines from Columbus to Cleveland and Springfield.

A franchise ordinance is being arranged to be presented to the City Council of Newport, Ky., and it will be sold to the highest bidder. The successful bidder will be required to put two miles of wire under ground the first year.

A new Bell toll line has been completed from Cincinnati to Hamilton and another is being constructed between Hamilton and Middletown.

The Central Union Telephone Company is arranging to build a branch exchange on the east side in Columbus. The company is now erecting an exchange building on the north side and is also building a new central building. The equipment for Columbus will thus be almost new. The capacity of the plant when these buildings are completed, will be 20,000 telephones.

The Sunday Creek Telephone Company has been organized by a number of Cleveland men to build an exchange at New Lexington and other points in the Hocking and Sunday Creek valleys. It will be an Independent company and will have the long-distance service of the United States Telephone Company.

The Home Telephone Company, a new Independent organization, has been granted a franchise to build a plant in Ironton. The company was organized some time ago with S. P. Humphrey as president. It will connect with other Independent lines in Lawrence County and there will be a line between Ironton and Huntington.

The Cuyahoga Telephone Company now has 23,500 subscribers, a gain of 800 since June 1st. C.

GENERAL TELEPHONE NEWS.

W. T. Nelson & Co. have engaged in the telephone business in Mineral, Kan.

The Grayson County Telephone Company of Sherman, Texas, has sustained a loss by fire.

The North Dakota Independent Telephone Company will ask a franchise for a local exchange at Fargo, N. D.

The People's Telephone Company will build a new plant in Leavenworth, Kan., and will put all wires underground.

The South Dakota Union Telephone Company of Northville, S. D., has been incorporated with a capital stock of $50,000.

The Northwestern Telephone Exchange Company has increased its capital stock by $5,000,000, to cover the cost of extensions and improvements.

A company is being organized to establish a telephone system in Sulphur Rock, Ark. Sam Tuggle, W. R. Rice and J. C. Gill are interested.

The Bay Shore Telephone Company of Green Bay, Wis., has been incorporated with a capital stock of $10,000 by Henry F. Hagemeister, J. B. Duchaben and others.

Valley City, N. D., will probably be made headquarters for the North Dakota Independent Telephone Company. The construction materials are being shipped there for distribution.

Among the recently incorporated telephone companies are the Lenora Telephone Exchange Company, Lenora, Kan.; Atkins Telephone Company, Atkins, Ark.; Chillicothe Telephone Company, Chillicothe, Texas; Home Telephone Company, Jonesboro, Ark.

The Japanese Department of Communications intends to establish telephone-exchange offices at 130 more cities and towns, the work to cover seven years. The cost is estimated at over $10,000,000. During the present fiscal year telephone-exchange offices may be established at 12 or 13 places out of 80 whence applications have been received. Some 2,000 subscribers will be enrolled at these places.

Maxwell Blake, consul at Funchal, reports that a telephone system is badly needed on the island of Madeira. The different business enterprises carry on trade throughout the island, which is rather mountainous, so that communication is difficult. The island is 36 miles long and three miles wide. A franchise for a telephone system might be secured from the Lisbon government, especially if Portuguese capital were interested in the enterprise.

A practical test will soon be made of the electric telephone invention of J. W. Tatum of Durham, N. C., who believes that he has solved the problem of preventing head-on collisions between trains. About two miles of telephone line will be put up on the Durham and Southern Railroad for the experiment, a company having already been organized to exploit the invention. The device is nothing more than the establishment of telephonic connection between engineers on the same line, whether approaching or receding from each other, and if it is a success it will be very useful on single-line railroads.

When the young Spanish queen returns to Madrid she will be presented a magnificent silver telephone set. It is the wedding gift of the officers of the telephone company. The telephone consists of three pieces. The base is in Louis XV. style, and surmounted by the columns of Hercules, at the feet of which is sitting a small boy holding the Spanish arms. He is in telephonic communication with an English girl, beside whom crouches the British lion. On the top of the columns a Renaissance arch supports two Cupids, who hold the transmitter. The apparatus, which is of solid silver, is crowned by the arms of Spain and England.

CORRESPONDENCE.

Continental Europe.

Paris, August 20.—The new electric plant which has been erected at Brigue, just outside the mouth of the Simplon Tunnel, in order to supply current for the electric locomotives within the tunnel, is at present equipped with a three-phase alternator of the revolving-field type, furnished by the Brown-Boveri firm. This machine is rated at 1,200 to 1,500 horsepower, which is a sufficient capacity for running the locomotives at present. It operates at the low frequency of 16 cycles, and delivers 3,300 volts. With it are used two exciters of the four-pole type, rated at 95 horsepower each, and delivering 125 volts.

Experiments have been made lately at St. Petersburg with an electric train which uses a gasoline engine in connection with electric motors. The train is made up of six cars drawn by a locomotive of special construction. In the locomotive is mounted a 40-horsepower gasoline engine, which is coupled direct to a generator. After passing through the switchboard and controller, the current from the machine is taken into each car by a cable which runs the whole length of the train. Each car is mounted on two trucks, and carries a double-reduction motor on each truck. In this way the locomotive forms an electric plant which supplies current to the motors of the cars. A series-parallel coupling of the motors is given by the controller.

The Société Energie Electrique du Littoral Méditerranéen, which is one of the leading companies in the Mediterranean region, installed a large plant not long ago in connection with the Compagnie Française Thomson-Houston in order to afford a good supply of current for the city of Toulon. It is to be used for lighting as well as for the city tramway lines. A hydraulic plant of some size is located on the Argens River at Entraygues, and it sends current at 28,000 volts over a 40-mile overhead line to Toulon. The station contains three main turbine groups of 1,000 horsepower each, delivering 3,500 volts. A bank of transformers raises this to 28,000 volts for the line. Sub-stations at Toulon and other localities reduce the voltage to the proper amount. The Entraygues plant also furnishes current for many of the towns and villages in the region.

A new process has appeared for making lamp filaments of tungsten or molybdenum. A very fine carbon filament serves as the base, and the metal is deposited upon it by flashing in an atmosphere of gas containing the metal. When the deposit has the proper thickness the carbon is burned out by using a high current in a chamber filled with rarefied hydrogen, in order to form a carbide, and then heating it a second time to eliminate the carbide in an atmosphere formed of water vapor and a reducing gas.

Tantalum lamps have been put on the market in Paris by one of the leading firms. The standard type is a 50-candlepower lamp, which is guaranteed for a life of 1,000 hours, and it is claimed to run upon 1.6 watts per candlepower. The new lamp is sold for four francs (80 cents).

I may also mention the new mercury-vapor lamp which has been brought out by the Allgemeine Gesellschaft of Berlin, in connection with a syndicate formed in that city for operating the system. The lamp is constructed of quartz, and is claimed to be a great improvement, and the cost of running it is low. As it gives a high candlepower, it may be used in many cases to replace arc lamps.

A number of firms in and near Paris are building small gasoline motor and dynamo sets, and these are coming extensively into use in France, owing to their compact form and the great convenience in running them. One of the most recent of these groups is built by the Masson firm and uses a two-cylinder gasoline motor. Next the crank-case is mounted a heavy flywheel, and adjoining it is a four-pole dynamo. The whole is well enclosed in a tight casing, and a special ventilating device secures a good cooling of the dynamo. An oil-pressure system is used on all the bearings.

It is stated that the patents for the Birkeland and Eyde process are for sale in certain countries. This process, as will be remembered, has been successful in the production of nitrous products from the air by means of a special form of electric furnace, using the arc with a heavy current. It is to be used in practice to obtain nitrates such as are of commercial value.

An up-to-date electric-tramway system was installed in the city of Bologna, Italy, not long since by the Compagnie Français Thomson-Houston. Here the animal-traction lines were changed over, and were also extended considerably. Current for the new lines comes from a central station which has been erected for the purpose in the suburbs. It contains three main groups of 230 kilowatts each, driven direct from tandem-compound horizontal engines. The generators are worked in parallel with a 300-cell storage battery. The cars are of a small type containing 45 places in all, and are equipped with GE58 motors. At present there are about 60 cars running on the different lines. A large car shed and repair shop is erected at La Zucca, in the suburbs, beside the generating plant.

Among the most recent steam-turbine plants which have been installed on the Continent is the plant erected by the Brown-Boveri Company at Pforzheim, Germany. It contains three direct-current generators of 500 kilowatts each and delivering 260 volts. The dynamos are mounted upon the same foundation plate with the turbines, so as to form a compact group. The same company has supplied three similar turbine-generator sets for the municipal plant at Geneva. A. de C.

Great Britain.

London, August 22.—It is taxing all the ingenuity and skill of Sir George Gibb, who was elected to fill the place of the late C. T. Yerkes as managing director of the District Railway, to bring that undertaking into a good financial position, notwithstanding the high hopes held out to the shareholders of dividends when the period of complete electrification should have been reached. The whole of the company's lines are now being worked electrically, and the plea made in the last few half-years, that the full fruits would not be realized until this period arrived, no longer holds good. After a full six months' complete electrical working the bald fact stares the directors in the face that they are working at a loss. The expedient aimed at is to increase the fares, but whether this will meet with the public approbation is somewhat doubtful. It is true that an enormous number of workmen are being carried on this line at a positive loss, but the real secret of the comparative failure of this line to pay is that for the particular routes which it serves the competition is so severe, both by motor omnibus and the Central London Railway, that something more than mere electrification is needed. The anticipations were that electric traction would sufficiently reduce the working expenses to make the line pay almost without additional passengers, but in spite of electrification and increased traffic there is still this deplorable condition of affairs. Really the undertaking is a mystery, if the suggestion made above as to too much accommodation for the traffic to be served is put aside. The best men in the country have been secured by the company, and the most up-to-date American methods have been adopted. Do these latter not synchronize with the more phlegmatic temperament of the Londoner? It may be an interesting sociological problem, and not a technical one after all! It is a curious commentary that the electrified lines of the Northeastern and the Lancashire and Yorkshire railways, designed and evolved on purely British methods, have been successful.

The subject of railway electrification in Great Britain is one worthy of fuller treatment, which I will do next week. In the meantime, I would just mention that the contract with the Allgemeine Elektricitäts Gesellschaft of Berlin for the conversion of some 12 miles of suburban line in London on the single-phase system has been finally sealed by the directors of the London, Brighton and South Coast Railway Company. As before stated, only the motor equipments will be made in Berlin, the remainder of the equipment having been sublet to home contractors. The supply of electrical energy will be given by one of the London supply companies with whom a contract for seven years for a minimum of 4,000,000 units per annum has been entered into.

The London County Council tramway finances are in a very flourishing condition, notwithstanding the terrible things prophesied by its opponents. With an incomplete system on the south, and only just commencing electrification on the north, the net surplus for the year ended March 31, 1906, was no less than $312,500, after paying capital charges, but without putting anything to reserve. Actually about $120,000 was available for relief of the rates, but the council does not intend to do this in view of the special circumstances surrounding the undertaking and the transition stage in which it must remain for some time yet. It may here be mentioned that the new Cross car shed of the council, which has just been completed, is the largest in England, being capable of accommodating 280 cars.

The only overhead railway in England, viz., that at Liverpool, finds it increasingly difficult to make both ends meet, mainly owing to the corporation tramway competition. Under the circumstances, a strict inquiry has been made into the working expenses, and considerable economies have had to be effected. Through-running is also being arranged and extended with the electric lines of the Lancashire and Yorkshire Railway, which runs between Liverpool and Southport.

After paying interest and sinking fund, the Glasgow municipal telephone system last year showed a profit of only $250, against $7,500 for the previous twelvemonth. G.

New England.

Boston, Mass., September 1.—The Boston Elevated Railway Company has ordered 50 more semi-convertible cars for use in the East Boston Tunnel and on lines running into the Sullivan Square station. The company has been using 50 of these cars for some months and has found them satisfactory. The seats run crossways and the large windows can be easily opened.

The Telephone Toll Meter Company of St. Johnsbury, Vt., has been organized. It has a capital of $25,000 and it owns patents on a device for measuring the time during which a telephone is in use.

The Boston and Northern and the Old Colony Street Railway companies are installing semi-convertible cars on their lines connecting Boston with Quincy, Salem, Lawrence and Lowell, Mass. The cars are operated by multiple control.

The Massachusetts Gas and Electric Light Commission has approved an issue of new capital stock which will yield $75,000, by the Haverhill Electric Company, the proceeds to be used for the payment of promissory notes amounting to $62,500 and additions to the company's plant, which cost $12,500. The stock is to be sold for $160 per share.

The Boston, Lowell and Lawrence Electric Railroad Company seeks authority to build an electric railway between Boston and Lowell, Mass.

The Old Colony Street Railway Company is asking authority to carry baggage and freight in the towns of Raynham, Bridgewater and Middleboro, Mass.

The next Maine Legislature will be asked to charter a company to build an electric railway between Springvale and Bridgton Junction, a distance of 40 miles. It will be known as the Ossipee Valley Line. The directors are headed by George W. Hanson of Sanford.

The Boston Elevated Railway Company and the Boston and Northern Street Railway Company are negotiating with the Metropolitan park commissioners in an endeavor to have the latter modify the plans for an electric railway through Middlesex Fells, the companies having failed to accept the locations granted them within the time fixed by the commissioners.

The General Electric Company is building a large foundry on the old ball grounds in West Lynn, Mass.

The Twin State Gas and Electric Company of Hartford, Conn., has filed a certificate of incorporation in Connecticut. Its maximum capital is $1,700,000. Its franchise, among other things, authorizes the company to generate and transmit electricity and acquire water rights. William M. Wherry, Jr., Harold G. Villard and George D. Martin of New York are the incorporators.

The Standard Manufacturing Company has awarded the contract for a brick building, three stories high, 30 feet wide and 90 feet long, in Bridgeport, Conn. The company manufactures electrical supplies.

Workmen who were demolishing a bridge connecting Newton and Watertown, Mass., came across a conduit which they decided was useless and they cut it away, severing 760 telephone wires, including trunk lines connecting the Bell Telephone Company's Newton exchange with Cambridge, Waltham, Medford, Malden and Somerville. The men were working under the direction of the Watertown superintendent of streets, and that town will probably be called upon to pay damages.

The Edison Electric Illuminating Company of Boston reports, for the year ended June 30th, gross earnings, $3,780,911; expenses, $2,443,286; net earnings, $1,337,625.

It is believed that the recently formed New England Security and Investment Company, which has assumed control of all the electric-railway properties in Massachusetts owned by the New York, New Haven and Hartford Railroad Company, has obtained a controlling amount of the Boston and Worcester Street Railway Company's stock. This would give it a line of electric railway from Boston to the New York state line with a branch from Worcester, Mass., to Hartford, Conn.

The Worcester Electric Light Company has been authorized to issue 2,000 shares of additional stock at $160 per share. The proceeds of 1,200 shares are to be used for installation of underground conduits and wires, and the remainder to pay for other additions to the company's property. B.

New York.

New York city, September 1.—The Kings County Electric Light and Power Company has made application to the state commission on gas and electricity to increase the capital stock of the company from $8,200,000 to $10,000,000.

The New York Phonograph Company has begun an action in the Supreme Court, Brooklyn, which involves large phonograph interests. It seeks to prevent about 250 defendants from buying phonographs from the Edison Phonograph Company. According to counsel for the plaintiff, his client in 1888 purchased from the National Phonograph Company all its rights to sell phonographs in this city. Through the formation of the Edison company later, he alleged, the National company was enabled to get back into this territory, because of which the plaintiff had suffered a loss of $10,000,000. Counsel for the plaintiff has asked for permission to examine by open commission Thomas A. Edison and others as witnesses. Justice Jaycox has reserved decision as to whether he shall admit the suit on the complaint submitted.

The complaints over the delay in getting action on applications for patents in the United States Patent Office continue to grow, and it is now

said that Congress will be asked to provide some means to hasten the work. According to Frederick W. Barnaolo, a patent lawyer of this city, the number of applications pending has steadily increased during the year, so that now it is practically 11 months before the applicant hears from the Patent Office in reference to his patent. In the week ended January 2d of this year there were 17,353 applications for patents awaiting action and only 669 patents were granted. In the week ended August 2d there were 21,611 applications pending and but 512 were acted on.

The application of the Manhattan Railway to the State Railroad Commission for permission to issue $4,800,000 additional stock covers the stock which remained in the treasury of the company at the time of its lease to the Interborough Rapid Transit Company. The authorized capital of the Manhattan Elevated is $60,000,000, of which $55,200,000 is outstanding. This treasury stock has been held in reserve to provide for the cost of improvements and other expenditures by the Manhattan Railway. The amount spent by the Interborough Rapid Transit Company for the account of the Manhattan Railway since the lease of the latter in 1903 amounts, it was said yesterday, to close to $7,000,000.

Bridge Commissioner Stevenson submitted his quarterly report today. The receipts over expenses of the Brooklyn Bridge for April, May and June were $22,028. The Williamsburg Bridge showed a profit for the same period of $3,349. The report showed that the Manhattan Bridge has so far cost $5,861,000, with $9,200,000 yet to be expended upon it. The Blackwell's Island Bridge has cost $4,483,000, with $3,738,000 more to be spent to complete it. Horses and vehicles to the number of 305,603 crossed Brooklyn Bridge during the second quarter of the year. Surface cars numbered 363,056, an increase of 15,479 over the same period of 1905. C. I. C.

Ohio.

Cleveland, September 1.—The properties of the Cincinnati Gas and Electric Company have been turned over to the Union Gas and Electric Company on a lease, as agreed some time ago. The deposit of $5,000,000 as a guaranty and improvement fund has been made in the banks, and everything is now in shape. A few days ago the capital stock of the company was increased from $10,000,000 to $20,000,000. In New York, a few days preceding the formal transfer, the stockholders held a meeting, when Norman G. Kenan, Casper H. Rowe, Reuben A. Holden and J. T. Carew, representing the Ohio interests; J. W. Gill of Lima and George D. Heard, representing Pittsburg interests, and Henry A. Everett of Cleveland and George W. Young, O. L. Gubelman, A. S. White and A. B. Leach, representing the eastern capitalists, were elected to the directorate. The officers chosen temporarily are as follows: President, A. S. White; vice-president, George W. Young; secretary, Theodore Caluss; treasurer, James Campbell. It is said that Norman G. Kenan will be made president within a short time, the delay in placing him in that office being a desire to complete the details of the transfer, as he is also president of the old company.

The Dayton Street Railway Company of Dayton has been incorporated with a capital stock of $10,000 by Dennis Dwyer, Charles Bosler and others.

At a meeting of the City Council of Columbus a few days ago an ordinance was introduced and read a second time fixing the maximum price for electric current at seven cents a kilowatt-hour. The ordinance is the same as the one defeated in the federal court some time ago, except the price is changed from five to seven cents.

People of Hamilton will vote upon the proposition to issue $350,000 bonds for the purpose of rebuilding the waterworks, gas and electric plants, which are in bad shape. It is stated that unless the bonds are issued, the plants will have to be leased to private corporations.

Reports have been circulated that the owners of the New York Central system have made an offer for the properties of the Columbus Railway and Light Company, Columbus.

On application of Gorman Bros. of Toledo, R. H. Burgonn of Fremont and Willis Baldwin of Monroe, Mich., have been appointed receivers of the Toledo, Ann Arbor and Detroit Railway Company. The firm built a power house for the railroad company. It is said that the difficulties of the company involve the disappearance of $300,000 bonds which were issued some time ago.

A few days ago the Cleveland City Council passed a resolution to the effect that it would entertain no further negotiations with the Cleveland Electric Railway Company until it ceased its opposition to the new three-cent-fare road. This is looked upon as a move to prevent the company from submitting its offer to a vote of the people. Mayor Johnson has announced that the offer is not what the people should vote upon. There is some doubt as to the power of the Board of Elections to handle the question, even if it is submitted, but the company has announced its willingness to pay the expenses of a special election for that purpose. The officers believe that their offer will appeal to the people as the best manner of settling the long contention.

On September 5th the Northern Ohio Traction and Light Company will inaugurate through cars from Cleveland to Canton. This will double the limited service on the line from Cleveland to Akron, where through limited cars are already operated.

The Columbus Railway and Light Company has equipped some of its cars with handle-bar shields to prevent women from getting off the wrong way.

The Dayton Lighting Company has brought injunction proceedings against the Citizens' Electric Light Company to prevent its operating under the law passed last winter, and under the act of the City Council in granting it a franchise. It is claimed that the amendment to the law, providing that the question of a new company beginning business in a city should be submitted to a vote of the people, was not submitted to Governor Pattison, and is not legal.

The Ely syndicate has been granted a franchise for street railways in Steubenville. The first ordinance was vetoed by the mayor because of certain objectionable points, but these were omitted from the last form.

Officers of the Cleveland Electric Railway Company are considering a plan for building new repair shops at Norwalk. The company now has shops at Fremont.

The Forest City Railway Company is planning to furnish light at Cleveland, as well as operate street railroads, it is said, and the old pumping station, which was leased a few days ago, may be used for a plant. O. M. C.

Southeastern States.

Charlotte, N. C., September 1.—United States Circuit Court Judge T. R. Purnell has at last signed the order for the sale of the Buckhorn Falls Power Company at Raleigh, N. C., after the sale has been advertised four successive weeks at the court house door of Chatham County, Pittsboro, N. C., where the sale will occur. The contract for completing this big plant will be sold with the rest of the plant, the mortgage debt being $350,000.

The Baltimore Passenger and Power Company announces that it will put in a double track system to the scene of the Jamestown Exposition, from Richmond, and as soon as right-of-way is secured work will be started. The railroads are also expected to put in any needed tracks to aid in handling the crowds.

G. W. Ragan and W. W. Glenn of Gastonia have bought the Narrows of Tuckaseegee River near Dillsboro, N. C., with eight acres near the fall of the river and power will be developed for a cotton mill and other enterprises.

The Richmond Traction Company in its application for the right to lay 1,800 feet of track on a new route, is meeting with strong opposition in Richmond where a systematic improvement of streets and boulevards has been inaugurated, and it is claimed that the tracks will despoil the beauty of the streets. The Civic Improvement League is active in opposing the plan.

The Louisville (Ky.) and Northern Railway and Lighting Company, has perfected a plan for revising its passenger rates to Charleston and two sets of commutation books are being put on sale.

The petition of the Danville (Va.) Street Railway for a 30-year franchise to operate cars and do an electric-motor business, has been turned down by the common council. The company had been engaged in the motor business for several years but this is now in the hands of the city. The company did not ask for an exclusive franchise but asserted that it could lower the price of electricity as compared with city charges.

At the general depot of the quartermaster's department, Washington, D. C., sealed proposals in triplicate will be received until 2 p. m., October 11, 1906, for electric conduits, wiring system, electric elevator plant, etc., for the Walter Reed Army General Hospital, Army Hospital Grounds, Washington, D. C. Proposals should be marked "Proposals for constructing, etc., Army General Hospital, Washington, D. C.," and addressed to Capt. A. W. Butt, quartermaster, Washington, D. C.

At Hagerstown, Md., Judge M. L. Keedy, on behalf of surviving trustees of bondholders of the Chesapeake and Ohio Canal, ratified a contract with the Martinsburg Power Company to supply water power from dams Nos. 4 and 5 in the Potomac for milling and other industries.

The United Railways Company of Baltimore, Md., will shortly build four new car barns at a total cost of $500,000. It is proposed to have the Maryland Railways Company erect the new barns as part of the contract in the financial plan. The Maryland recently sold $4,000,000 five per cent. first mortgage bonds and part of these proceeds it is understood, will be used in erecting the new structures. L.

Indiana.

Indianapolis, September 1.—The Evansville and Cannelton Traction Company has filed articles of incorporation, capital stock is $10,500. It is proposed to build street and interurban roads serving Evansville, Booneville, Newberg, Rockport, Christney, Granshaw, Troy, Tell City and Cannelton, and to supply electricity for light, heat and power in these towns. F. W. Cook heads the incorporators.

All of the grading on the Seymour extension of the Indianapolis, Columbus and Southern Traction Company is about completed and steel will be laid at once. A traffic agreement has been effected between this company and the Indianapolis and Louisville Traction Company by which the limited cars on the local line will run from Indianapolis to Louisville and vice versa. The running time between Indianapolis and Louisville will be about four hours, which is about forty minutes slower than the steam road. The subject of fares between Louisville and Indianapolis has not yet been decided by either road.

Direct traction connection between Indianapolis and Cleveland, Ohio, by almost an air line route is made probable by the announcement that the link between Portland, Ind., and Celina, Ohio, is to be constructed immediately. The Western Ohio Railway Company, which operates a line 110 miles long from Piqua through Lima to Findlay, says that it will build the link without delay unless the syndicate represented in Ohio by W. Kesley Schoepf and in Indiana by Hugh J. McGowan does so.

Traffic was officially opened on the Connersville extension of the Indianapolis and Cincinnati traction line this week. A special chair car made the first trip, which was entirely satisfactory to the officials. The transformer at the power house was connected and the current went over the high-tension wires for the first time. The party was in charge of Chief Electrical Engineer J. D. Nichols and there were 50 guests on the first trip, composed of local employes at the offices and their wives and officials of the road. Hourly service was opened Wednesday to accommodate patrons to Rush County Fair.

The interurban roads of Indiana handled more trains and more cars in August than in any previous month. July was a good month but August has kept every bit of equipment in full service all the time.

The Ft. Wayne and Wabash Valley Traction Company will extend its South Calhoun Street tracks in Ft. Wayne, eight squares southward to the city limits, to meet the tracks of the Decatur, Ft. Wayne line, now almost completed to the city limits.

The proposition to install a new fire alarm system in Kokomo has been revived and it is thought little or no opposition will be encountered this time. The matter is now before the Council.

The Frankfort Heating Company of Frankfort has incorporated with a capital stock of $100,000. The company proposes to establish a larger heating plant. John D. Ross, G. W. Neal and H. C. Sheridan are among the directors. S. S.

Northwestern States.

Minneapolis, Minn., September 1.—It is announced that plans have been completed for financing the Chicago, Kenosha, Milwaukee and Lake Geneva Railway Company, and it is thought that construction work will be started this fall.

The council of Webster City, Iowa, is preparing a franchise which will be voted on this fall granting the Boone-Webster City Interurban Railway Company permission to build a street-car line. The survey for the proposed interurban line has been started.

The Milwaukee Electric Railway and Light Company will extend its trolley line to Horlicksville, Wis.

The Engineering Construction and Securities Company of Chicago is negotiating for the purchase of the electric-light plants at Atlantic and Red Oak, Iowa. If successful, it will build a trolley line between the two towns.

A franchise for three years was granted at Eveleth, Minn., to the Northern Electric Company, which also received the contract for the city lighting.

The Wausau (Wis.) Street Railway Company has filed articles of incorporation with a capitalization of $60,000. Neal Brown heads the list of stockholders. The work of construction will be begun this fall.

Bids are being taken at Two Harbors, Minn., for a new engine, generator and switchboard for the electric-light plant.

The Duluth Edison Company has accepted the council's offer for a contract for the city lighting at Duluth, Minn. The matter has been under discussion for a long time.

There is talk of establishing an electric-light system at Wyndmere, N. D.

The Belle Plaine (Minn.) Electric Light, Power and Heating Company has incorporated with $15,000 capital. J. R. Stratton is president and W. N. Southworth secretary.

The engine and dynamo at the electric-light plant at Princeton, Minn., are to be replaced with larger ones.

Estimates are being made at Pierre, S. D., for an electric-light plant which will cost about $25,000.

A. C. Runyan of South Haven has offered $70,000 for the electric-light plant at Escanaba, Mich., provided the council will grant him a 30-year franchise. R.

Texas.

Austin, Texas, August 30.—The building of a new bridge across the Colorado River at Austin is contemplated. The Austin Electric Railway Company has planned to etxend its line to South

Austin when the bridge is built. The proposed Austin-Lockhart interurban electric railway will also use the bridge. The preliminary arrangements for building the latter road have been about completed and construction may commence in the near future.

It is stated by W. O. Allen of the Citizens' Light and Traction Company of Fort Worth that the matter of building an interurban electric line between Fort Worth and Mineral Wells is now under consideration.

The building of an interurban electric railway between San Antonio and Hondo by way of Castroville, Quihi and New Fountain is proposed by eastern capitalists. Bonuses have been raised in the smaller towns, and a preliminary survey of the route of the proposed road has been ordered. It will be 25 miles long.

A street-railway system is to be constructed at Abilene by John H. Morrow and associates. The City Council has granted a franchise for the use of the streets.

Since Stone & Webster of Boston took hold of the project of building an interurban electric railway between Galveston and Houston a few months ago, a preliminary survey of the route from Houston to Virginia Point and from the Galveston Island side of the bridge to the end of Broadway in Galveston has been completed. The route cannot be determined upon definitely until it is known what action is to be taken in the matter of building a causeway across Galveston Bay. The building of this causeway is practically assured. It will be used by the railroads entering Galveston and by the interurban line and for vehicles.

The El Paso Electric Company is extending its street-railway line to Fort Bliss. The War Department approved some time ago the application for right-of-way of the proposed line across the Fort Bliss military reservation.

The Amarillo Traction Company, in which James T. Brock and associates are interested, will build an electric street-railway system at Amarillo. The necessary franchises were obtained from the city some time ago.

The Beaumont Traction Company is making important extensions of its lines to residence portions of Beaumont.

The construction of an electric railway from El Paso to Engle, N. M., is now being financed.

W. D. H.

Pacific Slope.

San Francisco, August 30.—John Martin, promoter of the California Midland Railway, which holds rights-of-way and franchises for an electric-railway line to connect Nevada City, Grass Valley and Auburn, Cal., with Marysville, is credited with negotiating for a sale of the system, as it stands, to the Northern Electric Company. The latter company has an electric road in operation between Chico and Oroville and has perfected arrangements with the counties of Sutter and Yuba and the city of Marysville for the construction of a joint combination bridge across the Feather River between Marysville and Yuba City. Marysville and the two counties will contribute $50,000 and the Northern Electric Company will contribute the remainder of the expense of the structure, which will cost over $90,000.

The United Railroads of San Francisco has six new suburban electric cars on the way out from St. Louis, and others will follow shortly. Twelve cars of this class, costing $12,300, will soon be on hand for use on the San Mateo line, and the cars formerly operated between San Francisco and San Mateo, a distance of 20 miles, will be put in the city service. The new cars have mahogany interior finish. They are heavier than the old cars and are geared for higher speed.

The periodical rumor that the Southern Pacific Railroad Company is about to adopt an electric system for the operation of its main line over the steep grades of the Sierras in California and Nevada is again in circulation. The company has been securing estimates from time to time from the large electrical-machinery concerns as to the probable cost of such installations, but the officials do not admit that any immediate construction is in view. The changing over of the Oakland and Alameda local steam lines, which connect with the San Francisco ferries, is, however, being seriously considered, and it is more than possible that something will be done in the near future toward a beginning in this direction. Officials intimate that a large oil-burning steam plant for generating electric power for the operation of the local trains would probably be first installed in a convenient location near the water front, as the supply of power that could be secured from electric companies is too uncertain.

The Canadian Pacific Railway and the British Columbia Electric Railway Company are negotiating for the construction by the former of a railway nine miles long from New Westminster to Eburne, B. C., the road to be electrically operated by the latter. Arrangements are also being made for the electrical operation of the Canadian Pacific branch lines from Westminster Junction, on the main line, to New Westminster, a distance of about nine miles. This road and the one proposed to be built to Eburne will be connected and will really form one line of 18 miles in length. Gradually the Canadian Pacific is electrifying its branch lines on the Coast.

The City Council of Sunnyside, Wash., has awarded a contract to the Chase Engineering Company of Spokane for the electric-light system for that city.

The Elgin Light and Power Company of Elgin, Ore., will shortly install a new 2,400-light dynamo to take the place of the one now in use, which furnishes but 500 incandescent lights.

J. A. Young of Seattle, Wash., has announced that he and associates, comprising some of the leading citizens of Seattle, have incorporated the Hanford Irrigation and Power Company with a capital stock of $250,000, and will put up a big power plant at Priest Rapids to develop 50,000 horsepower, to be used in a big irrigation scheme, water to be pumped from the Columbia River.

The Sunset Telephone Company is preparing to install another loop between Petaluma, Cal., and San Francisco.

The Oakland Traction Consolidated of Oakland, Cal., has begun to lay double tracks, standard gauge, in the center of the San Leandro road from the Oakland city line to Jones Avenue, Elmhurst.

A.

Spokane, Wash., September 1.—Official announcement is made by Robert M. Tucker, president of the Empire Electric Company, that the plant for the Home Telephone Company in Spokane will be completed soon. The building will be 70 by 100 feet, four stories high, of reinforced cement faced with white pressed brick and terra-cotta trimmings. It will cost $70,000, in addition to which amount the company will expend $300,000 for equipment. The company is an independent concern, and will have connection with the Puget Sound country and various towns and cities in the Inland Empire.

The committee of the whole of the City Council of Spokane recommended that the council pass an ordinance granting a street-car franchise to the Spokane-Pend d'Oreille Rapid Transit Company, which has right-of-way for a line from Spokane to Lake Pend d'Oreille, Idaho, 42 miles. The company will also build a spur line from Rathdrum to Spirit Lake, Idaho, 12 miles. W. S. McCrea, acting treasurer, announces cars will be running to Mauser Junction in six months and that the line will be completed to Lake Pend d'Oreille in a year.

Stockholders of the Lewiston and Southeastern Electric Railway Company have authorized the directors to issue first-mortgage five per cent. gold bonds to the amount of $3,000,000 on that corporation, and $2,000,000 on the Central Idaho Development Company, dated August 1, 1906, and payable August 1, 1936. The Scofield company of Philadelphia has the contract to build 100 miles of line between Lewiston and Grangeville, Idaho. Work will begin the coming fall.

The Walla Walla-Milton Interurban Electric Railway Company announces that the line will be in operation by December 1st between Walla Walla and Milton, 11 miles.

D. L. Huntington, general manager of the Washington Waterpower Company, has placed an order with Brill & Co., Philadelphia, for 17 cars for the Medical Lake and city lines. Delivery is expected the coming fall.

B.

PERSONAL.

R. E. Sheldon, president of the Columbus Railway and Light Company of Columbus, Ohio, has returned from a tour of Europe.

George Dodds, local manager at Winona, Minn., for the Northwestern Telephone Exchange Company, has been made district manager.

Mr. W. H. Whiteside, president of the Allis-Chalmers Company, Milwaukee, returned on August 22d from a two months' combined business and pleasure tour of England, France, Germany and Switzerland. Mr. Whiteside inspected various large manufacturing industries of England and on the continent.

Mr. J. Lester Woodbridge, formerly engineer of the sales department of the Electric Storage Battery Company, Philadelphia, has been appointed chief engineer of that company, succeeding Mr. J. B. Entz, who has resigned to accept the position of vice-president of the Electric Vehicle Company of Hartford, Conn.

Mrs. Frances A. W. McIntosh, who won an enviable reputation through her skill in mechanical advertising as advertising manager of the Standard Tool Company, Cleveland, Ohio, and was more recently connected with the advertising department of Power, New York, now has charge of the publicity department of the Norton Company, Worcester, Mass.

James Dredge, editorially connected for many years with the well-known technical journal Engineering of London, died last month. Mr. Dredge was well known in the United States. He was commissioner-general for Great Britain at the Brussels Exhibition of 1897, and he was created a companion of the Order of St. Michael and St. George for his efficient services. Mr. Dredge was also identified officially with other international exhibitions, including the World's Fair of Chicago. His several visits to the United States awakened his interest in American engineering and methods of manufacture. At the time of his death Mr. Dredge was engaged on a work relating to American industrial development with notes on the leading engineers and manufacturers of the country.

Anthony C. Douglass, who was connected with the wheel-pit work of the Niagara Falls Power Company, and who built the tunnels of the Canadian Niagara Power Company and of the Electrical Development Company of Ontario, Limited, has returned to his home in Niagara Falls after a trip to the Pacific Coast to investigate the proposed power work on the Feather River in California. The scene of the proposed development is about 26 miles from Oroville, where a tunnel 3,600 feet long and of about the same section as the tunnel of the Niagara Falls Power Company, 21 by 18 feet, is to be driven through the mountains. A tunnel 1,300 feet long is also to have its section enlarged. The elevation above Oroville is 3,000 feet, and the distance between Oroville and the development has to be made by stage, consuming nine hours. While Mr. Douglass realizes there is a lot of work to be done in California, he feels that should he undertake the contract it would necessitate his practically camping out for three years, something he doesn't fancy greatly at his time of life. Still, he will bid on the work. The development will be 100,000 horsepower.

ELECTRIC LIGHTING.

Hibler & Co. have been granted an electric-light franchise in Plains, Mont.

T. J. Neely will install an electric-light plant in Celeste, Texas, for Carver Bros.

The Moberly Electric Light Company of Moberly, Mo., will spend about $50,000 in remodeling its light plant.

D. O. Dunne is talking of organizing a company to build an electric-light plant and waterworks in De Ridder, La.

An electric-light plant to cost $15,000 is to be constructed and operated in Hindman, Ky., by R. Bates and associates.

The Board of Trustees of Logan, Ohio, contemplates building a municipal electric-light plant. L. B. Engle is president of the board.

The citizens of Carmi, Ill., are contemplating rebuilding the lines of the municipal electric-light system. Charles D. Faulkner is president.

The Sowell Lumber Company of Marked Tree, Ark., has been incorporated with a capital stock of $50,000 and will conduct an electric-light plant in connection with its lumber business.

Sealed proposals are invited until September 10th for furnishing and installing transformers, service wires and wattmeter for the electric lighting of the post exchange and gymnasium at Fort Omaha, Neb. Full information furnished on application to Major Zalinski, constructing quartermaster, Army Building, Omaha, Neb.

The old electric-light plant at Vera Cruz, Mexico, has been acquired by S. Pearson & Son of London, who will make extensive improvements in view of the fact that they are also the contractors for constructing a belt line of electric railways. In all probability, the Actopan Falls will be utilized for generating power. A company has been organized for the purpose of laying out, grading, draining, paving and lighting a large section of land immediately to the north of the harbor for the erection of dwellings and as a health resort for the people of the city.

ELECTRIC RAILWAYS

The Muskogee (I. T.) Traction Company will expend $100,000 in improvements.

A franchise has been granted to N. M. Lee to operate a street railway in Dunbar, Texas.

The Wausau Street Railway Company of Wausau, Wis., has been incorporated with a capital stock of $60,000 by Neal Brown, V. Anderson, M. C. Ewing and others.

It is reported that the Norfolk and Portsmouth Traction Company will build a sub-station of its electric power plant at Ocean View in order to supply electricity for its additional line to the Jamestown Exposition. E. C. Hathaway of Norfolk, Va., is general manager of the company.

The Alabama City, Gadsden and Attalla Railway Company of Gadsden, Ala., has awarded the contract to O. T. Fisher of Birmingham, Ala., for the erection of the steel buildings for its $125,000 electric powerhouse at Gadsden. The plant will be driven by steam turbines of 2,000 horsepower each.

Reports from Seattle, Wash., say the Seattle Chamber of Commerce and two-thirds of the business men of the city have organized to fight municipal ownership of street railways to be voted upon September 12th. At a meeting of the chamber a resolution was adopted, the gist of

which is that Seattle is in need of many things which will tax the property owners, and needs them worse than a municipal street railway. Following the action of the chamber, announcement is made of the organization of a business men's club to fight the proposed street-railway bond issue.

An extensive electrolytic survey has been made for the Chester Traction Company, Chester, Pa., and the Trenton Street Railway Company, Trenton, N. J. Several modifications have been made which bring the track-return systems of these two companies up to date. The survey was made by W. S. Barstow & Co.

The Citizens' Railway and Light Company of Fort Worth, Texas, has been incorporated with a capital stock of $1,000,000 to build a system of roads out of that city. The incorporators are Warren Bicknell, John A. Harper, J. B. Nutt and E. W. Christy, all of Cleveland, Ohio; W. O. Allen of Fostoria, Ohio, and C. B. Close of Toledo, Ohio.

The opening attack on the validity of the Mueller street-railway certificate ordinance of Chicago and the statute on which it is based was made in Judge Windes' court this week, when arguments opposing the ordinance and statute were begun and an intervening petition was filed by interests believed to represent the traction companies. The complaint itself contains a prayer asking that the Mueller certificate ordinance passed by the City Council January 18th last and the statute on which it is based be declared void, and that the city and its agents be perpetually enjoined from issuing, negotiating or selling certificates on the proposed mortgage by which the municipality hopes to obtain sufficient funds for the operation of a street-railway system.

PUBLICATIONS.

James L. Robertson & Sons, New York, are distributing a pamphlet concerning their products, such as feed-water heaters, indicator piping, lubricators, planimeters, reducing wheels, damper regulators, packing, grate bars, waste-oil filters, etc.

A little incandescent-lamp dictionary published by the Sawyer-Man Electric Company, New York, maker of new-type Sawyer-Man lamps, will be found very convenient. It is 3 by 4⅜ inches in size, 16 pages, and gives definitions of words and terms used in incandescent-lamp talk.

An amusing "mule barometer" is issued by the Gregory Electric Company, Sixteenth and Lincoln streets, Chicago. The prognostications are made by observing the mule's tail, and are absolutely accurate. The Gregory company says that it is the "clearing-house of America" for second-hand electrical apparatus.

The H. W. Johns-Manville Company of 100 William Street, New York city, issues a booklet on "Fire Protection for the Home," with a return postal card attached to the cover. It is said that the Manville dry-powder fire extinguisher is cheap, effective and simple, and will not freeze, explode, corrode or deteriorate.

The Central Electric Company of Chicago is sending out a circular on D. & W. enclosed fuses, for which it is general western agent. This circular illustrates the D. & W. Fuse Company's new office and factories, said to be the most complete and largest enclosed-fuse factory in the world. This circular will be sent to any address on request.

Two blotters from Pass & Seymour, Solvay, N. Y., are intended to remind users of several of its latest specialties in attachment plugs and cleats. The company says that "if you want to overcome electrical misfits; if you want to save time, money and electrical irritations, you want to open wide your business eye and take in P & S, the trademark that guarantees quality in electrical specialties."

A useful pamphlet entitled "Applications of Electricity" is being sent out by the Co-operative Electrical Development Company of Cleveland. It gives the applications of electric current indexed under various lines of business. It is the product of the co-operation of several men in the electrical business, and the compilation includes all kinds of applications in the field of light, heat and power. The pamphlet will be found useful to all electrical men, especially solicitors. Managers of central stations can get additional copies from the association at printer's cost.

Recent literature from the General Electric Company of Schenectady, N. Y., includes six indexes, respectively, of price lists, flyers, descriptive catalogues, supply catalogues, pamphlets and bulletins. Price list No. 5153 of Edison Gem-filament street series incandescent lamps and flyer 2191, descriptive of reversing motor-starting rheostats of the type RS, are included in the batch. There are also five well illustrated bulletins—No. 4451, tantalum lamps; No. 4452, parts of direct-current series enclosed arc lamps; No. 4453, Edison Gem high-efficiency incandescent and Meridian units; No. 4454, GE-90 railway motors, and No. 4455, single-phase motors. Not to be overlooked is supply catalogue No. 7600, treating exhaustively of controller contact fingers and handles.

A circular from the Oswego (N. Y.) Boiler and Engine Company, gives, in brief, data and specifications of that company's horizontal return tubular boilers. A large factor of safety is a feature kept in mind in the making of these boilers.

"The Lighting of Public Buildings" is the title of an attractive booklet published by the Nernst Lamp Company of Pittsburg. The booklet treats at length on the planning of artificial illumination, giving the results of expert experience, and incidentally describes the Nernst lamp and its application to the lighting of public buildings. These lamps, although comparatively new, are giving satisfaction in many public buildings throughout the country, such as art galleries, railway stations, large dining rooms, council halls, armories, libraries and office buildings. A number of fine half-tones show some interiors lighted by Nernst lamps.

"Through 'Frisco's Furnace" is the title of a striking publication from the Joseph Dixon Crucible Company, Jersey City, N. J. It tells in an interesting manner of the originality of the American architect and engineer and of the soundness of their steel-constructed buildings under the crucial test of earthquake, dynamiting and fire. A number of excellent half-tone illustrations show the modern steel-frame constructed buildings of San Francisco that withstood the earthquake and fire of April 18th. The publication shows how well Dixon's silica-graphite paint preserves the maximum strength of steelwork of high buildings in the face of severe conditions. A copy will be sent by the company to those requesting it.

SOCIETIES AND SCHOOLS.

The Chicago meeting of the Railway Signal Association will be held in the Great Northern Hotel on September 11th at 1:30 p. m. Vice-president Peabody will present for discussion a revision of the standard specifications for mechanical interlocking plants. The identification of insulated wires and cables will be another subject discussed. The annual meeting of the association will be held in Washington, D. C., on October 16th, 17th and 18th. Headquarters will be at the New Willard Hotel. It is announced that the literature to be presented at the annual meeting will be the best ever issued. H. S. Balliet, Grand Central Station, New York city, is secretary.

TELEGRAPH.

Announcement is made from Scranton, Pa., that the Delaware, Lackawanna and Western Railroad will at an early date dispense with the services of all telegraphers on its system and will control the movement of trains with the automatic block system and additional telephone facilities. The change will affect the entire main line from Hoboken to Buffalo as well as all the branches. Trains will be controlled under rules similar to those in England, where there are no dispatchers.

The Madrid government has appointed a commission to report on the adoption of various devices for improving the Spanish telephone and telegraph services, such as the establishment of a higher school of telegraphy, simplification of the telegraph, regulations, development of the telephone system, purchase of modern material, and acceleration of the delivery of telegrams, more especially those intended for the newspapers. The commission is to report by October 1st in order that the necessary reforms may be begun as soon as possible.

MISCELLANEOUS.

A United States patent, No. 829,190, has been granted to William J. Wilgus of New York, vice-president of the New York Central Railroad, and Howard A. Carson of Malden, Mass., on a method of constructing subaqueous tunnels. The method consists in locating by sections an outer shell or mould at the bottom of the water on a suitable foundation. The shell is then made watertight and the water is removed and kept out by compressed air, after which the tunnel walls proper are built within the outer shell.

A news dispatch from Hazleton, Pa., says that while a farmer was driving along East Diamond Avenue his team of horses came in contact with a pipe through which the alternating current of the Hazleton Electric Light and Power Company ran to the ground. The insulation had been worn off the wire, charging the pipe with electricity, and when one of the horses got against it, with only his ear, he was instantly killed. The horse fell over on his mate, and the latter suffered the same fate. The driver, too, was badly shocked, the current, apparently, passing through the reins.

The United States Geological Survey is engaged in extensive topographic field work in a number of states. Topographic surveys are being taken and maps are about to be published which will be for sale at the nominal cost of paper and printing. The maps should be especially valuable in the development of natural resources. They will be useful to those cities and villages about to build reservoirs and waterworks, to individuals interested in the location and preservation of forest lands and in the building of good roads, and to engineers, surveyors and power companies in the building of electric railways, power plants and transmission lines. The maps may be obtained upon application to Charles D. Walcott, director of the United States Geological Survey, Washington, D. C.

TRADE NEWS.

The Hutchinson (Kan.) Electric Construction Company has been incorporated with a capital stock of $10,000.

The Spokane Electric Supply Company of Spokane, Wash., will in future do a wholesale business exclusively.

James L. Robertson & Sons and the sales department of the Eureka Packing Company announce their removal from 204 Fulton Street to 48 Warren Street, New York city.

J. S. Moon and associates have purchased a controlling interest in the stock of the Acme Electrical and Telephone Manufacturing Company of Chicago, and the plant will be moved to Albia, Iowa.

Commerce of the United States with Cuba in the fiscal year just ended was greater than in any earlier year of the trade relations between the United States and that island. This is particularly true of exports.

J. C. Kellogg, United States consul, writing from Colon, states that among the many agricultural products which can be successfully raised in Panama the castilloa elastica (rubber tree) is one which could be especially developed into a very profitable industry.

The Northwestern Storage Battery Company, formerly in Chicago, is now located at 448 Milwaukee Street, Milwaukee, where it has a finely equipped plant. Business is reported as very satisfactory, and no doubt the large number of Northwestern batteries already in use has something to do with this.

On September 18th the Bureau of Supplies and Accounts, Navy Department, will open bids for furnishing eastern navy yards with the following material: Schedule 131, porcelain insulators; schedule 132, mechanical telegraphs. Proposal blanks and detailed information can be obtained at the navy pay office in New York or upon application to the bureau at Washington.

BUSINESS.

Will F. Bruer, the pole dealer of Kansas City, Mo., reports a continuation of a prosperous pole season. A recent order received by Mr. Bruer was for all the electric-light poles to be used at Anthony, Kan., by the Citizens Improvement Company.

Among recent orders for electrical machinery the National Brake and Electric Company of Milwaukee reports sales of 75 to 500-kilowatt generators to the following-named companies: George W. Pitkin & Co., Chicago, Ill.; Clinton Sugar Refining Company, Clinton, Iowa; Alliance Electric Light and Power Company, Alliance, Neb.; Fort Morgan Electric Light and Power Company, Fort Morgan, Colo.; Stillwater Gas and Electric Company, Stillwater, Minn.; Clymer Power Company, Riegelsville, Pa.; Hendrie & Bolthoff Manufacturing and Supply Company, Denver, Colo.; Rockford Malleable Iron Works, Rockford, Ill.; Romadka Bros., Milwaukee, Wis.

The Wesco Supply Company of St. Louis is placing on the market its Wesco soldering paste and Wesco soldering stick, which are particularly adapted for armature work, especially in connection with soldering the armature leads to the armature. The tendency of soldering pastes and sticks is to carry an arc across between the leads unless great care is taken to see that every bit of the soldering stick or paste is removed before the outside wrappings are put on. The Wesco stick or paste has a tendency to act more as an insulator than as a conductor of current, so if any of it is left in the armature there is no danger of it causing a burn-out.

The Blake Signal and Manufacturing Company of 256 Summer Street, Boston, received an order on July 1, 1905, from the Illinois Traction System for five of its signals, to be placed on trial on the interurban line from Springfield to Decatur, Ill. These were given but a five-day trial before eight more signals were ordered for that system. The following December 4th the Blake people received an order for 30 more signals to be used on the Danville-Urbana line of the system. This order was followed by another for 15 signals, to be used on the St. Louis and Springfield division. This last order was received in July of this year, making a total of 58 signals now in use upon the Illinois Traction System's lines. The Blake people also report that their Canadian business has grown so rapidly that they are about to establish an agency at Toronto for their line of cleats and staples.

ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued (United States Patent Office) August 28, 1906.

829,381. Electric Bell. Sidney A. Beyland, Elyria, Ohio, assignor to the Dean Electric Company, Elyria, Ohio. Application filed April 22, 1904.

One claim refers to the combination of an arc-shaped member reversibly pivoted to a support, a gong post secured to the member, a gong thereon and means intermediate the pivot and gong post for adjusting the member when in either position from a given point so as to form a continuous arc of adjustment.

829,390. Trolley Harp. Benjamin L. Dresser, Uxbridge, Mass. Application filed September 14, 1905.

An improved trolley harp having a shank with a slot to receive the trolley pole is described.

829,403. Finger Contact for Electric Controllers. Francis E. Imeson, Thornaby-on-Tees, England. Application filed April 3, 1906.

In an electric controller the finger contact has a terminal roller or runner, a collecting spring and protecting tips or shields.

829,410. Telephone Desk Stand. Ray H. Manson, Elyria Ohio, assignor to the Dean Electric Company, Elyria, Ohio. Application filed February 28, 1905.

Combined with a tubular standard and a hollow base are a set of switch springs mounted in the base, a hook lever and an extension lever having a bifurcated end adapted to removably engage the long spring of the set.

829,416. Third-rail Insulator. John J. McGill, Chicago, Ill., assignor of one-half to Frank J. Guernsey, Chicago, Ill. Application filed December 14, 1905.

The combination consists of a split cap formed of two companion sections, a split base formed of two companion sections, a pedestal of insulating material interposed between the cap and base and entered into and closely united with the flanges of the cap and base respectively, means for securing together the flanges of both the cap and the base sections, and interlocking means between the pedestal and the flange of the cap and between the pedestal and the flange of the base.

829,419. Telephone Exchange. Nils E. Norstrom, Chicago, Ill., assignor of one-half to John Anderson, Salina, Kan., and one-sixth to the Globe Automatic Telephone Company, Chicago, Ill. Original application filed May 31, 1900. Divided and this application filed November 14, 1903.

One claim covers a generator and means for sending a continuous series of electrical impulses therefrom, two switches adapted to divide the series of impulses at two points, and means for operating the switches successively by the movements of the generator.

829,421. Electric Release Mechanism. Jack Ochs, Texarkana, Texas. Application filed February 27, 1906.

The mechanism of a vertically guided and weighted releasing strip is actuated by an electromagnet which has on its frame an armature lever one end of which is in engagement with the vertical arm of a bell crank lever.

829,429. Selective System. Sylvanus A. Reed, New York, N. Y. Application filed March 13, 1903.

A polystation telephone system includes a source of current and a circuit comprising parallel courses for the current, selectors adapted to receive opposing currents from the courses, telephone apparatus at the sub-stations, means controlled the selectors for connecting the telephone apparatus with the circuit and means for varying the relative strengths of the currents supplied respectively to the parallel courses.

829,447. Method of Producing and Utilizing Undamped or Sustained Electrical Oscillations. Frederick K. Vreeland, Montclair, N. J., assignor to the Wireless Telegraph Exploitation Company, New York, N. Y. Application filed February 28, 1905.

As stated in one of a long list of claims, this method of producing electrical oscillations consists in exciting or controlling a field by the oscillations of an electrical oscillating circuit, electrically commutating energy by means of the field, and adding by the commutation increments of energy to the oscillating circuit.

829,469. Parlor and Sleeping Car Having Electrically Controlled Berths. Louis J. Harris, New York, N. Y. Application filed May 23, 1906.

A railway coach has a compartment beneath the floor which contains a number of berths, an electric motor and means for raising the berths into position in the car by the motor.

829,511. Electromagnetic Mechanism for Musical Instruments. George H. Davis, New York, N. Y. Application filed November 16, 1900.

The actuating device is operated by a solenoid, the helix of which comprises two separate windings respectively of a relatively high and low resistance.

829,535. Telephone Wall Set. Ray H. Manson, Elyria, Ohio, assignor to the Dean Electric Company, Elyria, Ohio. Application filed February 28, 1905.

Details of a telephone wall set are covered by the patent.

829,538. Machine for Securing Filament Holders Into the Globes of Incandescent Lamps. George P. McDonnell, St. Louis, Mo., assignor to the American Electric Company, East Orange, N. J. Application filed May 15, 1905.

The combination consists of a bulb holder rotating around a fixed axis, a filament holder and means for applying heat to the bulb comprising burner supports on opposite sides of the bulb.

829,539. Finishing Electric-lamp Bulbs. George P. McDonnell, St. Louis, Mo., assignor to the American Electric Company, East Orange, N. J. Application filed September 1, 1905.

This method of finishing electric lamp bulbs on which the teat has been formed consists in first passing an electric current through the carbon filament so as to heat the residual gases and the glass of the bulb and its teat, then applying heat to the teat of the lamp bulb, which bulb has first been exhausted, and at the same time rotating the lamp or bulb.

829,545. Sparking Plug. Charles E. Ross, Crafton, Pa. Application filed July 9, 1904.

A hollow conducting casing has an annular groove in the internal periphery thereof; a core of non-conducting material engages the casing; an electrode rod passes through the core and a detachable cover of stamped spring metal is adapted to protect the exposed end of the core, the cover forming one of the electrodes of the mechanism.

829,568. Incandescent-lamp Filament and Method of Making the Same. Jean M. Canello, Paris, France. Application filed August 30, 1904.

The method consists in forming a filament of an oxid of a rare earth metal and rendering the same conducting by subjecting the same to heat in the presence of a reducing agent and vapors containing a metal of the ruthenium group.

829,570. Magnetic Dolly Bar. Edward G. Caughey, Huntington, W. Va. Application filed November 20, 1905.

A magnetic rivet holder or the like comprises an electromagnet having its two poles in juxtaposition but magnetically separated from each other and provided with a seat for the rivet.

829,572. Transformer. Frank Conrad, Edgewood Park, Pa., assignor to the Westinghouse Electric and Manufacturing Company, Pittsburg, Pa. Application filed January 20, 1904.

A transformer core is described which provides two magnetic circuits, one of a large cross sectional area and interrupted by an air gap and the other of a much smaller cross sectional area. There are three legs, one of the outer legs having a smaller cross sectional area than the other two and the other outer leg being interrupted by an air gap.

829,606. Railway Signal. Robert J. Sheehy, New York, N. Y. Application filed May 5, 1903. Renewed January 22, 1906.

A track block having an electromagnet at each end thereof has a battery with which the magnets are connected in parallel through circuits including the two track rails of the block; local signal loops at each end of the block are controlled by the respective magnets and means are provided for connecting the terminals of the loops with a signal circuit on a train.

829,628. Self-restoring Signaling Device. Henry P. Clausen, Chicago, Ill., assignor to the American Electric Telephone Company, Chicago, Ill. Application filed April 1, 1901.

In an electric signaling device a restoring armature is provided with an arm adapted and arranged to rest upon the signaling armature, the arm acting as a weight to throw the restoring armature away from its magnet when the signaling armature is attracted or drawn to its magnet.

829,640. Aerial Signaling Device. Frederick W. Erickson, New York, N. Y., assignor of one-half to Frederick W. Lord, Ipswich, Mass. Application filed October 7, 1905.

A balloon with means for anchoring the same has an electric sign suspended therefrom. A rudder is attached to the sign with guide ropes extending therefrom to the sign and downward.

829,643. Storage Battery. George A. Ford, Cleveland, Ohio, assignor to Harriet S. Ford, Cleveland, Ohio. Application filed December 22, 1905.

Comprised are a number of superposed battery units each consisting of a tray made of infrangible absorbent material having upturned marginal edges and a bottom which inclines from a central point upward to the marginal edges, a reinforcing frame having a bottom which is inclined to correspond with the inclination of the bottom of the tray and is made of narrow bars and an upturned marginal flange adapted to embrace and engage with the flange of the tray which contains an electrode.

829,646. Insulator. Walter T. Goddard, Victor, N. Y., assignor to the Locke Insulator Manufacturing Company, Victor, N. Y. Application filed January 7, 1905.

An insulator is described having a porcelain cap piece of substantially uniform thickness throughout and a separate conductor seat secured to the cap piece and consisting of a narrow strip having a retaining groove for the conductor.

829,724. Telephone-exchange Apparatus. Frank R. McBerty, Evanston, Ill., assignor to the Western Electric Company, Chicago, Ill. Application filed August 2, 1902.

Combined with a metallic circuit telephone line are a source of current, a magnet in each side of the line, a signal controlled by each magnet, an operating key at the sub-station for each of the magnets, and a telephone hook switch at the sub-station for effecting the simultaneous operation of the magnets to prevent the display of either signal.

829,726. Target-illuminating Device for Firearms. Douglas McIntosh, New Glasgow, Canada, assignor to Frederick Johnston, Montreal, Canada. Application filed September 1, 1905.

The patent covers a battery attached to the butt of a revolver, an electric lamp attached to the muzzle of the revolver and electrically connected to the battery through the metal of the revolver, an insulated return circuit from the lamp to the battery and means carried by the trigger of the revolver for automatically closing the circuit prior to discharge and breaking the circuit after discharge.

829,736. Intercommunicating Telephone Apparatus. Fred J. Ravlin and John Lofgren, Chicago, Ill., assignors of one-fourth to Arthur T. Averill and one-fourth to Glenn M. Averill, Cedar Rapids, Iowa. Application filed January 15, 1906.

A calling switch for an intercommunicating telephone apparatus is described.

829,742. Massage Instrument. William G. Shelton, Chicago, Ill. Application filed May 25, 1905.

The patent covers the mechanism of an electrically operated massage instrument.

829,780. Transformer. Walter A. Hall, Lynn, Mass., assignor to the General Electric Company, Schenectady, N. Y. Application filed May 12, 1904.

The combination, with a hollow rectangular iron core, consists of a number of uniplanar primary and secondary coils on a leg of the core, adjacent coils being in contact with one another on one side of the leg and having an intervening space on another side of the leg.

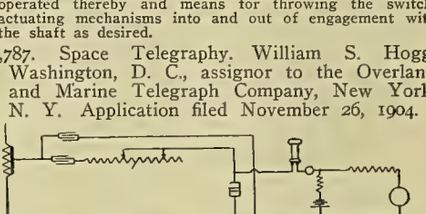
829,783. Black-signal System. Max R. Hanna, Schenectady, N. Y., assignor to the General Electric Company. Application filed March 10, 1905.

In combination with an alternating-current railway system employing the rails as return conductor for the power current are a direct-current signal system comprising means for supplying direct current to the track circuits, relays each comprising two relatively movable coils, one connected to the track circuit and the other supplied with direct current independently of the track circuit, and signals controlled by the relays.

829,785. Electric Switch. Edward M. Hewlett and Theodore E. Button, Schenectady, N. Y., assignors to the General Electric Company, Schenectady, N. Y. Application filed February 7, 1902.

In a system of controlling electric switches is the combination of a motor, a shaft operated by the motor, a series of switch-actuating mechanisms normally out of engagement with the shaft, a series of switches to be operated thereby and means for throwing the switch-actuating mechanisms into and out of engagement with the shaft as desired.

829,787. Space Telegraphy. William S. Hogg, Washington, D. C., assignor to the Overland and Marine Telegraph Company, New York, N. Y. Application filed November 26, 1904.



NO. 829,787.—SPACE-TELEGPAPH APPARATUS.

The first claim reads: In space telegraphy, a receiving station system embodying an aerial, a local circuit including a battery and material sensitive to waves of energy received through the aerial and two circuits connected with the aerial, one attuned to the waves to which the sensitive material is to respond and the other attuned to interfering waves. (See cut.)

829,790. Apparatus for Ozonizing Atmospheric Air. Edward L. Joseph, London, England. Application filed December 12, 1905.

The patent covers apparatus for ozonizing atmosphere air by the silent discharge of high-tension electric current within a casing.

829,794. Controller. Hermann Lemp, Lynn, Mass., assignor to the General Electric Company, Schenectady, N. Y. Application filed December 18, 1905.

A movable contact member has running positions and forward and reverse braking positions and a movable stop is adapted to engage with the contact member and bring it to rest in one braking position or the other, depending upon the direction from which the member is moved relative to the stop.

829,796. Sprinkler Alarm Device. William G. Meddings, Remuera, near Auckland, New Zealand. Application filed February 12, 1906.

Electrical apparatus for instantly recording the actuation of automatic fire-extinguishing apparatus is described, used in combination with a water pipe provided with a series of sprinklers, battery wires, one of which is electrically connected with the pipe and the other of which is insulated therefrom, the latter wire having exposed portions located directly under the sprinklers.

829,799. Collector Ring. Jacob E. Noeggerath, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed September 22, 1905.

In a dynamo-electric machine a collector ring composed of a number of parallel rings has portions engaging each other and the support, the portions being thicker than the main portions of the rings so that adjacent rings are separated by an air space.

829,801. Method of Making Hollow Articles. William H. Pratt and Alvarado Le Roy Ellis, Lynn, Mass., assignors to the General Electric Company, Schenectady N. Y. Application filed May 24, 1904.

The patent covers a process of making a coil consisting in molding a body of fusible material, winding the coil thereon, varnishing the coil and removing the body of fusible material by applying heat thereto.

829,806. Fixture Switch. Howard R. Sargent, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed December 1, 1902.

An open-sided frame for an electric switch and a disk adjusted to close one of the open sides and provided with recesses to permit the passage of a conductor wire

from the inside of the frame along the outside of the disk and back into the interior of the frame are the features.

829,808. Electrical Water Heater. Frederic F. Shipp, St. Louis, Mo., assignor to the Electrical Heating and Manufacturing Company, St. Louis, Mo. Application filed September 12, 1904.

The combination consists of a single member body of heat-radiating material that is a non-conductor of electricity and an electrical conductor coil laid interior of the body.

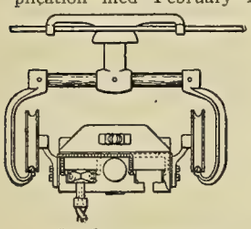
829,810. Temperature-controlling Apparatus. John H. Swan, Chicago, Ill. Application filed January 20, 1904.

The combination, with a fluid-pressure motor, consists of a fluid-pressure generator supplying fluid under pressure thereto, an electric heater for the generator, a switch controlling the circuit of the heater, a valve for retaining the fluid under pressure in the motor, and electrically controlled means for operating the valve.

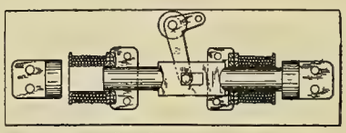
829,812. Telephone Disinfector. Nelson J. Tubbs, Louisville, Ky., assignor of one-fourth to Hardin Collings, one-eighth to Frank C. Carpenter, and one-eighth to Walter F. Jones, Louisville, Ky. Application filed May 8, 1905.

A disinfector is described comprising a cup containing a chemical disinfectant and adapted to receive the telephone receiver; the cup being mounted in vertical alinement with the receiver hook.

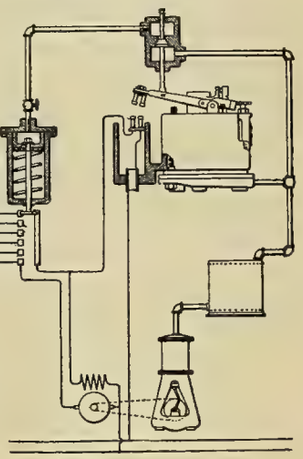
829,822. Trackless Trolley. Montraville M. Wood, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed February 23, 1905.



NO. 829,822.—TRACKLESS TROLLEY.



NO. 829,842.—KINETIC SOLENOID.



NO. 829,845.—FLUID-PRESSURE SYSTEM.

The combination consists of a trolley or traveling contact for electric vehicles, a flexible conductor for transmitting current to the vehicle connected to the trolley and automatic means carried by the contact for releasing the conductor therefrom. (See cut.)

829,826. Voltage Regulator. Ernst F. W. Alexanderson, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed March 10, 1905.

In combination are an alternating-current motor circuit having a low power factor, a lamp circuit in shunt thereto and a transformer having its primary in series with the motor circuit and its secondary in series with the lamp circuit and adapted and arranged to produce a secondary terminal voltage substantially in phase with the impressed voltage in the motor circuit.

829,828. Reverse-current Cut-out. Leonard Andrews, Manchester, England, assignor to the Stanley-G. I. Electric Manufacturing Company. Application filed June 19, 1905.

The patent covers a reverse current protective device comprising a magnetic core, two windings carried on two different portions of the core and connected in shunt and in series respectively with the circuit, a movable member forming a magnetic shunt for each of the two portions of the core, means actuated by the movement of the member for opening the electric circuit and means for adjusting the relative reluctances of the two portions.

829,832. Railway Switch Lock. Robert A. Becker, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed January 16, 1906.

The feature of the invention is a latch controllable from a distance for holding the locking member in locking position and means for preventing the closing of the casing door except when the locking member is in locked position.

829,841. Switch-operating Mechanism. Theodore E. Button, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed October 1, 1904.

Means are provided whereby energy sufficient for one or more movements of the movable member of the switch may be stored by a single operation of the motor, and there are means for automatically starting the motor only at the completion of the movements to store up energy for subsequent movements.

829,842. Kinetic Solenoid. Benjamin F. Carpenter, Roselle Park, N. J. Application filed May 12, 1904. Renewed December 30, 1905.

Combined with a resisting body having a stud are a slot bar fitted to the stud, an armature attached to the slot bar and a solenoid adapted to move the armature with the slot bar at first clear of such stud and finally to draw the end of the slot against the stud to move the body by impact. (See cut.)

829,845. Fluid-pressure System. Fred B. Corey, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed February 2, 1903.

One claim covers the combination of an electric motor, a switch in the motor circuit, a fluid-operated rheostat for starting the motor, means for controlling the passage of fluid to and from the rheostat and automatic means for mechanically operating the switch and the fluid-controlling means in response to variations of pressure in the system. (See cut.)

829,849. Telephone or Like Transmitter. Hahnemann A. Cutmore, London, England. Application filed September 28, 1905.

The patent covers a telephone or like transmitter having a conical conoidal chamber with a perforated diaphragm at each end thereof and a perforated diaphragm in the center thereof.

829,850. Lamp Socket. John C. Dallam, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed August 12, 1905.

An incandescent lamp socket having center contact is described.

829,860. Means for Controlling Alternating-current Motors. Friedrich Eichberg, Berlin, Germany, assignor to the General Electric Company, Schenectady, N. Y. Application filed January 11, 1905.

In combination with a number of alternating-current motors of the commutator type having their armatures connected in a locally-closed circuit are means for varying the relative connections of the motor fields to the source of current and for varying the number of effective field turns. (See cut.)

829,864. Safety Indicator for Elevators and Traction Cars. Robert H. Gaylord, Pasadena, Cal. Application filed September 29, 1905.

Electric means are operated by a latch mechanism for controlling the signal.

829,869. Adjustable Electrolier. Alton Hopkins, Denver, Colo. Application filed May 15, 1905.

Some of the features are: A spring-actuated drum journaled on a support, internal circuit conductors mounted on the drum, two electrodes, one being mounted to rotate with the drum and the other being stationary, a spring contact mounted to rotate with the drum and a stationary spring contact for connecting the rotary electrode with the other branch of the external circuit.

829,872. Method of Effecting Chemical Action in Gases. Dimmitt R. Lovejoy, Niagara Falls, N. Y., assignor to the Atmospheric Products Company, Niagara Falls, N. Y. Application filed March 22, 1901.

The method of causing gases to unite chemically consists in imparting to the gases to be united electrostatic charges of different polarities, then bringing the charged gases within the range of their mutual electrostatic attraction.

829,873. Apparatus for Subjecting Gases to High-tension Discharges. Dimmitt R. Lovejoy, Niagara Falls, N. Y., assignor to the Atmospheric Products Company, Niagara Falls, N. Y. Application filed May 29, 1902.

The combination consists of a chamber for inclosing the gases, means comprising electrodes to rapidly and successively form, elongate and extinguish a number of electric arcs within the chamber, the electrodes being of minimum size to insure the formation of arcs of minimum volume.

829,874. Method of Effecting the Combination of Gases. Dimmitt R. Lovejoy, assignor to the Atmospheric Products Company, Niagara Falls, N. Y. Application filed June 24, 1902. Renewed July 5, 1906.

The process of forming nitrogen compounds consists in producing an electric arc, attenuating the arc and introducing air enriched with oxygen into the presence of the arc.

829,875. Apparatus for Effecting Chemical Action in Gases. Dimmitt R. Lovejoy, Niagara Falls, N. Y., assignor to the Atmospheric Products Company, Niagara Falls, N. Y. Application filed July 19, 1902. Renewed July 5, 1906.

The combination includes a suitable reaction chamber or vessel, means for supplying gases thereto and means for imparting to the gases prior to entering the vessel electrostatic charges of opposite potential, comprising a source of difference of electric potential and a circuit therefrom including electrodes in the gas supply to the chamber or vessel and means for heating the electrodes.

829,876. Process for Effecting Chemical Action in Gases. Dimmitt R. Lovejoy, Niagara Falls, N. Y., assignor to the Atmospheric Products Company, Niagara Falls, N. Y. Application filed January 27, 1903. Renewed July 5, 1906.

The process of effecting the combination of gases consists in separately charging the molecules of the gases electrostatically and leading the separately-charged gases into a common chamber and subjecting them to the action of the electric arc.

829,877. Apparatus for Effecting Chemical Action in Gases. Dimmitt R. Lovejoy, Niagara Falls, N. Y., assignor to the Atmospheric Products Company, Niagara Falls, N. Y. Original application filed May 29, 1902. Divided and this application filed January 28, 1903. Renewed July 5, 1906.

The apparatus combines means for forming electrical arcs, means for passing gases to be treated in proximity to the arcs and means for separately charging the molecules of the respective gases to be combined to opposite electrostatic potentials.

829,902. Illuminated Advertising Sign. Frank H. Urry, London, England. Application filed May 31, 1906.

Details of an electrically illuminated sign are given.

829,905. Electrical Relay. Harry M. Abernethy, Cleveland, Ohio, assignor to the American Railway Signal Company, Cleveland, Ohio. Application filed July 8, 1905.

In a multiple relay are a reversible carbon point, means for adjusting the same, a reversible platinum contact and means for adjusting the platinum contact.

829,909. Electric Bell. Edward B. Craft, Chicago, Ill., assignor to the Western Electric Company, Chicago, Ill. Application filed October 21, 1904.

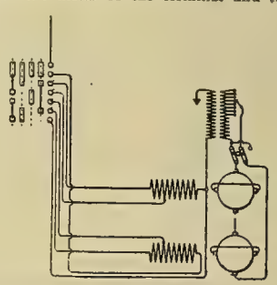
The patent covers the mechanism of an electric signal device.

829,917. Switch. Francis K. Fassett, St. Louis, Mo., assignor to William Maxwell Scott, Philadelphia, Pa. Application filed April 27, 1904.

The combination, with an insulation support, consists of laminated contacts having free edges of unequal lengths to form inclined faces, a hollow partition wall between the contacts, a bridge co-operating with the free edges of the laminated contacts, and a stem for supporting the bridge in position and for moving the same into and out of operative relation with the contacts, the stem projecting through the hollow partition.

829,931. Method of Making Rail Bonds. William E. Oakley, Millbury, Mass., assignor to the Worcester Steel Foundry Company, Worcester, Mass. Original application filed January 2, 1903. Divided and this application filed May 13, 1903.

This method of making rail bonds for electric railways consists in first inclosing an end of the connector in a matrix, then casting a terminal of metal upon the end of the connector of metal fusible at a higher temperature than that of the connector, directing the stream of molten metal against the end of the connector, thereby melting the end of the connector and causing an intermixture of the metal of the terminal and the connector.



NO. 829,860.—METHOD OF CONTROLLING ALTERNATING-CURRENT MOTORS.

829,934. Apparatus for the Production and Utilization of Undamped or Sustained Electrical Oscillations. Frederick K. Vreeland, Montclair, N. J., assignor to the Wireless Telegraph Exploitation Company, New York, N. Y. Original application filed February 28, 1905. Divided and this application filed November 14, 1905.

An apparatus for producing electrical oscillations is described wherein are combined an electrical oscillating circuit, a field excited or controlled by the oscillations of the electrical oscillating circuit and acting to electrically commutate energy and means for adding by such commutation increments of energy to such oscillating circuit.

REISSUE.

12,523. Apparatus for Use in Tabulating Systems. Herman Hollerith, Garrett Park, Md., assignor to the Tabulating Machine Company. Application filed July 25, 1906. Original No. 777,209, dated December 13, 1904.

An apparatus for tabulating record cards having index point positions successively arranged in columns has included in its mechanism a series of register-controlling electromagnets for each column of index point positions. A card-controlled circuit-closing device is common to the magnets of each series and there are means for feeding the cards to present the index points successively to the circuit-closing device.

PATENTS THAT HAVE EXPIRED.

Following is a list of electrical patents (issued by the United States Patent Office) that expired on September 3, 1906:

410,150. Electric Conduit. H. A. Chase, Boston, Mass.
410,153. Apparatus for Automatically Charging Secondary Batteries. S. C. C. Currie, Philadelphia, Pa.
410,170. Regulation of Coupled Dynamos. O. P. Loomis, New York, N. Y.
410,180. Electrically-controlled Elevator. C. E. Ongley, New York, N. Y.
410,181. Elevator. C. E. Ongley, New York, N. Y.
410,182, 410,183, 410,184. Electrically-controlled Elevator. C. E. Ongley, New York, N. Y.
410,189. Electric Gong. J. H. Phalan, Ansonia, Conn.
410,264. Electric Railway Plow. F. O. Blackwell, New York, N. Y.
410,270. Signal. W. H. Donner, Columbus, Ind.
410,305. Telegraphophone. M. Wheless, Nashville, Tenn.
410,410. Apparatus for Applying Sheaths to Electrical Conductors. C. Q. Goodwin, Malden, Mass.
410,468. Reactive and Induction Coil. E. Thomson and E. W. Rice, Jr., Lynn, Mass.
410,493. Electric Arc Lamp. R. L. Cohen, Camden, N. J.
410,498. Tubular Conductor for Electric Railways. L. Draft, Plainfield, N. J.

WESTERN ELECTRICIAN

EVERY SATURDAY

Vol. XXXIX. CHICAGO, SEPTEMBER 15, 1906 No. 11

Luisenstrasse Power House in Berlin.

By A. de Courcy.

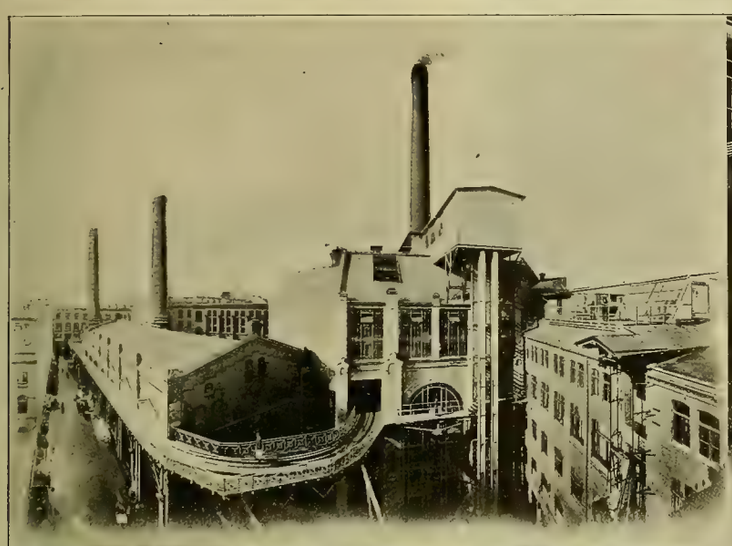
The city of Berlin possesses a number of large electric stations which give current for the lighting and power mains. Among these is the extensive plant located on the banks of the Spree which is the object of my present description. The electrical equipment of this extensive plant has been supplied in part by the Allgemeine Elektricitäts Gesellschaft, from which I have obtained the following data about the station. There are in reality two entirely distinct electric plants located on the premises, and these two stations are laid out on different systems, both in relation to the boiler plant and the dynamo room. The first of these stations will be mentioned but briefly in the present description. It is known as the Schiffbauerdamm Station and contains a boiler house fitted with four batteries of Steinmüller boilers—in all 11 boilers of about the same capacity and having a total heating surface of 750 square meters. Next the boiler room is a large dynamo room which contains three direct-current groups and two alternators, making five groups in all. The two alternators have a capacity of 2,000 horsepower and work at 3,000 volts, while the direct-current sets use two generators for each of the engines and give about 1,200 horsepower.

The second electric station, which is known as the Luisenstrasse plant, has been installed by the Allgemeine company. In this case the boiler room is placed in the second story of the building and lies above the dynamo room. This has been done in order to save space, as the ground was lacking. Coal for the boilers is brought into the plant by a well-designed system of conveyors, and it is thus unloaded from the barges of the Spree and brought to the grates with but little hand labor. A set of coal bunkers lies overhead between the ranges of boilers, and the coal is dropped down onto the floor in front of the grates by a set of circular chutes. There are two rows of boilers, four in each row, making a total of eight boilers in this plant. In all they afford a heating surface of 300 square meters. A set of feed-water heaters, using steam pumps, is used for the boiler feed, and after leaving the boilers the steam is superheated to 300° C. by a set of heaters.

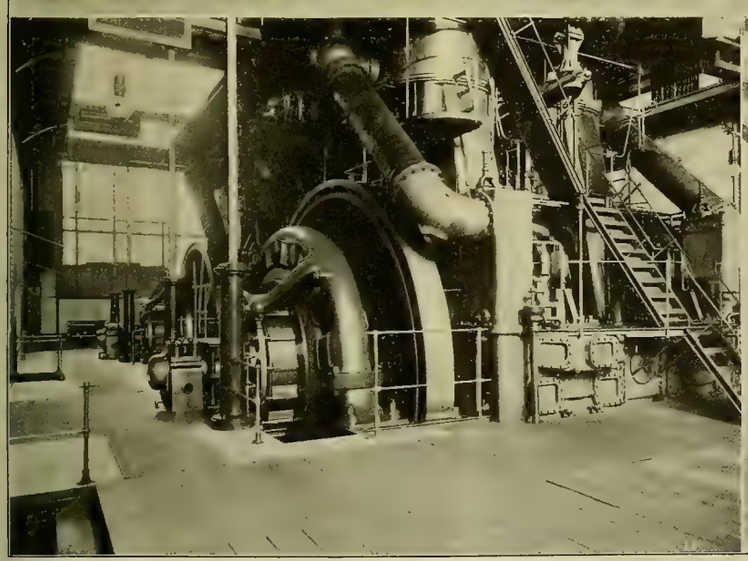
A space about 10 feet in height is left between the floor of the boiler room and the ceiling of the dynamo room, and this space is used to contain the steam piping which runs from the boilers to the engines in the floor below. The steam passes from the boilers into a main collecting pipe, and from this pipe there is a branch which leads down to each engine of the dynamo room. The boilers mentioned above are of the Heine water-tube pattern, one of the best-known German makes. Working at a steam pressure of 14 atmospheres, the steam consumption of the engines is relatively a low figure, owing to the superheating and consequent absence of losses. The good arrangement of the piping is another factor which adds greatly to the efficiency of the steam plant. On the tests which were made under the usual running conditions, the amount of coal and of steam for an (indicated) horsepower-hour is stated to be 4.3 kilogrammes of steam, which corresponds to 0.6 kilogrammes of coal.

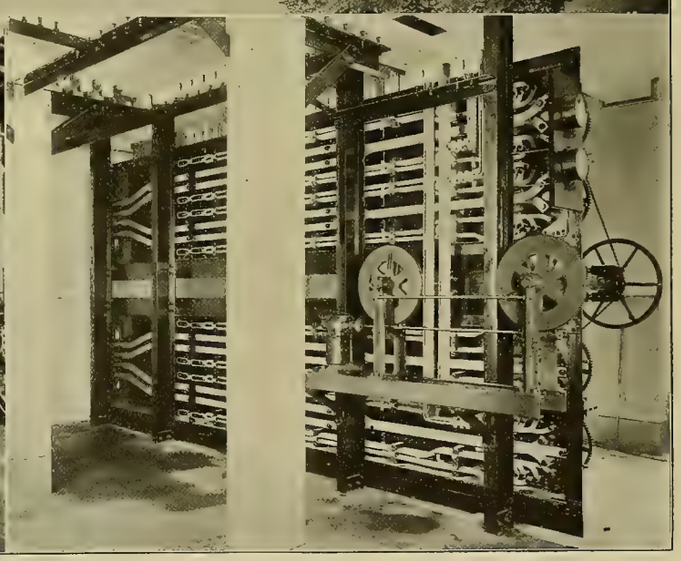
Three units of 3,000 horsepower each are placed in the dynamo room, and the general appearance of these groups will be noticed in the accompanying view of the interior. Engines of the upright four-cylinder triple-expansion type are used in the plant, and these are of uniform appearance and power. Coupled on the shaft of the engine in each case are two direct-current generators of 1,000 kilowatts each. The engine cylinders are mounted in two pairs of two cylinders each, with the two pistons common to each pair working on two cranks on the engine shaft. In the first pair the upper cylinder is the high-pressure and the under cylinder the low-pressure, while in the opposite pair the order is middle-pressure, low-pressure. There are therefore two low-pressure cylinders per engine. The top of the engine lies near the ceiling, so that the feed piping, which comes from above, is short. Water for the condensers is taken from the river, and a large supply is used in this case. Before going to the condensers it is filtered. The condenser feed and discharge pipes, which are of large size, are placed in the basement of the plant, which is also used to run the different cables of the station.

As noted, the three engines each carry two generators, one of these being mounted at each side upon the main shaft. This shaft carries an outer bearing, as will be seen. Between generator and engine is mounted a flywheel of large diameter. These generators have a capacity, as above men-



General Exterior View.
Engine-Generator Units.





A View in the Boiler Room.
Motor-operated Device for Battery Charging.

LUISENSTRASSE POWER HOUSE IN BERLIN.

tioned, of 1,000 kilowatts each, and the operating speed is 85 revolutions per minute. This speed is well held by the governors of the engines. Sixteen poles are mounted in the circular field casting, which is of narrow form and reaches an outside diameter of five meters. A drum armature carrying copper bars is employed here. The winding is made up of a set of 500 hard-drawn copper bars of rectangular section and placed one layer deep. A good micanite insulation is used in these machines. Four heavy arms bolted to the side of the field-casting serve to hold the copper ring of large diameter which forms the brush-holder support. It can be turned in the arms by means of a handwheel and endless screw.

In the Luisenstrasse plant the current is used mainly for the electric traction lines of the city and suburbs, but if need be, a part of the current can be sent into the switchboard of the first-mentioned station so as to afford a reserve for that plant. The circuits are laid out accordingly with this end in view. In an upper galley along one side of the dynamo-room is placed the main switchboard for handling the circuits. A special set of panels is used for the connections which go to the other plant. The middle portion of the switchboard has the panels for the six generators. On either side are the panels for the traction feeders. The bars are so arranged that a machine can be thrown upon the tramway or the lighting circuits (of the second plant) by a double-throw switch lever. In order to give the standard voltage, 500 volts, for the traction lines, the two generators of a set are connected in series. On the generator panels are mounted a voltmeter, an ammeter, a double-throw switch lever and fuse-plugs; also the rheostat wheels.

Two separate batteries of accumulators are used upon the traction and the lighting circuits, respectively. For the traction circuit the battery is connected in parallel upon the bus-bars and is used as a buffer to take up the shocks. This battery is made up of 250 cells which work in series. It has a capacity of 1,400 ampere-hours on a one-hour rate of discharge, working at 500 volts.

The second battery is operated in a different manner. It is connected upon the bars of the lighting switchboard so as to keep the voltage constant. Charging of the cells is done at night, when there is but a light load on the generators. An interesting feature of the plant is the motor-operated cell-changing device. When the cells are charging or discharging, the voltage changes, and a certain number of cells must be thrown in or out in order to equalize the voltage. This apparatus takes the place of a booster. An automatic device worked by a small motor shifts the contacts so as to include or exclude the right number of cells, so that the voltage is kept constant during the charge and discharge of the battery. One of the illustrations shows the accumulator board mounted in an iron frame and the motor-operated device.

Street-center Lamp Posts to Facilitate Traffic.

At three busy boulevard intersections in Chicago the South Park commissioners have adopted a plan to prevent reckless chauffeurs from disregarding the rules of the road and speeding carelessly around corners, thereby increasing the confusion. At the corner of Jackson Boulevard and Michigan Avenue two graceful iron lamp posts have been erected on substantial cement foundations in the center of each street. One is on the line of the south crossing over Michigan Avenue and the other on the west crossing over Jackson. On top of each post is a large red globe intended to indicate a dangerous crossing, and it is noticeable from a distance.

Each red globe contains three ordinary 16-candlepower incandescent lamps, which take current from the incandescent alternating-current lighting circuits of the central-station company. The rule which the crossing policemen must enforce is simply that all drivers observe the red light by going slow and in all cases, whether turning the corner or not, keep to the right of the lamp posts. The other places where the scheme is being tried are at Michigan Avenue and Thirty-third Street and at Thirty-third Street and South Park Avenue.

G. W. Reagan, president of the Arlington Cotton Mills, and associates of Gastonia, N. C., are said to have purchased the Harikns waterpower property on the Tuckaseegee River, one mile from Dillsboro, N. C., and will develop it. Their plans involve the erection of a large cotton factory to be driven by electricity which will be transmitted from the waterpower development and to distribute electricity generally for power and lighting purposes.

English Power-transmission Line and Pole Testing.

By Frank C. Perkins.

The accompanying illustrations show the poles and line construction, as well as the methods employed in testing the former, of the Swinton route of the Lancashire Electric Power Company. The poles were installed by Richard Wade, Sons & Co. of Hull, and before installation a series of important tests was carried out to ascertain the breaking strain and deflection from the straight

LANCASHIRE OVERHEAD POWER TRANSMISSION LINE, SHOWING JUNCTION WITH UNDERGROUND CABLES.

of wooden poles, both single and double, at a given load, and also any permanent set after the bendings. It is stated that the tests were undertaken with the approval of the Board of Trade and by the desire of several large users of poles adapted for overhead electric power lines. Professor Goodman of the Leeds University supervised the test, and a number of officials of the Lancashire Electric Power Company, as well as railway officials and electrical advisers of the Board of Trade, were present.

Two pictures are given to show the arrangement of the poles during the tests, which were of a valuable character and of great interest. The tests were carried out on double and single poles;

POLE ARRANGED FOR DEFLECTION TEST.

OLE DEFLECTED FROM THE STRAIGHT.

and in one case it is stated that a single 40-foot pole bent to the extent of 14 or 15 feet out of the straight, like a great bow, before exhibiting signs of strain fracture. It is further stated that the deflection was something like 20 feet without actually breaking through (only the outer shell cracking), and when released the pole went back practically to its original position.

On the Swinton route of the Lancashire Electric Power Company the overhead transmission line starts immediately outside the Radcliffe generating station, and extends for a distance of about 650 yards almost due south to a point where connection is made to the underground trunk mains The cables and conductors and other electrical conductors were constructed by the Callender Cable and Construction Company. Two three-core, paper, lead-sheathed, single-wire-armored cables are used for the underground trunk mains, laid on the solid system, in wooden troughing, and suitable for a working pressure of 10,000 volts. The overhead line is, of course, in all respects suitable for the same working pressure.

The main transmission poles are shown in an accompanying illustration. They are spaced at intervals of about 50 yards along the route, the poles being sunk in the ground to a distance of about six feet. The distance between the lowest transmission wire and the ground level approximates 23 feet. The poles themselves are made of Swedish timber, and are thoroughly creosoted all over. The top of each pole is provided with a galvanized-iron roof. The crossarms are made of the best English oak, and each pole is provided with a spiked iron collar to prevent anybody endeavoring to climb up it. The poles, where necessary, are, of course, stayed with galvanized-steel wires.

The transmission line wires consist of hard-drawn copper wire having a breaking strain of about 24 tons to the square inch. There are six individual wires, corresponding to the two three-core cables to which they connect. The minimum distance between wires is two feet nine inches, and the size of the wire is No. 000.

The finest glazed white English porcelain is used for the insulators, which are of the triple-shed type, each insulator being made in two parts and cemented together. The porcelains are supported on seven-eighths-inch steel pins, which are attached to the wooden cross-arms.

Where the overhead wires connect to the underground mains at the southern end of the route, a special terminal pole has been erected. (See cut.) Two wooden poles are used, braced together by ironwork, and at the top of the poles are arranged cross-pieces of angle iron, to which shackle insulators of a special type are attached. The overhead wires are strained up to this terminal pole, and connected to three shackle insulators, arranged in series.

Connection between the overhead wires and the underground mains is made by taking bare copper trolley wire from the transmission line through porcelain sealing ends fitted to dividing boxes clamped to the pole. From the other end of the dividing box a three-core, paper, lead-covered cable is led down the pole inside a galvanized-iron pipe. The terminal poles also contain a wooden shed, holding the lightning arresters (not shown in the illustration), and the poles themselves are stayed in a very substantial manner.

The strain of the six transmission wires at the generating-station end of the route is taken up by the shackle insulators in series, which, however, are attached to wooden beams on the wall of the generating station. Connection to the switchboards inside the generating station is made to the overhead mains by means of single-conductor, paper,

lead-sheathed cables, which are carried through the wall of the generating station in porcelain tubes, the bare copper trolley wire being connected to the paper, lead-sheathed cable by means of a special corrugated sealing end.

The overhead telephone wires run parallel to the overhead mains.

It is stated that on this particular section, the route being short, no intermediate straining poles are required, but on other routes on this same transmission scheme intermediate straining poles are used. These straining poles are put up at distances of about every 500 yards. The strain is taken up by shackle insulators in series, and connection is made from one side of the pole to the other by bare copper wire supported on ordinary straight-line porcelain insulators.

The Large Hydro-electric Plant near the St. Lawrence River at Massena, N. Y.

After some vicissitudes the large and interesting hydro-electric power plant of the St. Lawrence River Power Company at Massena, N. Y., is reported to have passed into the control of the Pittsburg Reduction Company, well known for its aluminum production, which takes for its own use, in its adjoining works, a large portion of the output of the power plant.

With a capacity of 20,050 kilowatts, the plant is operated from waterpower derived from discharging water from the St. Lawrence into Grass River (an affluent of the St. Lawrence, on the American side, running nearly parallel to the larger stream) through a canal about three miles in length. St. Lawrence County, in which Grass River runs for its entire length, is the largest in the state of New York and second only to Niagara County in its waterpower resources. It leads all other sections in the extent of its mineral deposits. Along its northern boundary the St. Lawrence River flows for 73 miles, passing down Galaps, Du Plats and Long and Little Sault Rapids in its course. The last-named rapids represent a fall of nearly 50 feet in the river along 10 miles of its course.

The plant at Massena is located more than a hundred miles away from any of the larger cities of the state, and is in the midst of a territory rich in natural resources. The company in control of the plant has chosen to build up a manufacturing center about it, and to supply energy at favorable rates to industries only a few miles distant, rather than to undertake long transmissions of power. Some of the reasons for this policy may be found in the fact that St. Lawrence County offers an attractive field for the manufacture of paper from wood pulp, and contains large deposits of magnetic and hematite iron ore, and of white and blue marble.

Nearly one-half of the present capacity of the electric station is devoted exclusively to the development of energy for the nearby works of the Pittsburg Reduction Company. One of the accompanying illustrations shows a view of the power-house interior, in the foreground of which may be seen four Allis-Chalmers type HI generators, each rated at 2,200 kilowatts, 500 volts, direct-current, which supply the power required for the aluminum works, and are kept in operation 24 hours a day and seven days a week, with very short intermission for inspection and repairs. Each pair of these generators is direct-connected to the shaft of a single set of horizontal turbine water-wheels.

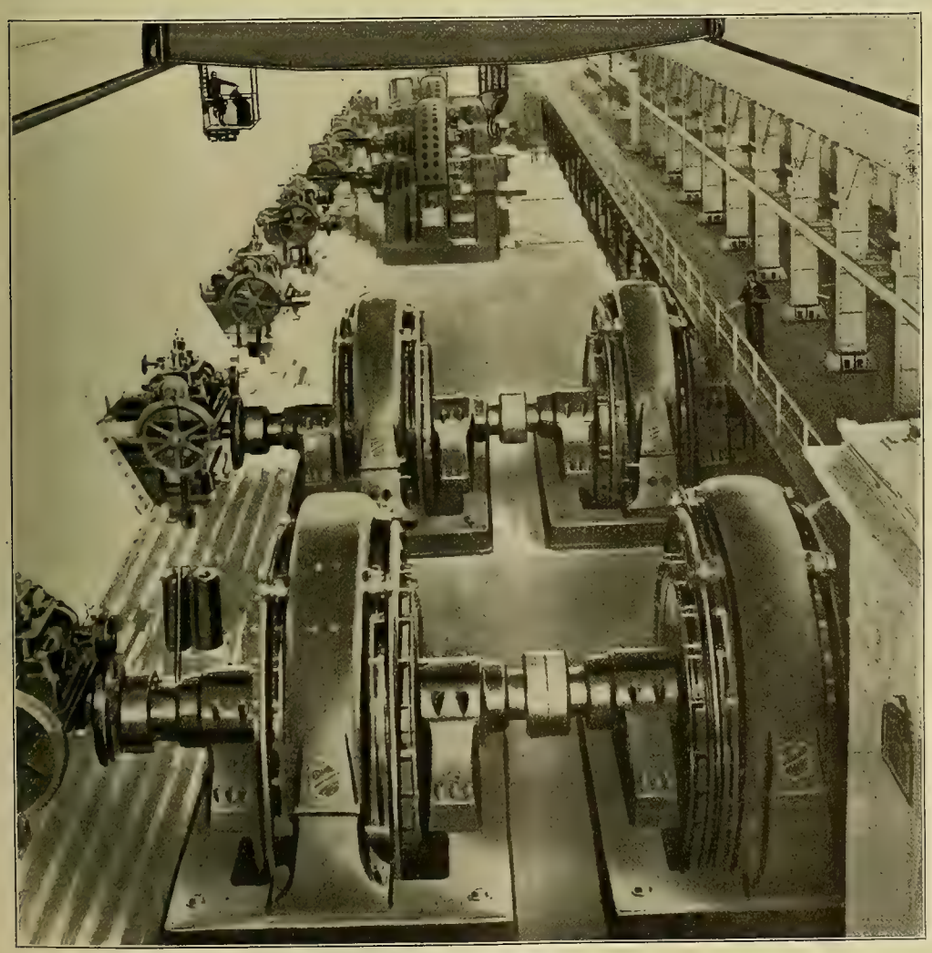
The output from the four generators is transmitted from the waterpower station to the works of the Pittsburg Reduction Company over conductors which have a single length of about 1,500 feet and are probably among the largest in the world. Each side of the two-wire 500-volt circuit which carries this current of 17,600 amperes is composed of a number of large flat bars of aluminum to a point a little outside of the power house, when it changes to 250 round aluminum wires, each having a diameter of three-eighths inch. For the support of the two conductors like those just described, there are two parallel pole lines with cross timbers between opposite poles, and the aluminum conductors lie directly on the wood at every support. An examination at one or two points has failed to show any signs of charring in the wood next to the aluminum wires, and it is stated that no trouble has developed from this cause.

In the works of the Pittsburg Reduction Company the greater part of the energy represented by the 500-volt current is used in the production of aluminum, but quite a large portion is consumed as power in the wire-drawing mill. Though aluminum is produced at other points by the Pittsburg Reduction Company, it is said that all the aluminum wire which is made in the United States is drawn at the Massena plant.

Exterior View of Power House.

Steel Bridge and Pole Line for Aluminum Conductors to Aluminum Works.

HYDRO-ELECTRIC PLANT NEAR THE ST. LAWRENCE RIVER AT MASSENA, N. Y.



VIEW IN MASSENA, N. Y., HYDRO-ELECTRIC POWER PLANT, SHOWING FOUR 2,200-KILOWATT DIRECT-CURRENT GENERATORS IN FOREGROUND.

Standardization of Units and Standardization of Machinery.

Unfortunately two standardization commissions got mixed in the article "Standardization Considered by the British Association" in the Western Electrician for September 8th. The report of the British Association committee refers to the meeting at Charlottenburg and to the official commission on electrical units and standards, which is to convene in London some time in October. This commission will be made up of accredited delegates from many governments.

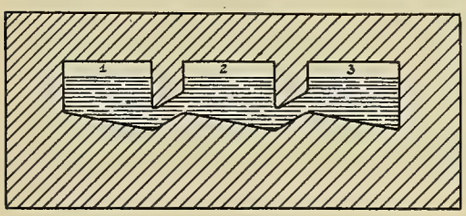
The other commission is the one on standardization of machinery. It consisted of delegates sent by several technical and scientific or engineering societies. It was this commission that met in London in July. This last is a technical commission as distinguished from an "official" one. Last week reference was made to the appointment of Mr. Higman of Ottawa as the Canadian representative on the official commission to meet in October. Both of these commissions, it will be recalled, were provided for at the St. Louis International Electrical Congress.

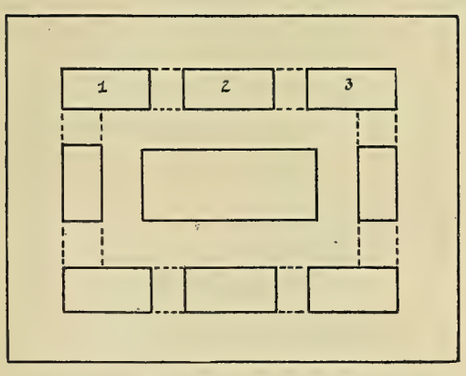
Henry S. Carhart of the University of Michigan, Ann Arbor, Mich., has a commission from the Department of State as a delegate for the October meeting in London.

An Electric Furnace with Circulating Basins.

A new form of electric furnace which operates on the induction principle has lately been invented on the Continent, and it is said to give superior results in the way of a good distribution of heat and the proper melting of the mass under treatment. With the usual form of induction furnace, in which the primary is formed of a large coil of a few turns of heavy conductor and the secondary by a circular trough containing the material to be treated, it is difficult to obtain a uniform distribution of heat and of the reaction in the mass, owing to the low conducting value of the mass for the heat as well as the slow diffusion of the melted bodies. In practice the best effect would be reached by a continuous circulation of the melted metal, as this will bring about a good mixture of all the parts of the bath and give a good renewal of the surfaces which are to be brought in contact with the reacting bodies of the mixture, either solids, liquids or gases.

To carry this out in the best way, the inventor uses the arrangement which is shown in the diagram in section and plan. The circular canal or trough containing the melted matter and forming the closed secondary circuit is replaced by a rectangular system, consisting of a succession of connecting chambers. The bottom of each chamber is sloping, and at the deepest part is a canal which connects the chamber with the shallower part of the next basin, and so on. As the heat effect of the current varies inversely as the section of the mass, the portion which lies in the deeper part of the basin is less heated. Therefore the two masses which are connected by the canal have different densities, owing to the difference of temperature, and there is thus produced a movement of the matter in the canal from one basin to the next. This movement is further reinforced by the heat of the current itself, and this gives rise to a continuous circulation of the melted matter around





AN ELECTRIC FURNACE WITH CIRCULATING BASINS.

the series of connecting basins, so as to give a good mixture of the products and carry out the proper reactions. In the diagram is shown a furnace with eight basins. The section shows the three basins of one side, with the connecting canals.

State Commission Lowers Lighting Rates in Syracuse.

The New York State Commission of Gas and Electricity on September 6th granted an application for an order fixing the maximum price of gas in Syracuse at 95 cents per 1,000 cubic feet, beginning October 1st. The price of electricity for street lighting is fixed at $68 per arc lamp and for commercial purposes at nine cents per kilowatt-hour for one year, beginning October 1st, the price after that to be eight cents. Present lighting rates in Syracuse are: Arc street lamps, $85.77½ per lamp per year; commercial incandescent, 12 cents per kilowatt, with two cents discount if paid before 15th of month; gas, $1 per 1,000 maximum. The complaint on which the investigation was had was filed last spring by Mayor Forbes of Syracuse.

Proposed Chicago-New York Electric Railway.

Although the announcement of the proposed construction of an air-line electric railway between Chicago and New York has been received with considerable incredulity, men connected with the project declare that they fully expect ultimately to complete such a road and that work on the line has already been begun. Some of the plans of the promoters were given in an interview with a representative of the Western Electrician by Alexander C. Miller, president of the New York-Chicago Electric Air Line Railroad Company, and J. D. Price, president of the Co-operative Construction Company, both having offices in Chicago.

On September 1st ground was broken 2½ miles south of Laporte, Ind., for the construction of an electric road by the Goshen, South Bend and Chicago Railway Company, the line to extend from a point near Goshen to near Chicago. This company is a subsidiary of the Chicago-New York company, and the road, Mr. Miller said, will be the first section of the big air line.

The beginning of construction work on September 1st was marked by a celebration at Laporte. In one of the accompanying pictures Mr. Miller is shown turning the first sod. A tastefully designed silver spade with ebony handle was used,

BREAKING GROUND FOR ELECTRIC RAILWAY NEAR LAPORTE, IND., THAT MAY BE A LINK IN CHICAGO-NEW YORK LINE.

and has since been on exhibition in Chicago. Another picture shows a traction engine, Western grader and a number of teams which were on hand to take up the work where Mr. Miller left off. The ceremony of the occasion consisted of prayer by Rev. A. J. Loettert of Laporte and addresses by Hon. George E. Clark of South Bend, Mayor Darrow of Laporte, Frederick H. Wood, secretary and treasurer of the construction company, and Messrs. Miller and Price. Two bands furnished music.

According to Mr. Miller, the proposed air line is to be built in sections similar to the one just mentioned. The Co-operative Construction Company, of which Mr. Price is president, will not only do the construction work but has also charge of the financing. What has already been realized from the sale of stock will be used in the construction of the Goshen-Chicago line, it is asserted. When this is fully provided for, another company will be formed to build further, and so on, till the entire line is completed, the Chicago-New York Electric Air Line Company to be the holding company for all.

A site has been purchased near Laporte for a power house to supply the present section. Mr. Price said the power house would be of the most modern and substantial construction capable of supplying current for 50 miles in either direction. The adoption of single-phase or direct-current operation, however, is still being considered.

The route through Indiana and Ohio is to be practically a straight line. This part of the road has been located, the heaviest grade being 16 feet to the mile. Through Pennsylvania and New Jersey surveys have been made, but the line has not been located, as the question of deviating slightly from an air line, to avoid expensive cuts and filling, is being considered.

Construction is to be for heavy traffic, and the entire road is to be double-tracked. It is expected that the Goshen-Chicago line will be profitable from the beginning, as it crosses many electric roads to which through service will be offered. The air line touches few cities, but many lie from two to 20 miles distant. It is the purpose to build branches to these nearby cities, and make traffic arrangements where cross-lines already exist. The first consideration, Mr. Miller explained, was to provide a first-class through service for passenger and freight business by the shortest route possible. There will be no grade crossings. The route, as now nearly located, will be 750 miles between Chicago and New York, the two shortest

READY FOR CONSTRUCTION WORK AT LAPORTE, IND., FOR ELECTRIC RAILWAY THAT MAY FORM LINK BETWEEN CHICAGO AND NEW YORK.

steam routes, according to Mr. Miller's figures, being 911 and 980 miles, respectively.

Asked about a Chicago terminal, Mr. Miller said that three propositions for an entrance were being considered, and one of them would be accepted, but ultimately he said the company would have its own terminal. Mr. Miller also says that he believes that the present project will some day develop into a four-track air line between Chicago and New York.

The Edison Convention.

The convention of the Association of Edison Illuminating Companies, held on September 4th, 5th and 6th, at the Hotel Frontenac, Thousand Islands, N. Y., added another to the list of successful meetings of the Edison Association. The business programme was carried out as planned and included the reading and discussion of the following papers:

"Costs of and Results from Advertising and Soliciting." By H. K. Mohr, Philadelphia, Pa.

"Details and Costs of an Inexpensive Underground System for Alternating Distribution in the Semi-suburban Residence Districts of a Large City." (A symposium of short papers by the underground experts of the large companies.) By W. T. Morrison, New York; William C. L. Eglin, Philadelphia; D. W. Roper, Chicago; Sidney Hosmer, Boston.

"Adjuncts to the Power Load." By C. J. Russell, Philadelphia.

"Investigation of Various Losses in the Electrical Systems of the Edison Electric Illuminating Company of Boston." By L. L. Elden, Boston.

"Recent Developments in Incandescent Lamp Manufacturing." By F. W. Willcox, Harrison, N. J.

"Various Types of Lamps and Practical Hints on Illumination." By S. B. Burrows, Brooklyn.

"The Isolated-plant Question." By M. F. McAlpin, New York.

"Alternating-current Motors for Various Purposes, with Especial Application to Elevators." By E. W. Lloyd, Chicago.

"Legislative Influence on Income Through the Meter." By Caryl D. Haskins, Schenectady.

"A Brief Report on Municipal Ownership." By Arthur Williams, New York.

In addition there was an interesting evening lecture by Mr. W. S. Andrews of Schenectady on the development of the Edison central station from the earliest examples. This was illustrated by lantern-slide pictures and proved to be very interesting and enjoyable.

The election of officers resulted as follows:

President—Alex Dow, Detroit.

Vice-president—Thomas O'Dea, Erie, Pa.

Treasurer—Louis A. Ferguson, Chicago.

Secretary—Ernest H. Davis, Williamsport, Pa.

Executive Committee—Alex Dow, Detroit; Joseph B. McCall, Philadelphia; Samuel Insull, Chicago; J. W. Lieb, Jr., New York; Charles L. Edgar, Boston; Thomas E. Murray, New York; L. A. Ferguson (ex officio), Chicago; E. H. Davis (ex officio), Williamsport, Pa.

As usual, the social features were greatly enjoyed. Philip Torchio of New York won the first prize and J. B. McCall of Philadelphia the second

prize at the golf handicap tournament. The lowest gross score at golf was made by L. A. Ferguson of Chicago, who thereby won the president's cup. In the mixed foursome the first prize was won by Mrs. McCall of Philadelphia and Frank E. Donohoe of New York, the second prize going to Miss Duclos and Charles B. Davis of Boston. A sailing party, tennis tournaments and a match at croquet for the children were other features of the outdoor sports, while receptions, card parties and the like passed the time agreeably in the evening.

The delegation from the Chicago Edison Company consisted of L. A. Ferguson, vice-president; John F. Gilchrist, assistant to the president; R. C. P. Holmes, purchasing agent; E. W. Lloyd, contract agent; E. J. Fowler, statistician; O. J. Bushnell, meter department, and Ernest Lunn, storage-battery department.

Surface-contact Street-railway System at Monaco.

Surface-contact electric traction has been applied with apparent success upon the lines which the Compagnie Française installed in the principality of Monaco, and it therefore merits description, especially as there are comparatively few electric-tramway lines on the Continent which are using the surface contact. The Monaco system includes a number of lines and branches which connect the railroad station, the Casino of Monte Carlo and many of the leading hotels, some of the lines running to the limits of the principality.

For the track grooved rails weighing 80 pounds to the yard are used. The rails are laid upon ties, which are sunk below the pavement in all cases. A narrow-gauge track of one meter is used throughout the system. One of the points about the Monaco lines is the profile of the road, seeing that the ground is very irregular, and contains a succession of hills and valleys. The principal grade, which occurs on the Avenue Monte Carlo, is 400 meters long, and it reaches eight or nine per cent. The least radius of the curves is 20 meters. As in general in surface-contact systems, the current is brought into the car by a series of blocks placed at intervals between the rails of the track, and a rubbing contact placed underneath the car passes upon the blocks. Here the contact blocks are connected by underground wiring with a series of switches of special design, which are placed in manhole pits spaced along the track.

The contact blocks are placed between the track rails in two parallel lines, which are staggered; thus the block of one set faces the space of the other set. A space of 0.30 meter lies between a block and the nearest rail. No current passes, and the blocks are entirely dead except when the car passes over them. The block is composed essentially of a contact-piece of mushroom form, which is screwed by a projecting piece into a cast-iron base-plate. The screw-thread runs clear through the plate, and at the under side it receives a copper contact piece, into which has been soldered the end of the cable which brings the current. The block which is thus formed is solidly fixed in a wooden block used as part of the pavement, and the block is fixed in a cast-iron box frame.

For one of these two series, called negative or low potential, the boxes, which entirely surround the wood block, have an outer base which is cast with them. They are connected with the rails by a copper cable. Once in place, the block is fixed to the ties of the track by long screws which pass through the outer base. For the other series, on the contrary, which is known as the high-potential set, the box frames have no outer base and do not entirely cover the wooden block. They are fixed from the interior upon the ties. The latter set is used to transmit the current from the feeder to the motors. By omitting the base of the cast-iron frame, the distance from contact block to rail is increased, and thus the loss to ground is diminished. From the under side of the block the cables pass off to the switch boxes in the pits.

At the side of the track are the pits, which are 2.10 meters deep, 2.60 long and 1.60 wide. They contain 22 changing switches, placed in two horizontal rows, with six mounted on each of the ends of the pit and 10 upon one of the sides. The fourth side remains free, so as to allow access into the pits. Upon the sides of the pit are creosoted pine boards, fixed in corner pieces and held in the wall. These boards serve to hold the sets of switches, and the rest of the wall is covered with cement. Above the empty side is placed the manhole cover, which is lodged in an iron frame flush with the pavement, and is tightly screwed down so as to be watertight.

The changing switches of the block circuits are composed of a solenoid in which an iron rod can move back and forth by the action of the current. An iron plate is connected with the rod. On the plate are mounted three small carbon contacts which are connected electrically by the metal of the plate. When the rod armature of the solenoid is attracted up, the carbon contacts come against three corresponding copper contacts placed underneath the solenoid. These latter contacts are insulated from one another. One of the copper pieces is always connected to the principal feeder, while the other two are joined, respectively, to the cables of the two following contact blocks of the high-potential series and to the corresponding contacts of the neighboring switches. When the current ceases in the solenoid, the disk falls, and the blocks which its contact made to operate on the 500-volt circuit are now cut out of that circuit. At the side of the switch is a magnetic blow-out, which prevents any arcing at the contacts when the falling of the plate breaks the current.

Under the truck of the car are mounted two contact bars, which lie parallel to each other and are of equal length. A cast-iron connecting piece fixes the bars to the motors. Mounted with the bars is a double system of levers, which is designed to give the right pressure upon the bar in order to make it run upon the top of the contact blocks, but without dragging upon the ground and producing a disagreeable noise, such as is sometimes observed in surface-contact systems. The tops of the contact blocks lie at a distance of 0.014 meter from the surface of the pavement.

SURFACE CONTACT CAR ON AVENUE MONTE CARLO, MONACO.

SURFACE-CONTACT CAR NEAR THE CASINO, MONACO.

The accompanying pictures show different views upon the Monaco lines. One of them shows the car mounting the grade on the Avenue of Monte Carlo, while the second view represents one of the cars on the line near the Casino. The cars are very comfortable, and are divided into first and second-class compartments, containing 36 places in all. Current is supplied from a station which has been erected near the railroad station of Monaco

Life of Wooden Poles.

The German Postal and Telegraph Department has recently published statistics collected during a period of 52 years on the life of wooden posts impregnated with different preservative substances, says the Electrical Review of London. The number of posts under observation amounts to nearly 3,000,000, and the following are the average results obtained:

Poles Impregnated with	Length of Life.
Sulphate of copper	11.7 years
Corrosive sublimate	13.7 years
Creosote	20.6 years
Unimpregnated	7.7 years

The manner of preparing the poles has been improved from time to time, and this is clearly shown in a further table giving the average length of life of the poles under different methods of treatment with each preservative at different periods. For example, in 1883, with sulphate of copper the average life was 9.4 years, while in 1903 the method of treatment had been improved so that an average life of 13.3 years could be obtained.

Detroit River Tunnel.

The contract for the construction of the tunnel under the Detroit River at Detroit for the Michigan Central Railroad has been awarded to Butler Bros. & Hoff Company of New York city. The contract date of completion is June 1, 1909. In this important tunnel the trains will be hauled by electric locomotives.

J. J. Berger of Eminence, Ky., is one of the incorporators of the Henry County Light and Power Company, capitalized at $40,000. The company has organized to conduct a general lighting and power business in Henry County, Kentucky.

WESTERN ELECTRICIAN

EVERY SATURDAY.

PUBLICATION OFFICES:

507 Marquette Building, - CHICAGO.

TELEPHONE, MAIN 1746.

Eastern Office, 150 Nassau Street, New York.

Telephone, 5220 Beekman.

Trade Supplied by Western News Co.

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REMITTANCES.—All checks, drafts and other remittances should be made payable to the order of the publishers, the **Electrician Publishing Company,** and addressed to the offices of publication, Suite 507, Marquette Building (204 Dearborn Street), Chicago, Illinois, U. S. A.

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FALL TRADE prospects in the electrical industry are indeed excellent, as is shown by the views of electrical business men on the subject published elsewhere in this issue. This has been the case, also, for a number of preceding years, and one wonders whether the "good times" will continue indefinitely. Let us hope that they will, but in the meantime a tremendous home demand for electrical apparatus should not make us neglect the foreign market, which is assiduously cultivated by Great Britain, Germany, Switzerland, Austria-Hungary, Belgium and other nations, in the electrical field, and which may, at some future day, be more important to us, relatively, than at present. The electrical export trade of the United States is growing very satisfactorily. Prosperous trade conditions at home should not, however, be permitted to make us in any way indifferent to it.

IT IS A QUESTION to what extent outside experts should be employed to standardize and systematize the bookkeeping methods of electric-light companies. Mr. T. E. Crawford of Cleveland, who read a paper on "Comparative Statement of Revenues and Expenses" at the recent Ohio convention, said that he was familiar with the systems of accounting in use by many of the smaller central-station companies of the state, and the greater part of such systems are based on cash receipts and cash disbursements, instead of the scientific principles of "revenue and expense." Simplicity in accounting systems should be the first principle to be considered in the smaller cities, for bookkeepers and auditors there have had but little experience in scientific accounting principles.

Mr. Crawford is thoroughly convinced that the smaller central-station managers could not make a more profitable investment than to procure the services of a thorough, practical public accountant to systematize and devise a scientific accounting system, and thereafter make a semi-annual, or at least an annual, audit of the books and analyze the working of every department on a "revenue and expense basis." Further, he also thinks that the larger companies would be greatly benefited by having some disinterested, practical accountant to audit and analyze their records. However, Mr. Crawford is not at present, we believe, connected with any electrical company, and perhaps he looks at the situation from a different viewpoint than the average station manager. Perhaps, if standard accounting is ever secured, further expert supervision will not be necessary.

AN INTERESTING and apparently novel point was brought out by Mr. C. F. Jenkin, in a paper on "The Advent of Single-phase Electric Traction," read before the Engineering Section of the British Association at the recent meeting in York. The author pleaded for a relaxation of what he termed the extravagant precautions now demanded for the safety of the public in travel, and pointed out that these resulted in far more lives being lost in the crowded slums (which the utilization of electric railways would avoid) than were saved by the avoidance of rare accidents. This is a bold doctrine to proclaim, and in England of all countries. In a broad view it is perhaps justified, but a better plan is to do away with the crowded slums by ample electric-railway facilities, while at the same time giving the traveling public the benefit of all reasonable protective requirements.

Elsewhere in his paper Mr. Jenkin called attention to the rapid advance of electric traction on railways, pointed out its advantages, and described briefly the system on which it should be carried out. The cost of electric hauling may be more or less than that of steam, according to circumstances. The real advantage of electrification is that it will make the line pay better. It will provide a faster, more frequent and more comfortable service for the public, and consequently will attract a much larger traffic.

ADDING his testimony to the many advantages of electric drive in cotton mills, Mr. John A. Fernley of New Bedford, Mass., gives the results of his practical experience on the subject in a paper read before the National Association of Cotton Manufacturers at the Lake Champlain meeting this week. One of Mr. Fernley's suggestions relates to the blowing out of motors. He points out that in a room where there is a large amount of dust and cotton fibers in the air, such as is found in card rooms, etc., the air gap will soon become more or less clogged up, thus interfering with the operation of the motor. To overcome this it is necessary to have the motors thoroughly cleaned out by blowing out this accumulation of dust and dirt. The time intervals between such cleanings depend upon the position of the motor, but Mr. Fernley inclines to the idea of giving it a good cleaning at certain stated intervals rather than simply to clean it a little every day. About the only effectual way to get this lint and dust from the interior of the motor is to install a compressed-air system, the pump for which may be placed in the engine-room basement or other convenient place, and to carry this air by means of pipes to every motor in the mill, placing a valve on each side of the motor. Some man should be selected to attend to this work in the different rooms and provided with about six feet of strong rubber hose, capable of withstanding a pressure of about 55 pounds. "Have it understood," says the author, "that the air must be applied to each side of the motor more than once, blowing from one side and then the other alternately. The reason for this is because there are so many crevices and angles in a motor that blowing from one side alone would only distribute the cotton dust around the inside of the motor." Then the electrician should go over the motors and inspect them, testing them with the gap gauge to see that there is no danger of the armature touching the field.

IN THIS ISSUE of the Western Electrician considerable space is devoted to the always timely and practical subject of the economical handling of boilers and furnaces in steam power plants. Mr. C. H. Williams' article on this subject, entitled "Fuel Combustion and Boiler Management," is intended for practical men employed about the station, and therefore it begins with first principles. It is written with admirable clearness, traversing the whole subject, and although it is not pretended that any novel or startling theories are presented, the subject is unfolded in such an attractive manner that we think every power-house superintendent will do well to call the attention of his boiler-room employes to the article, which will be concluded next week. The author, it may be added for the benefit of those who are not already aware of the fact, is the manager of the Wisconsin Light and Power Company of La Crosse, Wis.

Another article on the same general subject is that comprising the major portion of a paper on "Some Characteristics of Coal as Affecting Performance with Steam Boilers," by W. L. Abbott, chief operating engineer of the Chicago Edison Company, read before the Western Society of Engineers last week. Mr. Abbott, whose capacity for the investigation is undoubted, considers the effect of coal of different sizes, the influence of ash in coal, the effect of variation in size of coal screenings and the results of different thicknesses of fire. One result of his researches is particularly striking, and that is that the useful effect from the fuel drops to zero with 40 per cent. of ash, notwithstanding the fact that the other 60 per cent. of the composition is pure coal. "The fact should be emphasized," says Mr. Abbott, "that although over half of the composition fed to the fire was fuel, it burned without producing any useful effect, for which there are two reasons—one, that, on account of obstructed air supply through the fuel bed, incomplete combustion and escaping hydrocarbons carried away a portion of the heat, because the gases passed immediately among the tubes of the boiler. The other is that, owing to the presence of an excess of ash, the percentage of fuel on the rear portion of the grate is greatly reduced. On this account a larger proportion of the air passing through the fuel bed does not combine with the fuel, but enters the furnace as free air." If the beginner desires to know why too great a supply of air to the furnace is objectionable, he may well consult that portion of Mr. Williams' essay devoted to the subject. But the point that coal containing 40 per cent. or more of ash is absolutely valueless is important and should be remembered.

FALL PREPARATIONS AT THE CENTRAL STATION.

After the lull of summer, the progressive central-station manager may well ask himself, this fall, if there is no way in which he can signalize the fall and winter business of 1906-07 by a more material advance in connected load than would result from the natural growth of the business, or possibly accomplish a similar result by more efficient methods of operation. In short, are there no valuable "pointers" which may be given to the plant manager in cities of medium size as he stands facing the fall business? This very practical question was put to a few experienced central-station operators by the Western Electrician in the preparation of its Fall Trade Number, and the following brief, helpful articles from men who have "made good" in this line were the result:

Secure the Confidence of Your Customers.

By A. W. Zahm,

President of the Iowa Electrical Association and general manager of the Brice Gas and Electric Company of Mason City, Iowa.

The old adage, "There is no rest for the wicked," can be aptly applied to the campaign for central-station business. I say "wicked," because a central-station manager is usually looked upon as such by the general public, and one of the principal aims of the manager should be to overcome this prejudice and have the confidence of the consumers. This can best be done by making a study of every "kick" or complaint that is received, whether it be real or imaginary, and giving the same prompt and careful attention.

Push every current-consuming device, be it ever so small, for "every little helps." See that the store buildings are properly lighted by the proper distribution of the lights installed; also advocate and push window-display lighting. This is of double value, in that it advertises the lighting business and also the goods displayed in the merchant's window. I would suggest that the central-station companies make a flat rate per light for window lighting on limited service from dusk until 11 p. m. Also push the sale of electric signs, which can be done to the best advantage during the fall months.

With reference to current production, I suggest that special attention be given to the fireman. See that he uses judgment and burns your coal economically. Install a recording steam gauge and insist upon an even steam line. Also install a recording voltmeter and see that the voltage is kept constant. Prevent outages and interrupted service as far as possible. If your lights go out frequently, your consumers will soon lose confidence. They will find it necessary to install some other system of lighting to carry them over this period, and they may often continue to use this substitute during the long winter months to reduce their expenses at a time when the central-station companies should be reaping their best harvest.

Favorable Power Rates and High-efficiency Lamps.

By Emil G. Schmidt,

Vice-president and general manager of Springfield Light, Heat and Power Company, Springfield, Ill.

As local conditions vary in different cities, and every company has its own method of promoting new business, we would hardly presume to say that we have anything new to offer in this line. As our sales of light for the year 1905 were 52.15 kilowatts per capita, based on a population of 40,000, and our power sales were 12.86 kilowatts per capita, based on the same population, it will be seen that we are doing fairly well for a small-sized town.

These sales will be increased this year, especially in the power line, as we have taken on a boiler works, with a connected load of 400 horsepower and a watch factory with a maximum demand of 125 horsepower. We have made a special effort to secure this class of business by offering low rates between the hours of 7 a. m. and 5 p. m. We furnish 60-cycle three-phase current to these customers, which is supplied from the same generators that we use for supplying current to our commercial circuits. We have also offered a low rate on sign and window lighting to induce our customers to keep their store fronts well lighted until 10 p. m. every night.

We make it a practice to install the latest type of appliances for illumination, including the Nernst lamp and the new high-efficiency lamp manufactured by the General Electric Company, and carry a full line of electrical novelties, including cooking utensils, irons, etc. We have recently installed a "talking sign," manufactured by the Electric Motor and Equipment Company, outside of our office. This is attracting a good deal of attention, and will assist us in selling other signs.

Although the average rate received for current is materially reduced by giving these special rates, the net profits have convinced us that it pays to increase our load factor, even if it is done at a lower rate.

Some Pertinent Questions.

By Frank W. Frueauff,

Vice-president and manager of Denver Gas and Electric Company.

The central station, as it approaches the fall and winter season, must ask itself many questions and be prepared to answer them satisfactorily or find itself in difficulties too late to be remedied promptly.

Some of the important questions are:

Is our general service in good condition?

Are the additions to our plant, planned last spring and installed during the summer, completed, and will they be ample for our fall and winter business?

Have our customers said and shown they were satisfied with our treatment of them?

Are they pleased when they call at our office?

Do they say their lamps are all in good condition? Have we exchanged all their burned-out or dim lamps?

Are all the fuses in order?

Are we prepared to investigate and satisfactorily explain all the increases in bills that will be sure to arise in the next few months as the lighting hours increase?

Do our works foremen realize that a little watching and drilling of firemen and engineers will result in a saving in coal bills and in improved service?

Have our transformers been gone over to locate any defective or weak ones as a result of summer lighting or disuse?

Have we checked over our consumers' accounts to locate any meters not registering, and are there any that seem to be using less current than they did a year ago?

Have we inspected our pole lines? Are they ready for stormy weather?

Are our employes awake to the possibilities of the company during the fall and winter months? Do they realize that it has been "slow business" during the summer, and now they must exert their best efforts to help the company break even for the year?

Has our commercial department checked over its list of non-users and called upon them or sent advertising matter explaining the merit and saving in wiring their homes and using electric light?

Are we prepared to talk and advertise porch lights, hall lights and special electrical appliances in the homes?

Have we seen our merchants and talked "store and window lighting," an electric sign, or the outlining of their building?

How many places are there where merchants or manufacturers are making changes in their methods, where electric power can be installed?

What are we doing to shut down the isolated plants in our city?

Let us think these things over and apply them, and the savings and increases we look forward to will be sure to materialize.

Carnival Lighting and Wholesale Lamp Renewal.

By "New Business,"

A prominent Wisconsin central-station manager who desires that his name be withheld.

At this season of the year, when new-business departments are turning their attention particularly to the development of electric illumination, many companies are able to introduce display features in the way of window lighting and outlines, temporarily, by getting newspapers to make appeals to business houses to decorate during local fairs, carnivals and festivals.

Such disinterested appeals to the city's loyalty, followed up by wideawake new-business representatives, who bring with them full information, make possible the taking on of a large number of special features in lighting on a dusk-till-midnight basis.

For such special work, for a short period, consumers are willing to pay more than regulation rates, and considerable net revenue may be secured for the short interval without affecting the annual peak, which comes much later in the year.

The big advantage of such installations, however, comes not from the petty-larceny profits to be derived from the temporary lighting; but where the work is properly laid out and put up in approved form, it is not a difficult problem so to cultivate the consumer that the value of such form of advertising grows upon him, and when the time for the contract to be signed arrives, the relatively small cost of running the feature till midnight every night in the year, compared with the cost for the short period, offers a pleasing argument, while the public is ready to condemn as niggardly the consumer who would at first thought discontinue such a valuable means of becoming conspicuous in the public eye.

This is one means of getting started a very desirable class of long-hour business, and on annual midnight contracts every central station can afford to sell at a very attractive rate.

As pointed out in the last Milwaukee meeting of the Northwestern Electrical Association, many stations might find it to their advantage to consider a wholesale renewal of incandescent lamps just previous to the annual peak load.

Consider a plant loaded to the point where the manager is wondering if he is to be able to secure delivery on an additional generator to take care of an unexpected increase of load. Deliveries, he is informed, will be delayed and perhaps disappointing, and the 24-hour shifts of the working forces, in their efforts to get in shape, bear heavily on those in charge.

Consider the cost of new equipment, with the extra piece tacked on for "hurry-up," the tearing to pieces of the station under load, and the resulting unfavorable service on the one hand, and on the other hand the difference in the cost of a high-efficiency lamp and the one you are using, together with the cost of changing and loss of revenue, and see if the balance is on the new-equipment side.

Consider a plant of 400 kilowatts, loaded full, with a 33⅓ per cent. load factor on lights. This means 18,750 lamps connected, if lamps using an average of four watts per candlepower at the machine are used.

If instead of the four-watt lamps a change be made to lamps consuming but three watts for the interval of heavy peak load, 25,000 lamps could be operated under the same conditions of load factor without changes in the regulation on the lines.

Each case must be figured for itself, but conditions in some plants, no doubt, are such that schemes of this kind should be given consideration.

St. Georges-Fabrezan Power Transmission.

In the South of France a hydro-electric plant has been installed by the Société Méridionale de Transport de Force, which is one of the most important in the country. It furnishes current through a very extended region, as will be remarked from the fact that the distance from the generating station to the principal center of distribution is about 45 miles, and from the latter point are run different lines up to 30 miles length. At present the overhead lines have more than 350 miles total length, and they furnish current to over a hundred communes, representing a total of 150,000 inhabitants.

The generating station is located at the entrance of the gorges of St. Georges, and utilizes a fall of some 300 feet. It is laid out for eight main turbine groups, with three-phase alternators of 800 horsepower. The turbines are supplied by the Vevey Company and are of the horizontal-shaft pattern, operating at 300 revolutions per minute and using an automatic governor with hydraulic motor. Coupled direct to the turbines are alternators of the Alioth type, which, like the rest of the electric outfit, have been furnished by the Société d'Applications Industrielles. These machines will give 700 kilowatts at full load, and work at 2,900 volts. Of the inductor type, they furnish three-phase current at 50 cycles and are connected on the star system. A set of step-up transformers raises the voltage to 20,000 for the overhead lines.

From the station a long feeder runs for 45 miles to the distributing center at Fabrezan. Three principal lines branch from this point to the important localities, taking in the small towns on the way. A large amount of current is used for lighting and motors, and the company has not only recovered the outlay for the plant, but is beginning to pay dividends.

FUEL COMBUSTION AND BOILER MANAGEMENT.

A Brief Exposition for Practical Men.

By C. H. Williams.

Part I.

In taking up the discussion of the generation of steam in the boiler, it is but logical first to consider the process which is carried on when the boiler fuel, as fuel, is burned, liberating the heat, which in turn changes the water in the boiler to steam.

The most common fuel for this work is coal, and in order to see where the coal receives its stored-up energy it will be interesting to look back and note how the coal itself was formed.

Centuries ago vegetable matter was very abundant on the earth, and the coal fields of today mark the locations of tremendous forests of the past. As the trees of the forests died and fell the wood decayed or decomposed, and the process of decomposition continued year after year.

Frequently the deposits of vegetable matter were very deep, and the air being unable to find its way to all parts of the mass, the process of decomposition advanced but slowly, and this very fact accounts for the possibility of the formation of the coal such as we now use in our furnaces. As time went on the masses of vegetable matter were gradually changed in nature, starting first with the trees, roots, mosses and leaves; the substances formed were peat, lignite, bituminous or soft coal, and, finally, anthracite or hard coal.

If, in the early stages of these changes, the substances had had free access to the air as the process of decomposition advanced, the result would have been the same as though the wood and roots were burned in a fire, and the deposits which would have remained, instead of coal, would be similar to ashes, and would possess no fuel value, as the heat would have all been liberated and the process of combustion completed. The changes which go on in a piece of wood when left in the air to rot are in every way similar to the process which takes place when a similar piece of wood is burned in a fire, and the products remaining are the same, the only difference being the length of time which is necessary to complete the change.

The amount of heat which is liberated in the one case is exactly the same as in the other, although we are not sensible of the heat which is liberated when the process is slow as in the case of decay, for the reason that the heat is dissipated as fast as it is liberated, and there is, therefore, no sensible rise in temperature. In other words, what we usually calling burning, what we call exploding and what we call decaying or decomposing are all one and the same thing. In each case the oxygen of the air unites with the carbon of the material acted upon, forming a new substance, and this process, which is a chemical change, liberates the heat which had been stored up in the substance at some earlier period.

In every case the heat which is liberated was originally absorbed from the sun. For example, the trees of the forests from which our coal mines are derived absorbed heat at the time when the trees were growing, and without heat they would not have developed; and if it were possible to measure the amount of heat which was absorbed during the life of these forests and to measure the heat which is let free when the forests, as coal, are burned, it would be found that the same amount of heat can be taken from the coal as was absorbed by the plants in their growth.

Heat and Temperature.

In order that we may be sure that we all have the same understanding of the meaning of certain terms which we will frequently use, it may be advisable to review hurriedly the meaning of some of the more common terms. Two of these are the words "heat" and "temperature." These two are frequently misused, the one being applied where the other is intended. To give a definition, "temperature" is a measure of the intensity of heat, while "heat" itself is measured in terms of quantity. For example, a pound of coal in burning is capable of liberating a certain quantity of heat, and this quantity of heat is expressed in so many heat units.

If a pound of coal is completely consumed or burned there is a certain definite amount of heat liberated. It makes no difference whether the burning required an hour for its completion, as might be the case where it smoldered in an open grate, or whether it exploded, as it might do if reduced to a finely divided state. Exactly the same amount of heat would be liberated in either case, but the temperature which would be produced by the action might be entirely different. In the case of the slow burning but a small amount of heat would be liberated per second, and therefore the heat would have ample time to be carried away without raising the temperature of the surrounding objects to any appreciable degree. But in the case of the instantaneous burning or explosion the heat could not dissipate itself instantly, with the result that the surrounding air and materials, if they are present, would take up more heat than they could get rid of, and therefore the temperature or the intensity of heat would be increased. If the heat which is liberated comes in contact with a vessel containing water, the water will absorb the heat and its temperature will be increased.

If a pound of water is available for absorbing the heat, and the walls of the vessel are so insulated that no heat is radiated from their sides, and all of the heat which is absorbed is retained, it will be found that every unit of heat which is added to the pound of water will raise the temperature of the water one degree, as measured on a Fahrenheit scale. When scientists first began the study of the action of heat they determined upon this definition—that the standard measure of heat, or the heat unit, should be that quantity of heat which would raise the temperature of one pound of water one degree, from which we get our definition of both the heat unit and a degree of temperature.

This unit of heat is called a British thermal unit and is often designated by the capital letters B. T. U.

After determining that a pound of coal produces, when burned, a certain definite number of heat units and no more and no less, experiments were made on other substances than water, and it was found that different substances had different capacities for heat. For instance, the amount of heat that would raise the temperature of water one degree would raise the temperature of a pound of iron eight degrees, a pound of copper 10 degrees, and a pound of lead 33 degrees. Following out these experiments, it is found that substances differ widely in the quantity of heat which is required to change a mass of one pound by one degree difference in temperature, and the amount of heat which is required to make this change is known as the specific heat.

As it is a fact that a certain definite amount of heat is liberated whenever a certain amount of fuel is decomposed, and that the same amount of heat is absorbed by these materials during the process of their formation, it is also true that wherever chemical changes take place or where two or more materials are united together chemically to form a new material there is exactly the same amount of heat liberated as there is absorbed when the product of this change is broken up and the compound returns to its original element. A common example of this is familiar to all in the freezing of water and thawing of ice.

When a pail filled with ice is brought into contact with heat over a flame it is apparent that a large amount of heat is necessary to make the change in the substance from ice to water, and although the reason may not have occurred to all, you are simply taking advantage of the absorption of heat when you place a pail of water in the cellar to keep the cellar from freezing. There is just as much heat given up by the pail of water when the water is changed to ice as is required to be supplied when you melted the ice to change it back to water. The cool air from the outside of the building lowers the temperature of the cellar, and it, being below that of the pail of water, absorbs heat from the water. This process continues until the water reaches a temperature of freezing, but before the water will freeze, and while remaining at the freezing temperature, it will give up an amount of heat equal to four times the amount which it gave up in cooling from 70 degrees down to the freezing point, or it gives up 142 heat units, and it is this particular property of the water, where heat is given up to produce the change, that makes the water a valuable reservoir of heat and prevents the freezing of other bodies from taking place.

Combustion.

When we speak of a substance exploding, burning, rusting or decaying, we mean that the substance is uniting with the oxygen of the air. In taking coal for an example we mean that the carbon of the coal and the oxygen of the air are coming together as separate substances and uniting to form other substances which may be and are entirely different from either of the elements with which the union took place.

The chemical combination of any substance with oxygen is always accompanied with a production of heat, and in case the burning is rapid enough the heat is accompanied with light. The rapidity with which the uniting of the oxygen and the carbon takes place depends very largely upon the temperature of these substances when they are brought together. In the open air, where the temperature would be that of the surrounding atmosphere, the action is very slow, and on the grate bars under the boiler, where the temperature of the furnace may be up to 1,800 degrees, the action is comparatively rapid. In another case, where the temperature lies between these two extremes, the action is but moderate.

The case to which I refer is that of the burning or combustion which takes place within our bodies; the act of breathing is almost identical with the action which goes on within the boiler furnace and in the open air where materials rust away.

In the lungs of our bodies we find a very effective furnace, and if it were not for the combustion which takes place within our lungs the temperature of the body would rapidly fall and the action of our physical system would cease. The oxygen of the air which is drawn in by the lungs comes in contact with minute particles of blood containing large amounts of carbon. The carbon unites with the oxygen, and in doing so produces heat. The heat in turn is taken up by the blood and forced through the system, maintaining the temperature at which the process of life can continue, and the products of combustion which leave our lungs, if analyzed, will be found to be almost identical with the products of combustion which leave the furnace and pass up through the stack.

Oxygen, Carbon and Other Elements.

I have spoken of the process of burning or combustion being that of the uniting of the carbon of the fuel with the oxygen of the air, during which process heat is liberated, and it will be well for us to consider for a few minutes what this oxygen and carbon we are talking about are like.

When we consider all of the materials and objects which are met with in the world in all their different forms and shapes and appearances, differing so widely from one another throughout the several divisions of the animal, vegetable and mineral kingdoms, it seems that there must be a tremendous number of different substances which go to make up all of the peculiar formations.

And it is a matter of some little surprise to some of us to find on investigation that all of the different substances which go to make up the world around us are in reality composed of but a very few elements, and that these are united in innumerable different ways chemically, producing what to all appearances are substances entirely unlike one another.

If we were to consider 100 of the common objects about us, including the air, water and our bodies, the trees, stones, sand, earth, and the fuel we burn, we find that over 90 per cent. of them are made up of different combinations of less than a dozen elements and that a very large percentage are composed of the elements oxygen, hydrogen, nitrogen and carbon.

The formation of substances from the elements is known as chemical formation, and in each case where a chemical change takes place the original substance loses its identity and characteristics, and a new one, perhaps differing entirely, is formed, and in the change heat is liberated.

If a drop of water were reduced to its elements it would be found that it is made of two, namely, oxygen and hydrogen. These two elements are gases; they are both invisible, have no taste and no odor, and the oxygen is a little heavier than air, while the hydrogen is the lightest substance known, being 14½ times lighter than air and 16 times lighter than oxygen. These two substances, known as elements, cannot be reduced any farther, for they are in their simplest form. They can, however, be united again to form water, and this is the way that all water is

formed, by the chemical combination of oxygen and hydrogen.

If air instead of water is analyzed a different condition is found to exist. Here we have two elements—oxygen and nitrogen—but they both exist in their original form, for air is only a mechanical mixture and not a chemical combination. The element nitrogen makes up about four-fifths of the air, the other fifth being oxygen.

The element oxygen is the most widely distributed of all elements and occurs in large quantities, for 40 to 50 per cent. of the solid crust of the earth is oxygen and eight-ninths of all water is composed of this element.

The Burning of Coal in the Furnace.

The process of burning or combustion as it ordinarily takes place in the furnace is in reality a two-stage process. I have spoken of a pound of coal as having a certain heating value, and by this we mean that if the fuel is completely burned a definite amount of heat is liberated. Investigation will show, however, that this heat is not all liberated at once, and this fact is of very great importance to us in considering the proper handling of furnaces to get the best results out of the fuel used.

In the manufacture of gas from coal, where a pound of coal is burned, which we will consider equal to pure carbon, it has been found by experimenting that 14,500 heat units are available, which means that if all of the carbon of the coal unites with oxygen of the air, so that each part of carbon combines with two parts of oxygen, all of the heat of the coal has been liberated and produced 14,500 B. T. U.

It is a fact, however, that the carbon of the coal and the oxygen of the air can unite in such a way that one part of carbon unites with but one part of oxygen, and in doing this about one-third of the total heat of the coal is liberated. When this occurs a gas is formed, and as this gas is capable of uniting with more oxygen and further burning, this gas is known as the combustible gas and is the ordinary water gas which is made at the gas-works, known chemically as carbon monoxide, which means carbon with "one" oxygen.

When coal in the furnace is burned to carbon monoxide there are liberated but 4,551 heat units out of the total of 14,500, and when the one part of carbon unites with another part of oxygen and forms carbon dioxide or carbonic acid gas, about 10,000 heat units are liberated for every pound of fuel burned.

Where fuel is burned on the grate bars in the furnace the air is ordinarily brought up through the bed of fuel from the ash-pit below, and the fuel, being heated to a full red heat, assists the combustion by raising the temperature of the air to the point where combustion readily takes place.

Supply of Air for the Furnace.

Too many men, in firing boilers, use as a guide the color of the smoke which comes from the stack, and although I do not want to get anyone into trouble with the municipal authorities by encouraging the production of smoke, I am quite sure that in the great majority of cases an analysis would show that much more air than is necessary passes through the firebox and is the source of a large amount of waste.

If too little air is admitted to the firebox, a loss is caused, as well as when too much air is admitted. The coal in the furnace depends upon the air for its supply of oxygen in order to burn, and if the supply is insufficient the result will be that the coal is only partially burned. To all appearances the burning may be complete and there may be nothing left but ashes on the grates, and there may be a colorless smoke leaving the stack, but there still may be a large amount of gas escaping from the stack, which, if supplied with oxygen from the air at a proper temperature, would liberate a tremendous amount of heat. In other words, by allowing too small a quantity of air to reach the furnace the coal may only be burned to carbon monoxide, to which reference was made before, wherein less than one-third of the heat is liberated.

Many boilers will show, when an analysis is made of the gases passing up the stack, that this condition exists, and if these stack gases could be collected they would be valuable for use in a gas engine, where additional air would be mixed with them and their pressure and temperature raised to the point where the burning would be completed and the other two-thirds of the heat made available.

The condition of an insufficient supply of air is not as common as that where too much air is admitted, and in this case losses may occur from two different sources. In the first case, if more air is admitted than is necessary for the complete combustion of the fuel, this excessive air robs the boiler of heat which otherwise might be used in changing the water in the boilers to steam, for the air flows in at the temperature of the room, which we will suppose is 75 degrees, and leaves at the temperature of perhaps 400 or 500 degrees, absorbing in its passage through the boiler 75 or more heat units for every pound of air, which do not do useful work. If these heat units could have been utilized by the boiler they would, from our definitions given earlier, have raised from 75 to 100 pounds of water one degree in temperature. But this is not the only loss, for the cold air coming into the firebox reduces the temperature of the firebox, and in many cases brings the temperature to such a low point that a large amount of gas which otherwise would have burned does not reach the critical temperature and so passes out through the smokestack unburned.

Construction of the Firebox.

At this point it might be well to mention another frequent serious loss in boilers which is effected in a similar way, and that is the loss due to the faulty construction of the firebox.

In building the firebox of a boiler it is necessary to know what kind of coal is to be used before an intelligent design of the firebox can be made. This will readily be seen if we consider the great difference in the action of different kinds of coal in the furnace. The coals which are offered to us for boiler purposes vary greatly in the amount of volatile matter contained in them. The bituminous coals used for making coal gas contain the largest amount of volatile matter of any coal with which we are apt to meet in this part of the country. These gas coals when subjected to the high temperature readily give off a large percentage of their weight in the form of gas which seems to be but loosely held in the coal and is separated very easily in a short time.

A fair example of this is seen at the gasworks, where the coal is placed in red-hot retorts and baked. The heat applied on the outside of the retort drives off the gas or the volatile matter and leaves the fixed carbon which is ordinarily termed "coke," the spongy appearance of which shows in a manner the way in which the volatile matter is distributed throughout the coal. Ordinarily this coal is baked for four hours, but every gas man will tell you that by far the greatest portion is given off during the first stages of the baking process, and this is true when similar coal is used for boiler purposes.

A shovelful of green coal is thrown on a hot bed of fuel in the firebox, and immediately a large volume of combustible gas is given off. In order that this gas may be burned and the heat liberated in the furnace, it is necessary that a sufficient space be given, and that sufficient time be given, for the air to mix with this gas for the combustion to take place before the combustible gas comes in contact with any cold surface. The shell of a boiler placed close to the grate bars presents sufficient cold surface to lower the temperature of the furnace gases to a point where the combustion will be very materially decreased, and for this reason it is necessary so to arrange the firebox that ample time is allowed for the gases to mix thoroughly with the air and complete the process of burning before the heat produced by combustion reaches those parts containing the water. This explanation will also show the necessity of firing small amounts of this kind of coal and firing it often, so that practically an equal amount of gas is being given off at all times, and that the air may be admitted in such quantities as to give the proper amount for complete combustion at all times.

After the volatile matter is given off the fixed carbon or coke burns more slowly and evenly, and the boiler under which hard coal or hard coke only is used can have the grate bars placed quite near to the heating surface without endangering a loss from this source.

Many boilers are so arranged as to admit some air through the grate bars, some through the firebox doors, and still another amount in the back end of the combustion chamber, or after the gas has started on its travel to the tubes. Where air is so admitted it is necessary to carry it through a hot passage in order to raise its temperature sufficiently to maintain combustion; otherwise the effect of this air would be entirely lost, and its admission to the boiler would only rob it of otherwise useful heat.

Type of Furnace to Be Employed.

For those coals containing between 20 and 40 per cent. of volatile matter, probably the best furnace is the plain grate-bar furnace with a combustion chamber thoroughly hot. The best furnace for coals containing over 40 per cent. of volatile matter is a furnace surrounded by fire brick with a large combustion chamber, and some special appliances for introducing very hot air to the gases distilled from the coal, or, preferably, a separate gas producer and combustion chamber, with arrangements for heating both air and gas before they unite in the combustion chamber. A long step will be taken in the right direction when this kind of a scheme is more carefully considered.

The furnace to be especially avoided in burning all bituminous coals containing over 20 per cent. of volatile matter is the ordinary furnace in which the boiler is set directly over the grate bars and in which the heating surfaces of the boiler are directly exposed to the radiation from the coal on the grates. The modern practice of heating by radiation instead of by contact is undoubtedly right, and it is certainly a fact that it requires a very much greater volume of non-luminous gas than it does of luminous gas to do a given amount of heating at high temperature, but to gain economies along this line regard must be had to the form of furnace, and something similar to the improved regenerative gas furnaces of late years must be resorted to, wherein the roofs are made much higher and use is made of this radiating principle, but in these furnaces maximum economies can only be gained by continuous operation, say for a week at a time, as it takes a large amount of energy to heat up these furnaces when they are once cooled.

Evaporation of Water.

Of all the heating processes there is none where more of the energy is made available than in the evaporation of water in a good boiler. Fifteen pounds of water evaporated for a pound of good coal is the theoretical limit. Ten pounds is not unusual in practice; 11 or 12 pounds under exceptionally favorable conditions is not entirely beyond our reach.

Twelve pounds would be utilizing 80 per cent. and 10 pounds 66⅔ per cent. of the energy of the fuel. If the temperature of the combustion chamber is 2,000° F., and that of the smokestack 500° F., 75 per cent. of the energy of the fuel has been utilized, provided the combustion is perfect without introducing an excess of air, but so far in practice this has not been accomplished.

It is a mistake to suppose that slow combustion under a boiler and a consequently low temperature is economical, for the greater the difference of temperature between the firebox and chimney, consistent with complete combustion, the greater, of course, is the utilization of heat.

If the temperature of the firebox could be raised to 4,000° instead of 2,000° without increasing the temperature in the stack, only one-eighth of the energy would be lost instead of one-quarter as before, and if the firebox temperature is lowered to 1,000°, the stack remaining at 500°, the loss would be one-half.

[*To be concluded.*]

New Hydro-electric Power Plant for Nevada Mining District.

The Mono Power Company, which has exclusive rights to power sites and water reservations on the Owens River, in California, has completed its revised plans for an electric power plant for the transmission of power to Goldfield and other points in Nevada. The distance of transmission will be about 100 miles. The initial installation is to include three 2,500-kilowatt direct-connected generating sets, each consisting of a three-phase generator and a high-head turbine wheel operated under a head of 530 feet of water. A force of workmen has been employed on the hydraulic work for some months past, and a water tunnel has been completed connecting the ditch system with the upper waters of the Owens River. Leon M. Hall of San Francisco is the consulting electrical engineer for the company, which is backed by Edson F. Adams of Oakland. This system was projected before any electric transmission system had been commenced with the new Nevada mining district as the objective point, but a refusal to permit the Owens River line to cross government reserves caused a serious delay in the carrying out of the enterprise and other concerns began to deliver electric power in Tonopah and Goldfield some time ago.

Some Characteristics of Coal as Affecting Performance with Steam Boilers.[1]

By W. L. Abbott.

The capacity and efficiency obtained with a steam boiler is the result of many influences more or less variable in character, and for the purpose of studying some of these influences certain experiments were conducted in which coal screenings were used, the results of which are presented in this paper.

The apparatus employed in the researches to be considered consisted of two Babcock & Wilcox

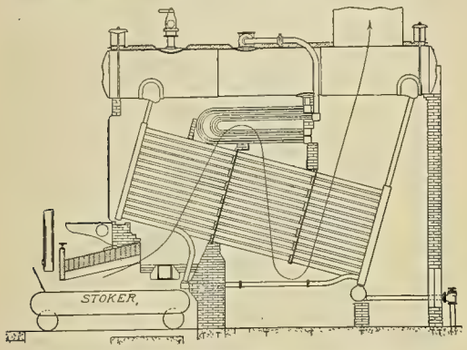


FIG. 1. BOILER EMPLOYED IN COAL TESTS.

boilers, one being 14 tubes high and 18 wide, of approximately 5,000 square feet of heating surface, fitted with a chain grate stoker of 75 square feet in area, which discharged the gases of the fire from under an ignition arch five feet long, immediately among the tubes of the boiler; this boiler was also fitted with a Babcock & Wilcox superheater having an approximate area of 1,000 square feet. The other apparatus employed in one of the series of tests differed only in sizes; its boiler was 12 tubes high and 16 wide, contained 4,000 square feet of heating surface, provided with a superheater and served with a chain-grate stoker of 66 square feet in area. Fig. 1 is a sectional elevation of the larger boiler.

Effect Produced in Steam Generation by Coal of Varying Sizes.

The experiments illustrated by the diagram (Fig. 2) consisted in the use of coal separated into various sizes by means of screens having the following square openings: 0.25, 0.50, 0.75, 1.0 and 1.25 inches. The coal was all from one lot, so that the different portions resulting from the screening process were necessarily the "same kind of coal," except that some portions were uniformly larger and others smaller, and that the smallest, on account of its size, was higher in ash. As shown by the curves of efficiency and capacity in the diagram, five tests were made, each with a different size of coal. In all other respects, however, everything was equal; thus influencing con-

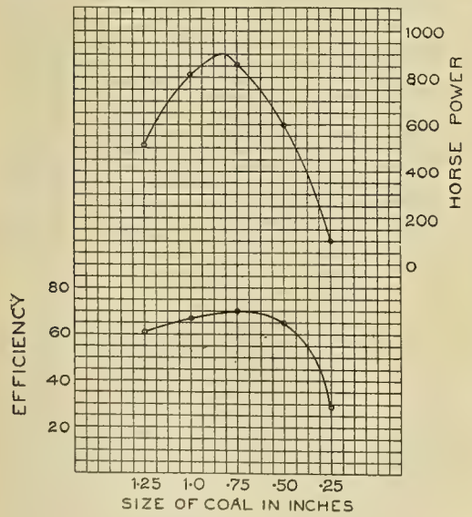


FIG. 2. STEAM GENERATION OF BOILERS AS AFFECTED BY COAL OF VARYING SIZES.

ditions, except those due to size of coal, were constant. In this way relative values for the feature studied were obtained as shown by the diagram.

It is well in this connection to give the percentage of ash in the dry coal of the various sizes:

Size of coal in inches	Square screens. Through.	Over.	Ash in Dry Coal.
1.25		1.00	13.7
1.00		0.75	14.0
0.75		0.50	15.6
0.50		0.25	20.8
0.25		0.00	30.8

The high per cent. in the smallest size is not due to ash in the coal itself, but to the fact that all of the fine-sized foreign matter separated from larger coal, or which comes from roof or floor of the mine, naturally finds its way into this smaller coal.

Influence of Ash in Coal on Capacity and Efficiency.

This diagram (Fig. 3) gives results of 18 tests made to determine the effect of varying quantities of ash associated with coal. One result of its presence is to reduce the heating power, owing to displacement of combustible matter. Therefore in this connection ash may be considered as a dilutant, and if this was the only result of its presence, it would have no effect on heat efficiency secured through a boiler. A proportionately less amount of water would be evaporated by a pound of such mixture of ash and coal, of course, but efficiency would not be affected. If, however, ash acts in some other way as well, such as an obstruction to the combustion process, the effect of its presence is doubly harmful.

To insure that the result would not be affected by any influence other than that of the ash, special coal was used which came from the No. 7 seam, north of Marion in Williamson County, Illinois. It was prepared in a Stewart washer and is known to the trade as No. 4 washed coal, a size made by passing over a screen having one-quarter-inch round openings and through one having similar one-half-inch openings. Its composition is represented by the following:

Moist Coal:	
Moisture	7.48
Ash	8.23
B. T. U.	12,191
Dry Coal:	
Ash	8.90
B. T. U.	13,176
Pure Coal:	
B. T. U.	14,463

The test indicated by the two points showing highest efficiency and capacity was made with coal

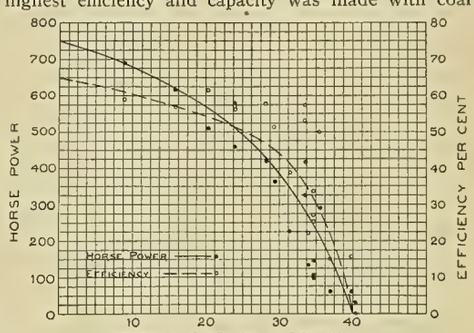


FIG. 3. INFLUENCE OF VARYING PERCENTAGE OF ASH IN COAL.

just as it arrived, or, in other words, was of the composition shown by the analysis. Beginning with the test of the second day, a quantity of refuse from the stoker ash pits was added to the coal to be used. This refuse was first weighed and the large pieces broken up, after which it was thoroughly mixed with the coal in the required proportion, and increasing amounts were added in each test which followed. This fuel composition was, of course, weighed as used and a sample of it selected for analysis in the regular manner.

It appears from the diagram that useful effect from the fuel drops to zero with 40 per cent. of ash, notwithstanding the fact that the other 60 per cent. of the composition was pure coal. The fact should be emphasized that although over half of the composition fed to the fire was fuel, it burned without producing any useful effect, for which there are two reasons: (1) That on account of obstructed air supply through the fuel bed, incomplete combustion and escaping hydrocarbons carried away a portion of the heat because the gases passed immediately among the tubes of the boiler. The other is, that owing to the presence of an excess of ash the percentage of fuel on the rear portion of the grate is greatly reduced. On this account a larger proportion of the air passing through the fuel bed does not combine with the fuel, but enters the furnace as free air. As the prime function of a furnace is to heat the gases passing through it, any increase in the amount of air entering the furnace without a corresponding increase in the amount of fuel burned must result in a lowering of the furnace temperature.

This lowering of temperature, besides making a long smoky flame which reaches up among the boiler tubes and is there chilled to below the burning point, also reacts on the fuel bed, reducing the rate of combustion and still further increasing the adulteration of the furnace gases with free air. When the temperature of the furnace has been thus reduced to about 600° F., the boiler is unable to absorb any more heat than is necessary to make up for radiation losses.

It will be observed that the points on the diagram do not fall in symmetrical order. This is particularly true of ash percentages of about 34, which may be explained by the refuse used in these tests being probably of a more fusible character than with others. These tests with the ash composition were made with the smaller boiler above mentioned.

Effect of Variation in Size of Coal Screenings.

In Illinois and Indiana, coal not sold as mine run is separated largely as lump and screenings, and such screenings furnish about 90 per cent. of the stoker fuel used in Illinois.

The diagrams (Figs. 4 and 5) illustrate the result of 62 tests. With each the size of coal is measured by screens with square openings ranging in dimensions from 0.25 to 1.50 inches, advancing by 0.25 inch, and the average sizes of coal as shown at the base of the diagrams were calculated from sizing tests made with these screens, and represent the dimension in fractions of an

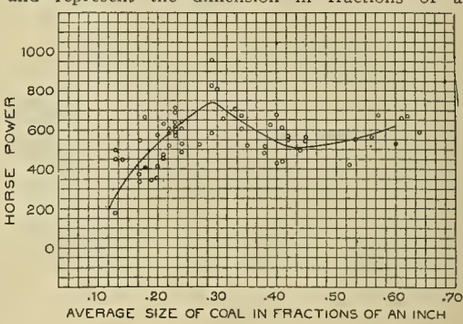


FIG. 4. CAPACITY OF BOILERS AS AFFECTED BY SIZE OF COAL SCREENINGS.

inch of openings in a screen which would allow one-half of the coal to pass through and the other half to go over the screen, and it is this that is designated as its average size.

In the diagrams, Fig. 4 shows the effect produced on horsepower output owing to this variation in size of the coal, and Fig. 5 illustrates the resulting efficiency from the same cause and for the same tests.

The curves for both efficiency and capacity drop midway between the tests with both small and large coal. This is a peculiarity which may be explained as follows: Performance becomes better as the size of coal increases, until a point is reached when the quantity of large pieces becomes so great that there is not enough fine material to properly close the interstices between, with the result that performance drops off, due to excess of air, until a condition is reached when all of the pieces of fuel approach uniformity, when owing to greater agreement in size they fit together better, and in a measure produce a homogeneous mass similar to that secured by the fine dust filling the spaces in the fuel bed in the first case.

The presence of fine dust in excess is a great and important source of trouble. Referring to Fig. 2, coal through an 0.25-inch square screen produced only 108 horsepower, yet a size of fuel known in Illinois as No. 5 washed coal, which will pass through an 0.25-inch round hole (a smaller aperture than the square opening), will produce as high as 600 horsepower under the same boiler. It is true that the lower ash content of the washed coal has a considerable influence, but this is offset by the larger size of the square screen as against the round one.

To arrive at a better understanding of the physical make-up of these two characters of fuel,

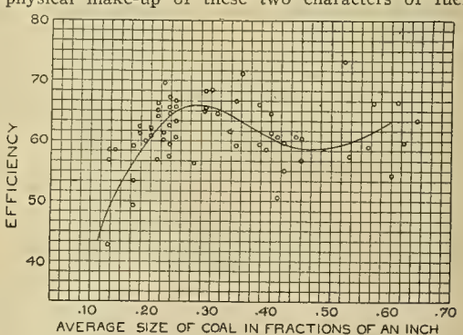


FIG. 5. EFFICIENCY OF BOILERS AS AFFECTED BY SIZE OF COAL SCREENINGS.

tests were made of the dust of each, using that quantity which would pass through a 20-mesh screen, with the results shown in the following table:

Quantity and Size of Coal Dust Below 20-mesh Screen. Per Cent. of Different Sizes.

Dust Sample.	Through 20 and Over 40.	Through 40 and Over 60.	Through 60 and Over 80.	Through 80 and Over 100.	Through 100.
No. 5 washed	63.36	16.78	6.51	2.93	10.42
Dust through ¼-inch square screen	46.10	13.87	8.18	3.84	28.01
Average of five tests from ordinary screenings	48.50	13.78	7.57	4.38	25.74

The quantity of the extremely fine dust through the 100-mesh screen is shown to be almost three times as much in the unwashed as with the washed coal. The third line of the table is an average from five tests taken from different lots of screenings, and it shows an approximate agreement with the quantities from the duff through the one-quarter-inch square screen, from which it

1. A portion of a paper presented before the Western Society of Engineers, Chicago, September 5, 1906. Mr. Abbott is chief operating engineer of the Chicago Edison Company.

follows that the presence of the fine dust has an enormous influence on the burning of the fuel.

Result of Different Thicknesses of Fire.

An excess of air accompanies a thin fire, and because of it, efficiency produced through the boiler is affected. On the other hand, a thick fire reduces the excess of air, but increases the volume of hydrocarbon gases which leave the surface, or in other words, makes more smoke. If a furnace is located between the boiler and stoker, these gases will be burned, otherwise they will largely escape among the tubes of the boiler as they did in this case. Therefore, under these conditions a thin fire increases the loss due to excess of air, but decreases that due to smoke and incomplete combustion. On the other hand, a thick fire reduces the excess of air, but increases the smoke and escaping combustible gas, and so the best thickness of fire may be a matter of importance. With this type of boiler of a height of nine tubes when served with chain-grate stokers discharging

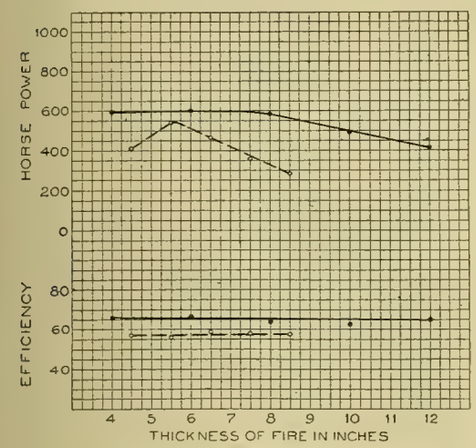


FIG. 6. UNIFORM HEAT EFFICIENCY OF BOILERS WITH VARYING THICKNESSES OF FIRE.

immediately among the tubes, it is always most economical to produce as large a volume of smoke as possible with the coal being used. With boilers of 14 tubes in height the conditions are different, because such boilers are more efficient.

With an ideal boiler the final temperature would be the same as the atmosphere, therefore an unlimited excess of air could be used without causing heat loss. No practical boiler can, of course, be an ideal one, but the Babcock & Wilcox type of 14 tubes high approaches much nearer to it than does one of nine high, and for that reason is more efficient, and in this connection is quite unique, as Fig. 6 will show.

The curves of efficiency in this diagram illustrate a constant heat efficiency produced through the boiler for a full working range in thickness of fire, insuring not only maximum excess of air but incomplete combustion loss as well, yet efficiency remained uniform, and the only opportunity for the "skillful" and "intelligent" fireman is in selecting that thickness best suited to capacity requirements.

The coal used in these two series of tests was very uniform in size and ash content, and for these reasons was well suited to the purpose of the experiments. In the series with thickness of fire from 4.5 to 8.5 inches, what is known as No. 5 washed coal was used, a size which passes through a screen having round openings 0.25-inch diameter. With the other series and a larger range in thickness, washed screenings were employed.

San Francisco Street-railway Strike Broken.

After 11 days of total suspension of business, the United Railroads of San Francisco resumed the operation of its street cars in San Francisco on the evening of September 5th, after 2,000 of Farley's strike breakers had arrived. The striking employes consented to return to work and arbitrate afterward, on telegraphic instructions from W. D. Mahon, president of the international organization of street-railway employes. President Calhoun of the United Railroads says there is a possibility that, since business has been resumed, he can come to an understanding with the men without an arbitration board. It is asserted by Mr. Calhoun that the wages paid carmen in San Francisco are 41 per cent. higher than the average wages paid carmen in the East and 8.4 per cent. higher than the highest paid in any other American city. He says that the cost of living in San Francisco has not advanced more than five per cent. since the fire.

The suffering inhabitants of the city hail the resumption of street-railway traffic with delight, as they were worn out with tramping over the debris of the burned districts and discouraged from the serious falling off of business, amounting to 50 per cent. in many lines, since the strike was declared. During the 11 days the only means of communication between the downtown section and the new retail districts was by the Geary Street and the California Street cable roads. The former had comparatively few cars and a number were broken down by the overcrowding to which they were subjected. The California Street line had only eight cars, as all of its rolling stock was destroyed by the fire.

The present programme is for the United Railroads to select one arbitrator and the Carmen's Union a second, the two to decide upon the third member of the board of arbitration. All questions of wages and hours are to be decided by this board.

It is expected that the rehabilitation of the several important lines of the United Railroads that had not been operated since the fire will be proceeded with as soon as a force of track laborers can be secured.

Comparison of Thury Direct-current and Three-phase Transmissions.[1]

At a time when the direct-current transmission system of Mr. Thury is being widely considered in connection with long-distance power transmission, and especially in the case of the 700-mile transmission from the Zambesi Falls of South Africa, it is interesting to note the results arrived at under certain conditions by Signor Motta of the Milan University, who, acting on behalf of the City Council, undertook a lengthy series of calculations and tests, and has finally decided in favor of the three-phase system and against the direct-current system.

The city of Milan has its public lighting provided by its own steam plant, and the private lighting and power for traction is supplied by the Milan Edison Company, which is one of the oldest electric power companies of the world. The tramway system, however, is the property of the municipality, and of late strong agitation has arisen in favor of making the tramway system entirely municipal. The general conditions are as follows:

Water rights have been acquired at Grosoto on the Upper Adda River, in Valtellina, where the supply will be sufficient to provide 38,200 horsepower at the turbines, or, approximately 28,000 kilowatts at Milan at the secondaries of the transformers. The transmission line is to be 150 kilometers long and will pass over the Orobie Mountains, a part of the Pre-Alpine range, the highest point being 3,500 feet above sea level.

The comparison above referred to was made on the basis of 150,000 volts continuous current and 60,000 alternating three-phase current, these values being settled by consideration of the most economical voltage of each system.

The Thury system was to consist of 10 groups, each group to have four generators, driven by one water turbine, the voltage limit per group being 15,000 volts. The preliminary system provided for a continuous-current transmission line, having both positive and negative conductors, the earth return not being employed and no permanent earth to be made at all on the system.

The 60,000-volt three-phase scheme is to consist of a number of units operating in multiple in the usual way with no novel features, the exact frequency to be determined later, but probably it will be 42 cycles.

The summary may be divided into two comparisons, as follows:

Efficiency Comparison.

Continuous-current System.—The overall efficiency of the two systems shows three per cent. in favor of the three-phase plan, the values given below being based on the full load of 28,000 kilowatts. The detailed efficiencies are as follows:

	Per Cent
Water pipe efficiency	96.5
Turbine efficiency	75.0
Generators	92.0
Line	95.3
Motors	92.0
Alternators for secondary distribution	93.0
Giving a total over all efficiency	54.2

Three-phase System.—The efficiency of the water pipes and turbines remain the same; that of the line, however, drops to 91 per cent., and the total overall efficiency is 55.8 per cent.

Cost Comparison.

The costs of the two schemes as calculated show in favor of the continuous-current system by 1.6 per cent., the figures being approximately 10,000,000 francs for the continuous-current transmission and 10,160,000 francs for the three-phase system. These costs are based on machinery, switchboards, line, insulators, poles, transformers for the alternating system and motor-generator transformers for the receiving end of the Thury system.

The following subdivided costs are of interest as showing a remarkable feature of the continuous-current Thury system, viz., the extreme cheapness of the transmission line and the high cost of the motor-generator transformers at the receiving end.

Continuous-current System.—(1) Machinery, including transformers, switchboards, etc., 7,000,000 francs; (2) line, including insulators, poles, lightning arresters, etc., 3,000,000 francs.

Alternating-current Three-phase System.—(1) Machinery, including transformers, switchboards, etc., 3,750,000 francs; (2) line, including insulators, poles, lightning arresters, etc., 6,410,000 francs.

The actual calculated cost of the machinery for the Milan sub-station on the Thury system was 3,600,000 francs, whereas the cost of the transformers for the three-phase system did not exceed 790,000 francs.

The costs include the interest on capital during construction. The period of construction may be assumed the same in each case. The cost per kilowatt per year, including all items, gives a calculated value of 160 francs for the three-phase system, this being based on the assumption that 8,760 hours per annum will be demanded—that is, full load the whole year, which, under the peculiar conditions of power demand in the city of Milan is not an unreasonable assumption.

An additional steam station for peak loads with a maximum output of 9,000 kilowatts and an average of 4,500 kilowatts for the whole year, and provided with accumulators, will also be provided, but no estimates of cost have as yet been prepared for this scheme.

The demand for power in the city of Milan during the last few months has increased so rapidly that it is doubtful if this scheme will be sufficient, and power is being eagerly sought for from other sources. The traction system in Milan may be said to operate for 17 hours in every 24, and during the remaining seven hours some of the factories will be offered exceptionally cheap rates to encourage their operation at this time; for this class of customers at present 3,000 kilowatts are supplied every night.

Other details of the comparison of interest are as follows:

The three-phase line to consist of three wires, each of 240 square millimeters section, and the continuous-current line to consist of four wires, two for each side and each of 140 square millimeters section. One feature which was a strong consideration in the decision to adopt the three-phase system instead of the continuous-current system was the proposal of Mr. Thury to have 104 commutators in series throughout the whole system.

1. From the London Electrician.

A Trolley Funeral Car for South Africa.

[From the London correspondent of the Western Electrician.]

So far as I am aware, to South Africa belongs the credit—if it is a credit—of being the first British colony to make use of the electric car for funereal purposes. I am able to give herewith a view of a funeral car which has been constructed

A TROLLEY FUNERAL CAR FOR SOUTH AFRICA.

by a British firm of car builders to the order of the Durban Corporation.

This car is arranged to take two funerals at a time, the ornamental doors seen on the right of the photograph opening outward, the first coffin going on the top shelf and the second one on the floor of the car on rollers. The funeral parties are divided by a partition in the center of the coach from each other, the car being handsomely fitted up with rattan cross seats and dignified fittings throughout, the whole style of decoration being silver and black.

The car is mounted on one of the new style of radial tracks with a wheel base of eight feet six inches, and there is a platform at the rear end for passengers to enter and leave the car. The electrical equipment is of the British Westinghouse Company's type, the car itself being constructed by Milnes, Voss & Co. of Birkenhead. The roof of the car is of the monitor type and is fitted with hinged ventilators and ceiled with lincrusta panels, painted white and picked out in purple. The shades are also purple to harmonize with this roof, and between the two compartments for passengers is a sliding door with ornamental glass.

The whole car is of the most elaborate description, and information from Durban shows that it is in frequent use. In fact, a funeral car for natives on similar lines has been constructed on the spot, the car shown herewith being exclusively used by Europeans. The cemetery at Durban is a considerable distance outside the city, and a special line was laid thereto by the Durban Corporation. G.

FALL TRADE PROSPECTS.

Almost without a dissenting voice the electrical business man and engineers who have answered the Western Electrician's question, "What is the electrical business outlook in the fall of 1906?" agree that the prospect is in every way a bright and hopeful one. This practical unanimity of sentiment is highly gratifying, and the following expressions of opinion on the subject will be read with interest:

H. H. Woodworth, advertising manager, Automatic Electric Company, Chicago: "I can say very briefly that prospects were never better and that this condition keeps getting 'more so' all the time."

E. Whitmore, manager, Manhattan Electrical Supply Company, New York: "There is every indication that the coming fall will be one of the most prosperous known to the electrical trade. We also feel that the outlook is bright for the year 1907."

H. Kimball Loud, H. M. Loud's Sons Company, Au Sable, Mich.: "We find the cedar-pole and tie trade very good this year, and the outlook for this fall is encouraging in every way. The prices are good, with a tendency to rise, and the demand is all that could be asked."

J. W. Marsh, vice-president, Standard Underground Cable Company, Pittsburg, Pa.: "We beg to express our opinion that the outlook is excellent for fall business in the electrical industry in general; in fact, we believe that it will be larger than ever before in the history of the business."

F. S. Hunting, sales manager, Fort Wayne Electric Works, Fort Wayne, Ind.: "The prospects at the present time seem to us to be most favorable for a very large electrical business this fall. Business has increased very materially over last year, and we see no reason why the remainder of this year should not continue to show a substantial increase over last."

J. O. Oliver, Stromberg-Carlson Telephone Manufacturing Company, Rochester, N. Y.: "We are pleased to report that business with us is exceedingly good. We have had a most prosperous summer, and the outlook for fall and winter is exceptionally bright. We are anticipating closing several large contracts, and the general outlook, as above stated, is very good."

F. L. Pierce, treasurer, The Cutler-Hammer Manufacturing Company, Milwaukee, Wis.: "We consider the outlook excellent for business in our line this fall. Manufacturers' facilities all over the country are being taxed to the utmost to meet the demand for high-grade goods. With bountiful crops as a basis and the general condition of the iron and steel industries, there certainly appears to be nothing but prosperity in sight."

W. W. Mumma, sales manager, Robbins & Myers Company, Springfield, Ohio: "We have every reason to feel that the fall trade in the electrical line will be at least steady, if not on the increase. We are just closing the biggest year of our history in the electrical line, and as the demand for our goods has been steady all year, rather becoming more marked the past few months than earlier in the year, we are inclined to think, as above stated, that the trade will be steadily on the increase."

Walter Ramsey, manager, American Arc Lamp Company, Kalamazoo, Mich.: "August business was exceptionally good. Each month this year we have more than doubled the business for the corresponding month of 1905. We are establishing also a promising foreign trade, having recently made good-sized lamp shipments to New Zealand, Australia, Venezuela, Spain and Italy. The outlook in the arc-lamp trade is certainly splendid. Every indication points to an unprecedented business during the coming season."

G. H. Rettew, general manager, Helios Manufacturing Company, Philadelphia, Pa.: "In our storage-battery department we are very busy at the present time, and both inquiries and orders which are coming in indicate an unusual amount of business during the fall and winter; this particularly applies to batteries for electric vehicles and to storage batteries used for ignition purposes in connection with gasoline automobiles. In general we feel that all electrical lines will be in great demand during the coming fall and winter."

E. F. Kirkpatrick, sales manager (Chicago), McRoy Clay Works, Brazil, Ind.: "The underground conduit manufacturer does not usually look for 'fall business,' since his product is sold in the first several months of the year and installed, as a rule, previous to coming of frost, except in the South, where underground work goes on in winter as well as summer. This year, however, all precedents in our business have been ignored, due to an unusually large amount of underground electrical wire subway construction, principally in the eastern states, and we therefore not only anticipate a 'fall business' but also a 'winter business,' as a large amount of subway work will be done in various parts of the country up to the close of the year, regardless of snow and frost, instead of ending, as usual, about November 1st. Hence it is hardly necessary to add that the conduit business of 1906 will show the maximum over several previous years in amount of output of conduit, although the amount of profit has been greatly reduced over other years by the advent of new competition, low prices and rigid and exacting specifications."

E. C. Wood, Mica Insulator Company, New York: "We believe that our order file reflects conditions in the electrical manufacturing industry, for the reason that our main business is supplying insulating parts to the manufacturers of dynamos and motors. Basing our opinion on its condition, we look forward to a good demand for our insulating specialties this fall. We are told by some of our customers that they are finding it necessary to operate overtime in order to keep up with the demand, which shows no signs of abatement. We certainly think the outlook for business during the fall and spring months is exceptionally bright."

V. R. Lansingh, general manager, Holophane Glass Company, New York: "The outlook for fall business for electrical industries in general seems to us to be better than for many years in the past, as far as we can judge from numerous reports which we have obtained from different parts of this country, Canada and Mexico. The general prosperity in the electrical lines is reflected in the business of the Holophane Glass Company, the orders through the summer running over 100 per cent. larger than the corresponding months of last year, and the demands for future shipments being greater by 50 per cent. than during the corresponding year past. Collections are also good, and the whole country seems to be exceedingly prosperious, with no sign of a decrease in this condition. We are looking forward to this condition of affairs to be with us for at least another year, although the presidential election in 1908 will probably affect matters to some extent."

O. A. Stranahan, sales manager, Allis-Chalmers Company, Milwaukee, Wis.: "Judging from the last year, in which the volume of our electrical business has more than doubled, and considering the continued interest in all business with which electrical machinery is in any way connected, we anticipate a still greater volume during the coming year. In order that we may be able to care for this increase, we are hastening to completion the extensions to our West Allis Works, which will greatly add to our capacity in all lines of electrical machinery as well as increase our facilities for the manufacture of our prime movers, including various types of Corliss engines, steam engines, hydraulic turbines and gas engines. We find a growing tendency upon the part of purchasers of power machinery to place their orders for complete electrical units, including the prime mover, and, as we are in position to furnish complete installations, including the prime mover for steam, gas or hydraulic power, the demand upon our manufacturing facilities is constantly increasing. We also have a growing demand for all kinds of electrical machinery to operate in conjunction with our mining machinery, crushing and cement machinery, flour-mill machinery and sawmill machinery. Altogether our position is naturally more favorable than with a company manufacturing only electrical machinery, but independently of this it is our opinion that the outlook for electrical business during the coming year is very bright."

L. P. Sawyer, manager, Buckeye Electric Company, Cleveland, Ohio: "It is gratifying to be able to say that business for our company for the first eight months of 1906 shows a very decided increase over the corresponding months of 1905. In January of 1906 I stated through your publication that I thought our increase of business for the year 1905 was due largely to the general awakening of the central-station men and consumers of current to the possibilities of electricity in general. I believe today that this awakening is spreading out and that all electrical men, from the manufacturer to the buyer of apparatus of any kind, are more thoroughly awakened to the possibilities than ever before. There would naturally be a certain percentage of increase, owing to new installations, but we believe the increase of the last eight months over the corresponding period for 1905 is not due entirely to this natural percentage of increase. We believe it is due a great deal to the co-operative work of each and every man in the electrical business. If this co-operation in all lines of electricity can be kept up and pushed as it has been for the past year or more, I am confident that all branches of the electrical business will continue to increase rapidly. Lamp manufacturers are this fall putting new lamps on the market in order to meet the lighting conditions that have not, heretofore, been properly met. Such progressiveness will undoubtedly mean a further percentage of increase in the incandescent lamp business. As stated above, by working with the consumer and trying to meet each and every condition presented to him, the lamp manufacturer as well as all other electrical manufacturers should find the next season one of great activity."

George A. Damon, managing engineer, The Arnold Company, Chicago: "We find the greatest activity in the building of industrial plants so designed and equipped to use electricity in all its branches to the greatest advantage. From our point of view we believe there is considerably more activity in this direction than ever before. In connection with the building of interurban railroads there seems to be a tendency toward more conservative financing methods, and, therefore, the activity seems to be more in extending 'going' propositions rather than the building of new roads. The consolidation of contiguous companies into one system and the natural betterment of the properties is marked, but the actual volume of building operations in the electric-railway line seems to be less. Investments in hydro-electric properties are getting more popular every day. There is apparently a very promising business to be developed in the near future in connection with waterpower development combined with irrigation enterprises, in which electricity will be used for pumping. A number of large tracts of land are to be developed by private enterprise in the West, in which electricity from waterpower plants will be used to operate cement and beet-sugar factories. The electrification of steam roads is coming on slowly. Among the next developments to be looked for are upon pushed grades in the West, using current generated by the waterpower developed along the line of the road."

The Uses of the Nernst Lamp.

Max Harris of Pittsburg read a paper at the recent convention of the Ohio Electric Light Association entitled "Some Notes on High-efficiency Units by the Manufacturer." Mr. Harris is connected with the Nernst Lamp Company, and in the course of his paper he said:

"Some of the advantages accruing to the central station by the use of the Nernst system will be briefly set forth. After all, the most important advantage is its ability to obtain and hold new business not already enjoyed by the central station.

"Another advantage of the system is its ability to hold customers who are dissatisfied because of insufficient illumination or high cost. It has been the writer's experience with this class of consumers that what they most desire is better and increased illumination without material increase in cost. This can invariably be accomplished by the installation of a sufficient number of units of proper size.

"Again, in the case of so many merchants who are using electricity for lighting their window displays and gas arcs for interior illumination, by cutting down some of the current consumed for the window display illumination and replacing the gas arcs by a complete Nernst installation, the consumer, at about an equal cost for a complete electric installation, replacing the former gas and electric outfit, is secured for the central station with dual advantages to the central station of an increased sale of current and a load which instead of being an entirely peak and after-peak load becomes a distributed load, with part of it in use during the day hours.

"Again, the installation of four three-glower lamps instead of two arcs will invariably result in an increased use of electric current, as, during the early morning and evening hours when the use of two arc lamps is too expensive for the average small merchant, such users will operate two of the three-glower lamps.

"In many cases on record central stations have changed their flat-rate to meter-rate contracts by installing Nernst lamps, and it requires no lengthy argument to convince you that in all such instances it is the proper move to install lamps of the highest efficiency available.

"As a means of broadening the peak the Nernst lamp is used. This is due to the ability of the central station to obtain a large number of small consumers, who, as a rule, have a connected load very nearly equal to their daily-peak consumption, and which class of consumers is better than a small number of so-called large consumers, who, as a rule, have a connected load greater than their usual daily-peak consumption.

"Another advantage lies in the fact that while central stations have been trying 'to sell current at the meter,' they now generally recognize they must go further and act as illuminating engineers, and accordingly become more interested in actually selling illumination. With the Nernst system this problem is made easier for the central station by reason of its many advantages—quality of light, efficiency, appearance and flexibility of the system.

"In conclusion, your attention is directed to the recent development of a series system of single vertical-glower Nernst lamps for street lighting. Briefly, the system consists of placing in circuit on any alternating constant-current circuit of 6.6 or 7.5 amperes a series transformer with each single-glower lamp. The total wattage consumed by the series transformer and lamp is 115 watts. By the use of this system central stations are placed in a position to compete with the single-burner Welsbach gas system."

THE SMALL CENTRAL STATION.

Practical Hints on Its Construction and Operation.

CHAPTER X. (*Concluded.*)

ARC AND INCANDESCENT LAMPS.

Incandescent Lamps.—Growth of business is hindered by no one thing that occurs in central-station operation so much as by the continued use of dim incandescent lamps. The appearance of such lamps is most assuredly a poor recommendation to the prospective patron of the service. Dim lamps result primarily from one of two causes—the installation of a poor grade of lamp or the burning of a good lamp beyond its economical life. A poorly constructed lamp has no economical life. It is an extravagance that cannot be afforded. The one way to get around furnishing current to poor lamps, and thereby being credited with poor service, is to furnish the lamps oneself. In order to do this the central station must supply renewals free of charge or at least at the cost figure. Assuming that the central-station management has contracted for a year's supply of lamps from a manufacturer whose product has been decided upon in competitive test, then the object becomes to get these lamps, and only these, upon the service. The adoption of the best lamp and the exclusion of all others is the motto to follow.

Free renewals, of course, immediately remove the trouble where the life of a lamp is the cause. Frequent and regular renewals can be made, and a new lamp substituted whenever an old one shows signs of weakening. Cost renewals, while not so effective as free renewals, still have a tendency to help the good work along and will be found advantageous in the long run.

Quoting one of the leading lamp manufacturers, the following will be of interest:

"Nothing produces such radical improvement in the lighting service as, first, the exclusive use of the best lamp, and, second, the frequent and regular renewal of dim lamps. These principles are the precepts and practice of the leading central-station managements, and should be law and gospel for every electric-lighting company"

The installation and use of a good lamp naturally mean the selection of a good lamp at the outset. Three points which should be observed in purchasing lamps are: First, that the lamps submitted are free from mechanical defects; second, that they possess accuracy and uniformity in candlepower and watt rating; third, that the lamps maintain their candlepower in service during a life approximating 600 hours. The watt rating for a lamp possessing the above characteristics should closely approach 3.5 watts per candlepower, when burning on a circuit of the voltage for which it was designed.

Under physical defects may be classed loose caps or bases, poor vacuum, spotted or discolored filaments, weak joints between filaments and platinum leading-in wires, etc. Any of the above defects render a lamp unfit for service and liable to cause trouble if installed on the line. Loose caps and bases will be found by twisting the cap and lamp bulb. A poor vacuum is readily discerned by causing the filament to vibrate. Vibration will cease quickly in a poor vacuum. A test for the continuity of a filament is obtained by bringing the lamp up to a dull red glow. If of proper construction, the filament will appear uniform in color, being free from bright or dark spots.

A wattage and candlepower test should show a lamp well within a range of 10 per cent. above or below its normal rating. The lamp must be tested at its marked voltage.

To determine the accuracy of a lamp's rating a photometric test is necessary. While taking candlepower readings, wattage readings should also be taken. These results may be plotted on a diagram, measuring the watts on a horizontal base line with the zero at the left, and the candlepower on a vertical line with the zero at the foot, the zeroes of the two lines being coincident. Starting with the 16-candlepower point on the vertical line we move horizontally to the right until we intersect a vertical line drawn from the 56-watt point on the base line. The intersection of these two lines will form the center of the test diagram. The intersection of two lines representing the wattage and candlepower of any lamp tested should fall well within a 10 per cent. rectangle constructed by drawing horizontal lines from points 10 per cent. above and below the 16-candlepower point and vertical lines from points on the base lines 10 per cent. above and below the 56-watt point. Such a diagram (not drawn strictly to the 10 per cent. limitation in wattage) is shown by Fig. 21. Note that the diagram illustrates the result that should be obtained from an initial test on well-made lamps. Note also the close bunching about center of rectangle (A B C D).

This diagram will serve to show whether further tests are to be made. Lamps failing to fall well within the rectangle should be discarded. Lamps that fall well within this rectangle are shown to be of good uniform rating and should then be tested for length of life.

The benefits to be derived from the use of uniformly rated lamps are summed up as follows:

1. Full and uniform brilliancy.
2. Uniform power consumption, and therefore definite meter bills.

When we speak of the economical life of a lamp, we mean the length of time, measured in hours, that it will burn without dropping in candlepower below 80 per cent. of its normal rating, consuming during this period of time not

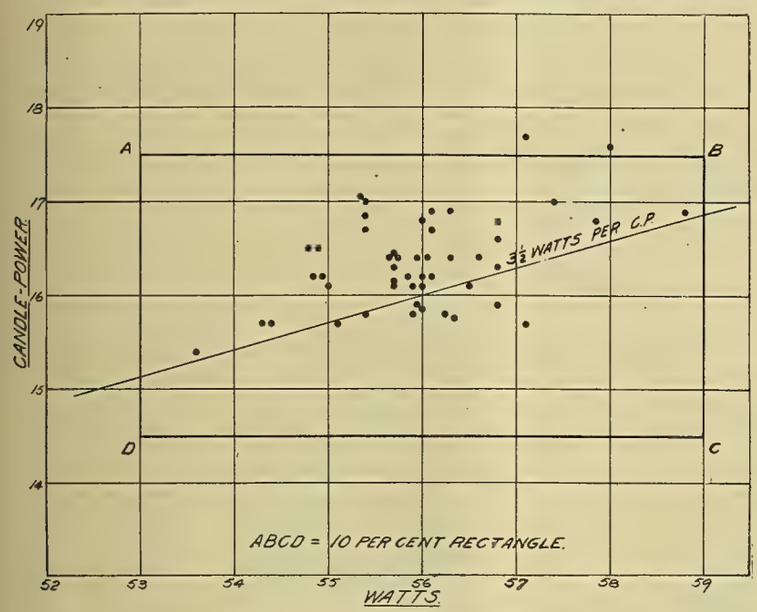


Fig. 21. Initial Test Diagram.

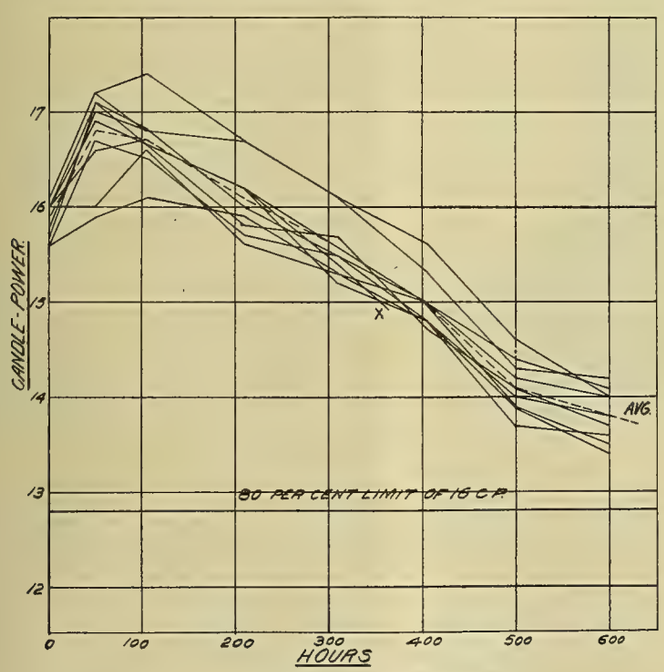


Fig. 22. Life Test and Candlepower Diagram.

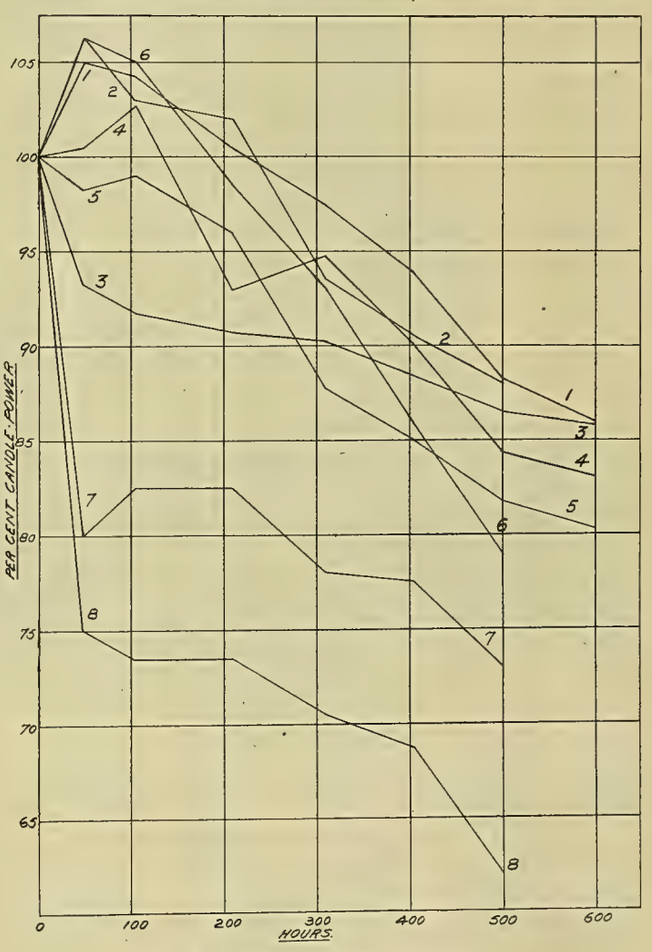


Fig. 23. Comparative Candlepower Diagram.

CURVES ILLUSTRATING VARIOUS TESTS OF INCANDESCENT LAMPS.

more than 3.5 watts per candlepower. A life test will therefore have for its object the ascertaining of this number of hours. Initial tests having determined the makes of lamps worthy of a life test, we proceed with them as follows:

Install the lamps to be tested on a circuit the voltage of which can be maintained constant. In the circuit place an ammeter and a voltmeter; record these readings and note the wattage of the lamp during the life test. A wattmeter may be used in place of the ammeter. Test each lamp separately and tabulate the readings, to be plotted later on a diagram, the vertical distances measured from the bottom representing candlepower and the horizontal distances measured from the left representing duration of time in hours.

A number of lamps of each make should be tested and a curve plotted for each. An average curve constructed from these will give the desired information; that is, the length of time an average lamp of a given make will burn economically. Readings may be taken every 50 or 100 hours. Such a life-test diagram is given in Fig. 22. This is for one make of lamps.

By inspecting this diagram it will be noted that the curves illustrate well-maintained candlepower performance and also uniformity in individual results. The lamps follow practically the same path. Breaking of one lamp is shown at X. The average curve does not decline to the 80 per cent. limit of 16 candlepower during the period of test —600 hours. Life tests made on a good make of lamp should show similar results.

The diagram of Fig. 23 shows the average curves —obtained from tests on eight makes of lamps— all plotted together for a comparison. Note the difference of performance of various makes during period of test. Makes Nos. 7 and 8 would be expensive as a gift.

All curves and diagrams shown in this discussion were obtained in an actual test made by a large mercantile establishment previous to the placing of a contract for a large number of lamps. The lamps tested were bought in the open market with the purpose of obtaining an average product. Lamps of each make were numbered and the labels of the makers removed. This was done to obviate the possibility of favoritism being shown by the men performing the test.

The curves most clearly emphasize the importance of the frequent and regular renewals of dim lamps. All lamps lose in candlepower as they burn. This depreciation of light must be repaired, and the only effective way is the replacing of old lamps with new ones. A consideration of the loss of candlepower in lamps, as shown by the curves, should lead every central-station manager to the necessity of adopting some system of lamp renewals not dependent on the customer and which will limit the life of a lamp to a period of time in which its candlepower will not fall below 80 per cent. of its normal rating—12.8 for a 16-candlepower lamp. The cleaning out of dim lamps cannot be left to the customer; it must be under the control of the station management.

Space is too limited to go farther into the subject of incandescent lamps, but as a parting word it may be urged that all central-station men thoroughly inform themselves or certain ones of their employes on the proper photometric testing of incandescent lamps and the importance of making such tests on every new make of lamp purchased for use on the lines of the company.

First-class 16-candle incandescent lamps cost not less than 16 cents when purchased in large quantities.

[*To be continued.*]

Wages and Hours in Electrical Factories.

Figures from seven electrical establishments collected by the Bureau of Labor of the United States government show that the average wage of armature winders is 28 cents an hour and the average hours of work weekly 55. Brass finishers employed in making electrical apparatus get 28 cents an hour and work 54 hours a week on an average. Women working in one incandescent lamp factory at carbon mounting, sealing in, exhausting, etc., get, on an average, 13 cents an hour and work 55 hours a week. Machinists in electrical shops get 28 cents an hour and work 54 hours a week, while pattern makers receive 38 cents an hour and work 55 hours a week.

The Auburn Electric Light and Power Company of Auburn, Neb., will extend its service to Johnson and Brock, Neb.

SELLING ELECTRICITY.

Under this heading will appear, from time to time, articles, suggestions and examples which will be of assistance in the constant effort to increase the existing demand for electric current and to create new demands.

Maintenance of New-business Exhibits.

In the campaign for new business which many central stations are now pushing there is no small chance that unless care is taken to keep exhibits in good condition, a great deal of the expense of commercial development may be wasted. A central station may inaugurate a new-business campaign with a first-class display of domestic apparatus at its general office, and it may at the outset press home, in circulars, with pith and vigor, the adaptability of electric power to the most diverse activities, but in a good many cases a time is pretty sure to come when enthusiasm slackens, and the inevitable tendency of an exhibit to deteriorate in appearance makes itself felt.

It is something of a problem to know what course to take at such a time. On the one hand, the manager feels that in some cases, certainly, the efforts which have been made to secure new business have borne small fruit; on the other hand, there is much to be said in favor of furbishing up the exhibit and adding new appliances further to attract the public's attention. If the previous work has been elaborate there is apt to be a feeling that there is little more to say that is new in circulars and advertisements. A case in point is that of a company which had an admirable new-business exhibit with large display windows filled with apparatus on the principal street of the city which it served about eight months ago; but today the exhibit has lost its attractiveness, and it appears as though little had been done to improve or extend it of late. Some of the same printed matter which was displayed months ago at the opening of the exhibit is still in evidence, and the whole layout looks rather the worse for wear. Obviously it is out of the question to prepare extensive exhibits of a novel character at very frequent intervals, but certainly any exhibit, large or small, ought not to be allowed to lapse into the cobwebbed state as long as it is open to the public.

It is the part of wisdom not to attempt elaborate exhibits of electrical appliances unless one can afford to maintain them with constant care. Even a small exhibit can be enlivened by slight changes in apparatus from time to time. It is better to display a motor-driven refrigerating outfit in first-class operating condition for a month or two, and then to substitute some other working device, than to display all the equipment at once and make no change in it for many months afterward. As for hand-bills, circulars, follow-up letters and the like, improvements in equipment are constantly being made which are worthy of brief description, and the results of operating experience ought to furnish a perpetual topic for treatment in new-business "literature." The actual financial economy of different installations is well worth bringing home to the prospective customer, and it is by no means necessary to publish specific names or so-called trade secrets in work of this kind. Constant, persevering work is essential to lasting success in new-business getting, and this in many cases involves good business common-sense far more than it requires the expenditure of heavy sums of money in complex business-getting propositions. H. S. K.

House Wiring Should Be Planned to Include Electric Heating.

One of the greatest obstacles in the exploitation of cooking utensils lies in the improper arrangement of the interior wiring. The ordinary lighting circuit designed for 660 watts will accommodate many of the smaller devices; but, as a general rule, such circuits are not satisfactory, on account of their location and the length of time required to get the desired results.

By establishing friendly relations with contractors and architects their co-operation becomes a valuable means for securing the proper number of outlets, increased capacity of branch circuit, the best attachment suitable for work of this character, and bringing the general standard of construction to a higher level. And it is well worth strenuous efforts to secure and hold such co-operation as an assistant in extending this class of business.

Another serious drawback in the development of this business has been the lack of interest by supply dealers and salesmen who are not thoroughly familiar with proper operation of these devices. Unsatisfactory results have been reported from devices which have been called upon to do work for which they were never intended. The time is ripe for educational work. Much of the business that can be secured will not come unsolicited. A general campaign of education should be started by central-station men all over the country. Each manager can inaugurate such a policy by arranging to supply the prospective consumer properly drawn plans and specifications for the use of electricity as an illuminant, as a motive power and for many household purposes.—J. Kermode of Cleveland, Ohio, before the Ohio Electric Light Association, August 22, 1906.

Interest the Housewives and Avoid Flat Rates.

The inducements of good service, courteous treatment, free renewals and day current will do much to solve the difficulty of slow business, but where this does not bring in the necessary amount of increase desired by a company, special inducements may be employed in some cases to good advantage. Where the company has a day current, and I believe that no company should operate without furnishing a day current, special inducements can be offered that will attract residence customers especially. I have always found that where you could enlist the interests of the ladies in your business that you had a strong aid if the inducements were such as to appeal to their ideas of good housekeeping and labor-saving devices. With a day current, flatirons can be made to prove a profitable investment, not supplied free, because I have always found that what costs nothing is usually but little appreciated, but supplied at actual cost installed without further cost than the iron. The best method of introducing the flat-iron problem is to order plenty, get consent to install on trial, say nothing about price or cost until they have had a chance to get acquainted with their use. Where irons are furnished at cost it will be found that less than five per cent. will come back to the plant when the time comes to close the contract or remove the irons. The same rule holds good as to water heaters, sewing-machine motors, small radiators for bedroom service, and other like appliances costing little but adding greatly to the convenience of the household.

One of the greatest mistakes some of the smaller central stations are making, and perhaps the primary cause of many plants not proving a financial success, is the system of selling current on a flat-rate basis. Many times a superintendent in order to secure business will listen to a prospective customer as to how much current he will use and the hours that he will use it, and, basing his calculations on the customer's statement, makes a price too low and in a short time finds the same customer using fully double the current he had contracted for. In this case you have no recourse other than to shut him off, making an enemy who will "knock" your business afterward, or letting him continue at a loss. If there is a superintendent here laboring under such unfavorable conditions, I would say do not sleep after you return home until you put all your customers upon meters, for this is your only salvation. You may hesitate, fearing you will lose some business; you may, but the probabilities are you will not lose any if they are properly handled; even if you should lose a few, don't worry, as the ones you lose will be the ones that you cannot afford to keep on your lines. The first thing to do is to find out as near as possible what your current costs to produce, and then add to that a fair profit, bearing in mind that you are now to get paid for all that you put out; and make your rate as favorable as possible to the customer, never losing sight of the fact that your rate must be such that the consumers can afford to use the current, not as they have been using it, but as they need it and as it should be used. If you have the confidence of your people, it is not a hard proposition to convince the average business man that you are giving him all that you can afford. With this change you will find that the gross earnings of your plant will increase very materially and at the same time your output and operating expenses will decrease. I am not giving you theory, but experience.—From a paper by Samuel Rust of Greenville, Ohio, read before the Ohio Electric Light Association at Put-in-Bay, August 22, 1906.

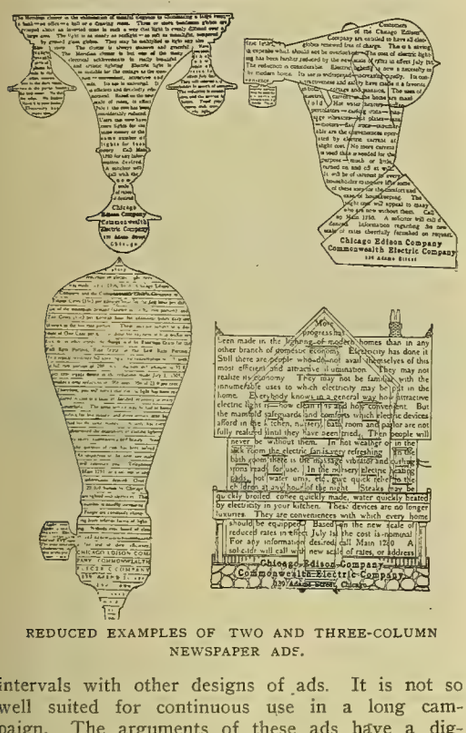
The Value of Bulletins.

In noting that the monthly Bulletin of the Portland General Electric Company of Portland, Ore., is now one year old, Mr. B. I. Dasent, advertising agent of that company, remarks that it is the experience of the company that the bulletin's circulation among its customers has been most profitable. "We have secured direct results from it," says Mr. Dasent, "showing that customers have been educated in the use of electricity for varied purposes other than as an illuminant, and it is conclusive that through the Bulletin a better feeling has been created in the minds of customers toward the company by its attitude of taking them into its confidence. It is undisputed that people are distrustful of a thing, a person or a corporation of which they know little, and

it is this latent feeling which the bulletin serves to dispel." While celebrating the anniversary of the Bulletin Mr. Dasent is striving to secure means for its betterment. Personally, he would greatly value any criticism or honest expression of opinion concerning the work the company is doing in Oregon in broadening the scope of electricity.

Central-station Newspaper Advertising.

Four examples of recent daily newspaper advertising by central-station companies in Chicago are reproduced herewith. The idea of using type pictures is an old one, but it is, nevertheless, effective, inevitably arresting attention, until it becomes stale by continued use. It is a good style of advertising to resort to occasionally or to switch in at



REDUCED EXAMPLES OF TWO AND THREE-COLUMN NEWSPAPER ADS.

intervals with other designs of ads. It is not so well suited for continuous use in a long campaign. The arguments of these ads have a dignified, convincing sound. Here is what is printed in the outline of the house:

"More progress has been made in the lighting of modern homes than in any other branch of domestic economy. Electricity has done it. Still there are people who do not avail themselves of this most efficient and attractive illumination. They may not realize its economy. They may not be familiar with the innumerable uses to which electricity may be put in the home. Everybody knows in a general way how attractive electric light is—how clean it is and how convenient. But the manifold safeguards and comforts which electric devices afford in the kitchen, nursery, bathroom and parlor are not fully realized until they have been tried. Then people will never be without them. In hot weather or in the sick-room the electric fan is very refreshing. In the bathroom there is the massage vibrator and curling irons ready for use. In the nursery electric heating pads, hot-water urns, etc., give quick relief to the children at any hour of the night. Steaks may be quickly broiled, coffee quickly made, water quickly heated by electricity in your kitchen. These devices are no longer luxuries. They are conveniences with which every home should be equipped. Based on the new scale of reduced rates in effect July 1st the cost is nominal. For any information desired call Main 1280. A solicitor will call with new scale of rates, or address Chicago Edison Company, or Commonwealth Electric Company, 139 Adams Street, Chicago."

Electric Fan Rids Bank of Flies.

At this season of the year the fly nuisance attains its greatest proportions, and patrons of restaurants, cafes and other places suffer extreme annoyance from these pests, while proprietors of such places are driven to desperation in the search for means to rid their premises of the plague.

After suffering from the annoyance for some time the cashier of the Oregon Trust and Savings Bank, Mr. W. Cooper Morris, devised a means of ridding the banking rooms of flies which annoyed the customers and seriously hindered the clerks at their work.

Mr. Morris installed a large ceiling fan in the vestibule at the entrance to the banking rooms. The fan throws a never-ceasing volume of cool air downward. This flood of air serves as an effective barrier to the entrance of the flies, and the bank has been comparatively free of the nuisance since the installation of the electric fan.—September Bulletin of the Portland (Ore.) General Electric Company.

A New Line of Alternators.

The first and simplest form of electric generator, a single-coil rotating between two magnetic poles of opposite polarity, was essentially an alternator. As the chemical generator, or battery, preceded the mechanical generator, or dynamo, the early conception was of a uni-directional current. Hence the commutator was added to the early dynamo, and little use was found for alternating current. The modern trend of electric development, however, toward distant transmission and higher voltages, has made the alternating current, with its advantages of transformation, greater simplicity in generating apparatus, and greater ease in insulating the stationary generator coils, a prevailing form in which electrical energy is now transmitted when any great distance is to be covered.

The Western Electric Company, in addition to its already developed line of direct-current apparatus, has just completed the design of a line of alternating-current generators. A number of machines have been installed during the last year and are giving the best of satisfaction.

The position of a company with the facilities and experience of the Western Electric Company in taking up the manufacture of alternators at this time is particularly fortunate. The stage of development during which all sorts of alternator designs were evolved and placed upon the market is past, and now a standard form of alternator, having a stationary armature and an internal revolving field, separately excited by direct current, has come to be the generally accepted type. After carefully studying the conditions which prevail in the high-voltage alternating-current apparatus, this company is now producing and installing a line of alternators in all of the standard types, speeds and frequencies, which it confidently believes to be of the best design and construction. With no old and obsolete patterns and dies to hamper the design, and with a general knowledge of the present-day class of machines, a complete line has been laid out, in which, it is said, each part is the best that can be produced under any conditions, and the best adapted to its particular function.

NEW WESTERN ELECTRIC ENGINE-TYPE ALTERNATOR.

From the viewpoint of the purchaser, the three most important features considered in selecting an alternator are heating, regulation and efficiency. These features are given especial consideration in the design and manufacture of Western Electric alternators.

The heating is kept low by a generous design of those parts developing heat. The working densities are low, and the radiating surfaces large. All coils are so constructed as to have unusually good heat-conducting properties, and an open construction insures excellent ventilation.

Especially good regulation is obtained by so proportioning the parts of the machines as to reduce the two quantities which tend to cause poor regulation. The local self-induction of the armature circuit and the back and cross-magnetizing tendency of the armature current are reduced to a minimum. Self-induction is also reduced to a minimum by the use of windings as widely distributed as possible, shallow open armature slots, and such a form of armature connection as will minimize the local leakage. The back and cross-magnetization of the armature current is also reduced by this distribution of the windings and by the form of end connections. Large running clearance is used, thus improving the regulation by reason of a greater excitation being required, and a consequent stiffer field. The efficiencies of these alternators are high. Depending as they do upon the copper and iron losses in the engine type, and the copper, iron and frictional losses in other types, a careful proportioning of these losses has produced machines with high efficiencies. While good ventilation is a feature, in no case is this taken advantage of to reduce the active material so as to impair efficiencies.

The result of the prevailing methods of alternator drive has been the placing on the market of three types of machines—the belted type, the waterwheel type and the engine type.

In the Western Electric Company's belted type, of the smaller capacities, the armature or stator is mounted in a cast-iron frame made of unusual width and stiffness, in order to carry the bearing brackets and resist the twisting moment due to the belt pull. Slide rails and adjusting screws are provided for belt adjustment. The bearings are supported by brackets attached to the lower half of the armature frame only. Light, removable shields are fastened to the upper part of the frame. This construction permits of easy access to the machine and easy removal of the bearing caps. For larger sizes the belted type is built with separate base and pedestal bearings, in most cases using three bearings. Slide rails, similar to those of the bracket type, are used.

The smaller waterwheel type is similar to the smaller belted type. The larger capacity is built with separate base and two pedestal bearings. The shaft at one end receives the waterwheel coupling and at the other end an exciter pulley, if such is used.

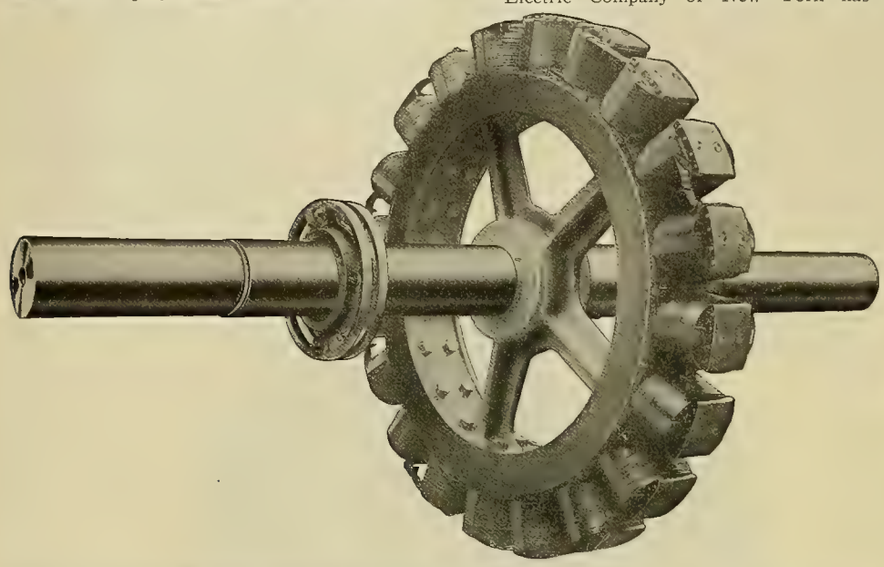
In the engine-type machine the armature is supported in a cast-iron frame of the deep box girder section. This frame rests at each side on a sole-plate and sub-base. When it is required to slide the armature parallel to the engine shaft this sub-base is made sufficiently long and suitable jackscrews are furnished. When the shifting of the frame is not required the sole-plate is omitted, and the frame rests directly upon the sub-base, which is then made shorter. The rotor in this type is mounted directly upon the engine shaft.

The cast-iron armature frames are made in one piece for the belted and medium-sized machines; for the larger, engine-type machines, they are divided horizontally, being secured at the joints by heavy eye bolts and keys or dowels. In some of the larger diameter of engine-type machines the armature is divided into quarters, preferably at 45 degrees from the horizontal or vertical line. Special attention is given in the design of armature frames to allow for free circulation of air in and around the armature coils and core. In the larger diameters, stiffness is insured by a deep section and large moment of inertia, so that the

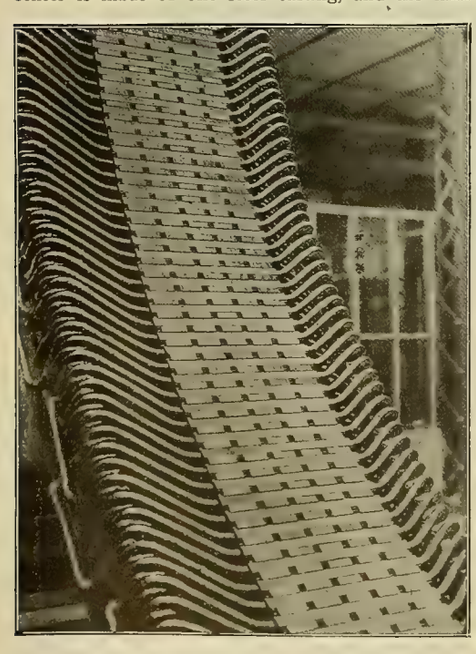
deflection of the frame either from its own weight or the unbalanced magnetic pull of an eccentric armature cannot occur.

On the larger machines a copper strip field is used. The strip is wound on edge and exposes its outer surface to the air, bringing the flat surface of the strip into the best position to resist the strains to which it is subjected.

The rotor construction on the belted and high-speed waterwheel machines is entirely of laminated steel. The poles are built up of thin sheets in order to minimize the iron losses due to the armature slots. The pole-face is curved to produce a widening gap from the center of the pole-face outward to distribute the magnetic field so as to generate a simusoidal electromotive-force wave. The inner end of the pole forms a dovetail or "T" projection, which is held in a corresponding slot in the laminated center by means of double-tapered keys. The construction permits of easy removal of the poles for repairs. The field center is built of heavy laminations and is homogeneous in structure, and insures uniform strength and good-running balance. In the medium-speed machines of the larger sizes the field center is made of one steel casting, and the laminated poles are dovetailed and keyed in place.



ROTOR, WITH LAMINATED POLE-PIECES, OF SMALLER SIZES OF WESTERN ELECTRIC ENGINE-TYPE ALTERNATOR.



ARMATURE OR STATOR WINDING OF WESTERN ELECTRIC ALTERNATOR, SHOWING FOUR SETS OF VENTILATING SPACES.

The rotor of the slow-speed and engine-type machines consists of a center or spider of cast steel, and poles of cast steel bolted to the rim. The pole-tips are laminated and secured by a dovetail to the pole-core. The pole-face is curved, the same as mentioned above. The rotor spiders are made solid and pressed on the shaft in smaller machines of this type, and in the larger capacity the fields may be split.

Carbon brushes are used, several to each collector ring. The collector rings are of a special grade of cast iron.

In the belted and waterwheel machines the shaft is a solid-steel forging and of large diameter to carry the weight of the revolving field and resist possible magnetic pull, due to the eccentric wearing of the bearings.

The journals are of ample design for cool running and are carefully turned and fitted. Special oil grooves are provided in the shaft to prevent creeping and oil throwing, not infrequent in high-speed machines. The bearings are lined with the best quality of babbitt metal and have from two to four oil rings, according to the size. Large oil wells are provided.

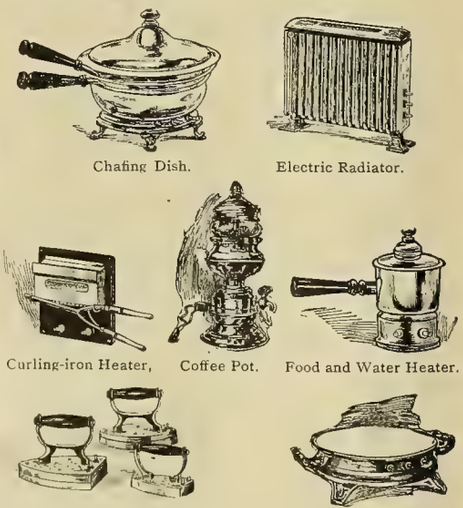
Cooking and Heating by Electricity.

Electric cooking and heating is no longer an experiment, but is constantly growing in popularity among those who desire the refinements of modern life in the household. The Prometheus Electric Company of New York has made an elaborate study of the interesting problems involved in this application of electricity and has developed a great variety of highly finished electric cooking and heating appliances—a few of which are shown in the accompanying group.

It has been said that among the useful applications of electric current none is more easily accomplished than the production of heat. To utilize efficiently this easily developed heat is the underlying principle of electric heating and cooking apparatus, and to accomplish this the effort is so to construct the apparatus that the heating device will transmit the heat instantly and directly to the object to be heated and to that object only.

In the case of electric cooking apparatus particularly, the essential feature is to bring the heater in the closest possible proximity to the food to be heated and to prevent the heat from being transmitted to anything else but the food. These conditions have never been fulfilled with any kind of coal, gas or oil stoves, because the best of these transmit only about 30 per cent. of their heat to the food contained in the cooking utensils, the remainder of the heat not lost through the chimney being consumed in raising the temperature of the surrounding atmosphere and in heating up the stove itself and the air space between it and the utensils. The most efficient, comfortable and convenient method of cooking, then, is to eliminate the stove and equip the utensil itself with the heater, and it is this method that is employed in the Prometheus system.

The heating unit consists of a strip of mica carrying a thin layer of non-oxidizable metal, which is firmly secured to the mica by a process of firing. This conducting strip is protected by another piece of mica placed over it, and the whole is enclosed in a metallic casing. This unit or "heating element" can be made to any desired resistance. The element may be either straight or circular and is readily inserted into or removed from a piece of apparatus in case of a breakdown.



ELECTRIC HEATING AND COOKING APPLIANCES.

Novelty Sleeve for High-tension Cables.

Realizing that the ordinary wiped joint has many drawbacks and that it is difficult to secure men competent to make a good joint, the F. Bissell Company of Toledo, Ohio, has developed the Novelty sleeve for high-tension cables, by the use of which the joint when made is accessible, and if trouble comes the joint can be inspected or repaired. Any man who can handle a soldering iron can install the Novelty sleeve. An interesting possibility is that two cables may be joined by a straight sleeve and later on this sleeve may be removed and a two-way or three-way branch substituted. The insulation is high and the sleeves are impervious to anything but mechanical injury. The maker calls special attention to the low cost of this manner of connection.

Referring to Fig. 1, for joining paper cables (P) to rubber-covered wires (R), the same general directions as for splicing telephone cables are followed, but with the advantage that the distributing rubber-covered wires are furnished complete in place. The porcelain tubes are held in place by pouring lead around them, (A) and (L). The rubber-covered wires are held in the tubes by compound, which is poured in between them and the tubes, filling the entire cavity. A small hole is provided at the top for pouring in the melted compound. The cover for the hole is a piece of brass soldered to the tube to prevent loss, which is loosened with a soldering iron pushed into place and soldered thoroughly. Fig. 2 shows the sleeve as it appears in use.

The illustrations show a three-way splice. The sleeves are furnished for one, two or three-way, and also special designs when required. Full details and samples will be sent by the Bissell company on application.

FIG. 1. INTERIOR OF NOVELTY SLEEVE FOR HIGH-TENSION CABLES.

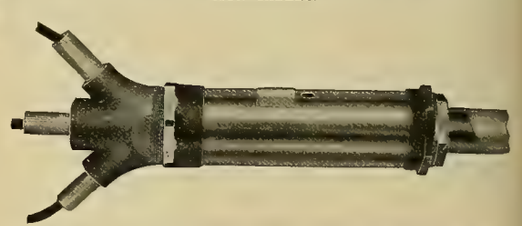


FIG. 2. NOVELTY SLEEVE FOR HIGH-TENSION CABLES.

SINGLE PHASE WESTERN ELECTRIC ALTERNATOR OF BELTED TYPE.

Results Obtained by the Use of Automatic Feeder Regulator.

The accompanying diagrams illustrate in an interesting way the voltage regulation obtained by means of the BR type of automatic feeder regulator manufactured by the General Electric Company. The construction and operation of this type of regulator, as well as the type IR automatic regulator made by the same company, were described in the Western Electrician of August 4, 1906.

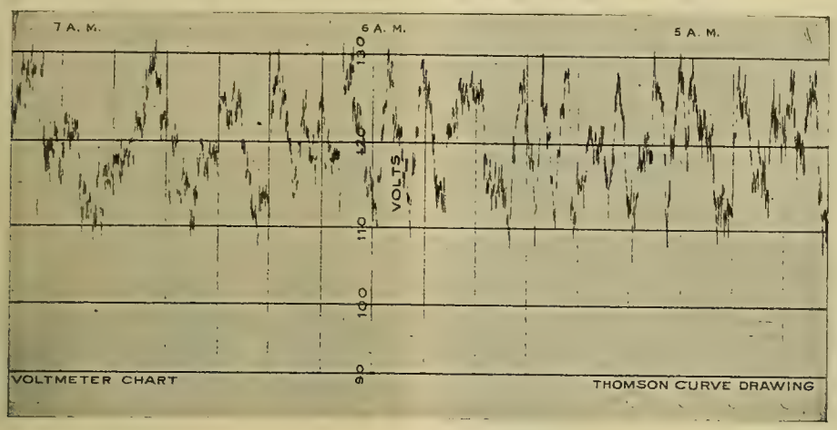


Fig. 1. Generator Side of Regulator.

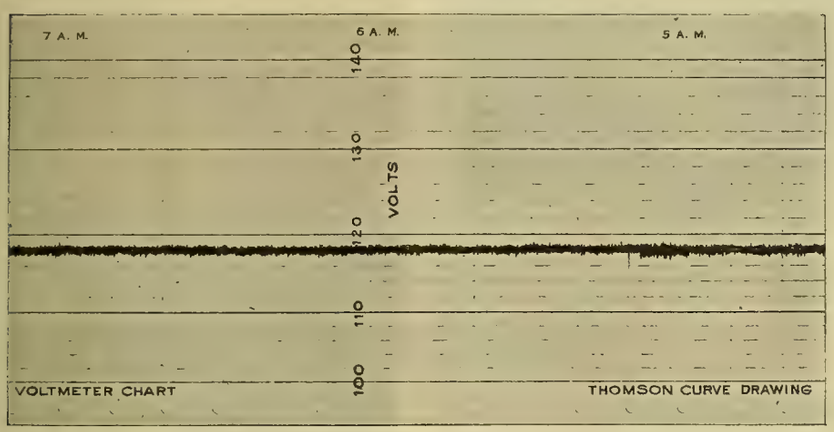


Fig. 2. Feeder Side of Regulator.

RESULTS OBTAINED BY THE USE OF AUTOMATIC FEEDER REGULATOR.

In principle the BR regulator is a variable ratio transformer or compensator having two separate windings. The primary or shunt winding is connected across the line, while the secondary or series winding is arranged in series with the line to be controlled, the regulator being connected between the generator and the load. Voltage is maintained constant by automatically changing the ratio of turns on the transformers and thus boosting or lowering the voltage to compensate for the fluctuations taking place when very heavy power service draws large momentary currents over the alternating-current feeder circuits.

The close regulation that is obtained with these regulators is seen by comparing Fig. 1 with Fig. 2. The charts were taken simultaneously with two Thomson curve-drawing voltmeters, one on either side of a type BR regulator, designed to boost or lower the voltage 10 per cent. The generator voltage (Fig. 1) was purposely varied over a wide range, so that the conditions are more severe than those usually holding in actual service.

In both charts the clearly defined record given by the Thomson curve drawing instruments is well exemplified. The instruments used in taking these records were equipped with 20-to-1 ratio potential transformers. Therefore the voltage variations illustrated represent the actual voltage regulation obtained at the lamps when the feeder circuit is 2,300 volts, since the ratio of transformation between the feeder circuit and the lighting circuit is the same as the ratio in the potential transformers, 20 to 1.

It will be noted that the actual maximum voltage variation on the generator side during the total time of the run was 508 volts, or approximately 22.1 per cent. of the normal generator voltage, 2,300; whereas on the feeder side of the regulator the maximum voltage variation is held down by the regulator to approximately 40 volts, or 1.7 per cent. This is true except at one point where the voltage variation was allowed to exceed the capacity for which the regulators were designed, as shown by inspection of the two charts. The point of minimum voltage (106) recorded at 5 ÷ 0.9¾ on the chart of the generator side of the regulator (Fig. 1) is about 1.3 volts beyond the boosting capacity of the regulator, as indicated by the drop at the corresponding point on the chart of the feeder voltage. The apparent discrepancy in time is accounted for by the fact that the chart of the feeder side was started slightly ahead of the chart on the generator side of the regulator.

The practical result of this demonstration is the fact that a steady light can be obtained with incandescent lamps on a feeder circuit which also supplies power for heavy motor service. Not only will the regulators maintain a uniform illumination, but since the lamp voltage is practically constant the life of the lamp is greatly increased. Both the BR and the IR types of regulators are built in standard sizes for cycles to boost and lower the voltage either five per cent., 7½ per cent. or 10 per cent. above and below normal. The BR regulator is usually built in sizes from 11 kilowatts to 22 kilowatts, while the types for single or polyphase circuits range in standard sizes from 5.5 kilowatts to 44 kilowatts. Their capacity, however, is practically unlimited and has already been extended to 800 kilowatts. The General Electric Company is also prepared to furnish automatic regulators of the same general construction as the standard types, but wound for special voltages and frequencies.

How to Get Electric Heating and Cooking Utensils Into Apartment Houses.

In many of the larger cities there are a great number of apartment houses which use electricity exclusively as an illuminant. These buildings are only equipped with sufficient gas pipe to connect the cooking range with each meter, and a branch from each meter to a common pipe line which connects to the stove in the laundry. The owners of these apartments furnish the laundry stove and have the branch lines from the meters arranged with valves that are held shut by means of a padlock, each tenant having a key for his own lock. With this arrangement, each tenant pays for his own gas used in the laundry.

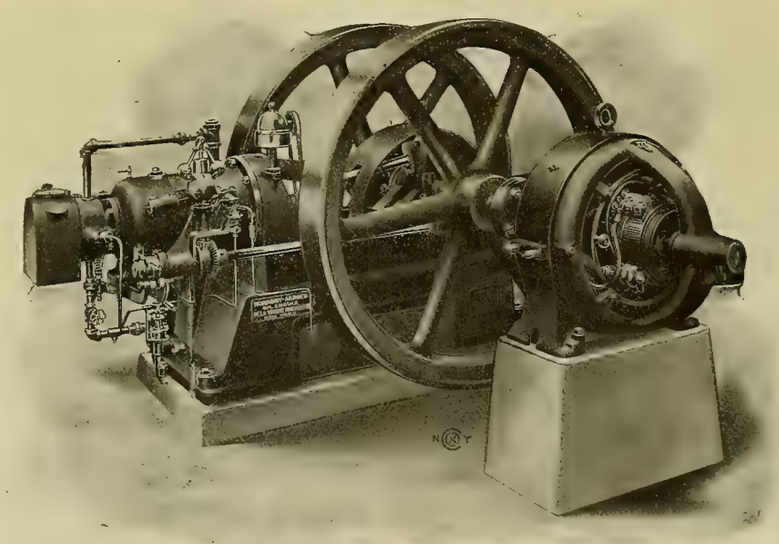
Appreciating the amount of business that could be obtained by a similar arrangement, the Cleveland Electric Illuminating Company induced the owner of a new apartment house to leave out the gas pipe and stove in the laundry, and provide enough electric irons to supply the tenants on their respective laundry days. A circuit was run from each meter to a gang of flush receptacles in the laundry. Each receptacle was numbered according to the suite number, and the doors on the flush plate are held shut by small padlocks, each tenant having a key to his own receptacle.

A tenant desiring to use the laundry for ironing applies to the janitor for an iron, which is already provided with the proper plug attachment. By simply unlocking the receptacle and inserting the plug, the iron is connected, and the current consumption is recorded on the proper meter. The installation of this arrangement costs less than the placing of gas pipe and stove, and the results are highly satisfactory.

Since the completion of this apartment it has been suggested to others, and at present there are two more apartments under the course of construction that will be equipped in the same manner. The use of the flatiron, heating pads and other small devices that you are fully confident will meet with success as a wedge to open this field, usually bring unexpected inquiries for larger articles. By active solicitation and usual commercial methods, the Cleveland company is selling, on an average, 20 pieces a day of heating and cooking utensils.—From J. Kermode's paper before the Ohio Electric Light Association, August 22, 1906.

Oil Engines for Electrical Work.

The De La Vergne Machine Company, New York, has recently brought out several new types of oil-engine generator sets which use as fuel, kerosene, crude or fuel oil. One of these is shown herewith. It is direct-connected, while another set is arranged for noiseless chain drive. The engines are of the well-known Hornsby-Akroyd type, which is extensively used for wireless telegraphy and electric power and lighting both by the United States government and in private plants. Several installations of this character were mentioned in the article by Frank C. Perkins, entitled "Oil Engines Driving Electric Generators in Lighthouses and Wireless Stations," in the Western Electrician of September 1st.



DIRECT-CONNECTED OIL ENGINE AND DYNAMO.

These oil engines are built in various sizes from five to 250 horsepower, the larger units being of the twin-cylinder type. Several of the 250-horsepower engines have been running for some time direct-connected to generators in the factory of the Baldwin Locomotive Works, Philadelphia, Pa., and the service has been such that several more have recently been ordered by the same firm.

Windmill Electric Lighting Plant.

Not a great deal has been done in the way of utilizing windmill power to furnish electric light in farmhouses or summer homes, owing to the irregularity of the windmill, making necessary the installation of a storage battery and somewhat complicated apparatus to regulate the speed of the dynamo or to connect or disconnect the dynamo or the battery. The whole outfit has been comparatively expensive and not particularly satisfactory. But the Windmill Electric Company of Noblesville, Ind., thinks that it has solved the problem by using the windmill to pump a head of water, driving the dynamo by a water motor and installing a hydraulic regulator. A storage battery completes the outfit, which is of some interest.

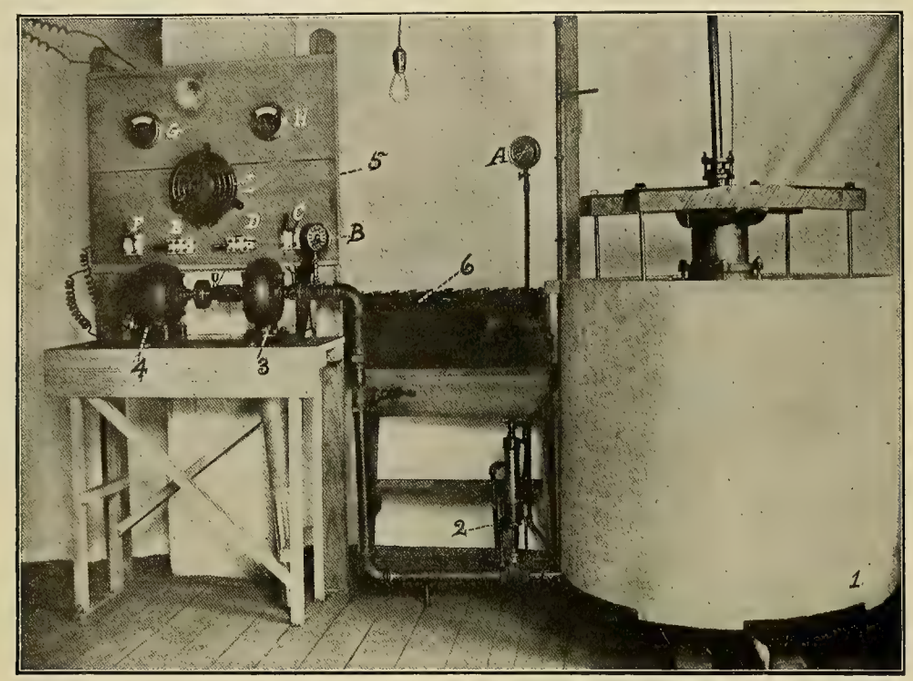


FIG. 1. WINDMILL ELECTRIC-LIGHTING PLANT.

In Fig. 1 is shown the complete electrical and controlling outfit, in which (1) is the hydraulic regulator, with a pipe leading from the windmill and well and another to the automatic valves (2). These valves control the water pressure from the regulator to motor. By an ingenious trip the valves are opened when the regulator is full of water, and by doing so the water is forced into water motors under pressure from plunger in regulator, and when water is exhausted the valves automatically close. The water motor is shown at (3). The water can be carried to a stock tank for watering stock, or it can be discharged into a barrel or tank to be used over again. The dynamo is at (4), switchboard (5) and storage battery (6). (A) is a gauge showing water pressure in the regulator and (B) a circuit-breaker, between the batteries and dynamo, worked automatically by the water pressure.

Fig. 2 shows the hydraulic regulator with water exhausted and valve closed, while Fig. 3 shows it full of water, with valve open. This device is intended to regulate the volume of water for the hydraulic motor at the desired pressure, regardless of the speed of the wind-driven pump. Water is pumped from a well and forced into the regulator, which is composed of stuffing box with plunger. The plunger has a weight suspended above to give pressure to the water, and when the regulator is filled the pressure is about 75 pounds to the square inch. In order that the water may pass into the water motor under a given pressure after the regulator is full, automatic valves are operated by an ingenious trip, and when the regulator is empty the valves close. In Figs. 1 and 2 (A) is the incoming pipe from the well, and (C) is the pipe leading to water motor, with automatic valves at (B).

The capacity of the dynamo is small, only 125 watts, but, with the battery, the manufacturer of the outfit asserts that the electric-lighting needs of an average family will be met. It is said that in Central Indiana a windmill will run, on the average, five hours a day.

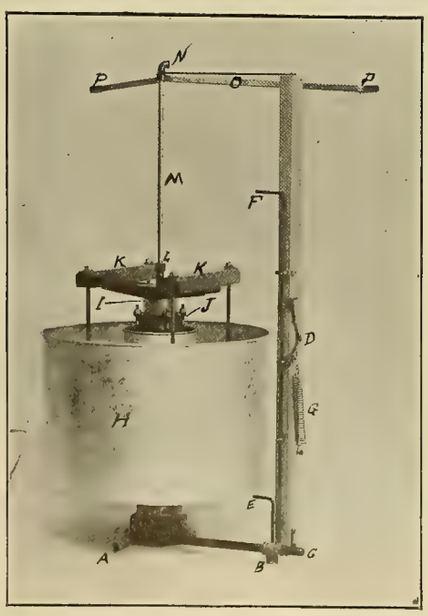


Fig. 2. Hydraulic Regulator with Water Exhausted, Valve Closed.

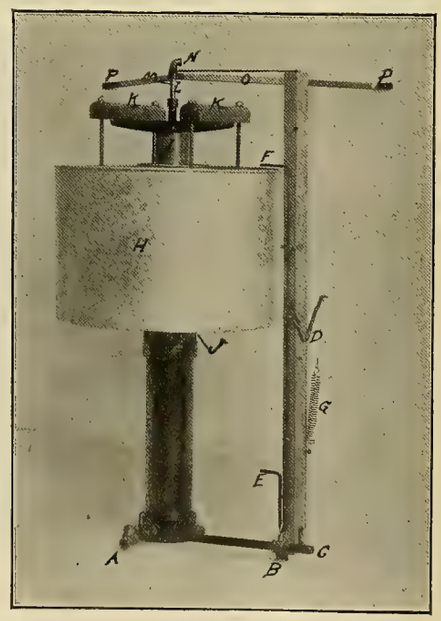


Fig. 3. Hydraulic Regulator full of Water, Valve Open.

WINDMILL ELECTRIC-LIGHTING PLANT.

Two Practical Hints.

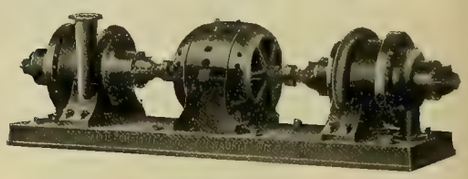
When a responsible man comes to me and asks what it will cost to run a certain piece of machinery by electricity, I almost always say, "I don't know; but we will put in a motor and find out;" and I will say this—the motor never comes out.

Always keep your name before the public in as good a light as possible. In small towns, where the manager is in his office every evening, and his office is kept open until about eight o'clock, let the public know that at the light office he can get money changed, postage stamps, special-delivery stamps, either telephone, city directory, possibility of a house to rent, or any information that will accommodate the public. These little courtesies put your company before the public in a good light, and at practically no cost to the company.—D. W. Low of the Alliance (Ohio) Gas and Electric Company, in a paper read before the Ohio Electric Light Association, on August 22, 1906.

Motor-driven Centrifugal Pumps.

The general use of centrifugal pumps in this country has, until recently, been confined to installations where a low lift was required, but the multi-stage centrifugal pump, for heads ranging as high as 2,500 feet or more, is rapidly coming into favor.

Among the features that recommend pumps of this type are their low first cost, the small space which they occupy, the light foundations needed and the limited amount of attention that they require. They are safe to operate, because they will produce no more than approximately the maximum pressure for which they are designed, even if the delivery is almost or entirely stopped by the closing of the valves in the discharge pipe. They are also able to handle gritty waters, and, when made of acid-resisting materials, to handle acidulous, corrosive or viscous fluids to good advantage.



CENTRIFUGAL PUMPS IN SERIES DRIVEN BY INDUCTION MOTOR.

The Allis-Chalmers Company of Milwaukee, one of whose small units is illustrated herewith, designs these pumps for any capacity and condition of service within the range of their adaptability, and the construction of each is planned with careful reference to the requirements of the service for which it is intended. They may be used in mining operations, for irrigation work, for auxiliary pumping stations in cities, for municipal fire service, for feeding boilers, or for any other service of a similar nature.

The pumps are built with as many runners as there are stages through which the water is required to be handled, each stage raising the total required quantity of water through its proportion of its total net head. They may be driven either by induction or direct-current motors. Both pump and motor are mounted on a common bedplate.

The electrically driven pump has a number of important advantages. One of these is that on account of the high rotative speed less work needs to be done for each revolution, thus reducing the size of the unit. Pumps directly connected to electric motors are also flexible in their operation. As the speed is constant, the power and output are in inverse ratio to the head pumped against, so that the efficiency remains practically constant within the limits for which the pump is designed. Then, too, the speed necessary for operating under high heads can be obtained without increasing the impeller diameter of the pump to such an extent as to render its construction impracticable. Further, it sometimes becomes necessary to erect pumping machinery at a distance from the source of power, and in such cases the use of electric current greatly simplifies the problem of construction.

Colorado Electric Light, Power and Railway Association.

The Colorado Electric Light, Power and Railway Association will hold its annual convention in Denver next week, September 18th, 19th and 20th. The following papers are on the programme: "Voltage Regulation," by Leonard Wilson; "The Use of Polyphase Motors in Outlying Districts," by W. A. Carter; "Profitable Commercial Co-operation," by J. Robert Crouse; "The Lighting of Small Stores," by J. R. Cravath; "Water-type Lightning Arresters," by A. M. Ballou; "Transformer Testing and Line Records for Transformers," by E. P. Dillon; "Steam Turbines," by C. C. Chappelle.

Arrangements are being made, it is said, to organize another telephone company at Denver, Colo. It will be an Independent home company and proposes to connect with the Pacific Coast.

Telephone News from the Northwest.

The Cannon Valley Telephone Company will install a new exchange in Waterville, Minn., replacing its old system. A new brick building will be erected for the exchange office.

August A. Monson of Minneapolis is reported to have invented an automatic telephone switchboard which gives privacy of communication and also admits of extensions.

The Great Western Telephone Company has sold its system to the Northwestern Telephone Exchange Company. The Great Western owned exchanges in Breckenridge and Campbell, Minn.; Wahpeton, Lisbon, Milnor, Fairmount, Hankinson and Forman, N. D. The company is owned by Fergus Falls people.

The Central Telephone Exchange Association met in Minneapolis September 4th and 5th to consider matters of interest to the members. The association is made up of eight companies located in the eastern part of Minnesota, all of them small but steadily growing. The next meeting will be held in either St. Paul or Minneapolis in November.

About 20 Independent telephone companies operating in Black Hawk County, Iowa, have organized an association, with E. W. Haradon of Jesup president and F. Ardecker of Janesville secretary and treasurer.

The Loyal Telephone Exchange Company of Loyal, Wis., has filed articles of incorporation with a capitalization of $1,500. C. M. Taylor heads the list of stockholders.

The North Dakota Independent Telephone Company has begun work on its new trunk line between Fargo and Bismarck. R.

Southeastern Telephone Developments.

As soon as the signature of the city authorities is secured work will be started on the underground system of the Bell Telephone Company in Asheville, N. C.

The lines of the Cape Fear Telephone Company are being strung from Bonsal to Buckhorn Falls, near Fayetteville, N. C.

W. R. Polk, owner of the lighting plant at East Point, Ga., has secured an injunction to restrain the Atlanta Telephone Company from so stringing its wires that the high and low-tension are mingled, resulting in trouble. The bill alleges that the telephone company has placed its wires on poles above those of the lighting system, and that when a wire falls great trouble is caused.

Mayor Timanus of Baltimore is having expert examination made to determine if the city cannot prevent the stringing of high and low-tension wires on the same poles throughout the city. The electrical workers' union has made complaint about the danger resulting, and it appears that it will be necessary to place the wires in municipal subways, this being the opinion of the city building inspector. The mayor will investigate further.

The Boland Telephone Company is chartered at Higginsville, Mo., by N. J. Dyer, S. S. McCullough and others, with a capital of $3,125. L.

Ohio Telephone Notes.

The voting-trust certificates of the Cuyahoga Telephone Company, common and preferred, have been listed on the Cleveland Stock Exchange. When the Brailey syndicate purchased the control of the company a voting trust was formed and certificates issued. As a certain portion of the stock has not been pooled, both the certificates and stock will now be handled by the exchange.

The July statement of the United States Telephone Company shows a good increase in the gross earnings over the corresponding month last year, and a decrease in the expenses. Whereas nothing was set apart for dividends on common stock a year ago, this statement shows $5,000.

The Independent Telephone Building Company of Akron has been incorporated with a capital stock of $35,000 by C. H. Taber, Charles Currie, R. E. Inskeep and others. The purpose is to hold the title to and have charge of the new telephone building that is being erected on South High Street, Akron.

Lee Humphrey and others have incorporated as the Malta-Elliott Telephone Company of Malta, with a capital stock of $10,000. C.

Indiana Telephone Items.

The Home Telephone Company of Peru has added 180 country lines and 50 more are ready to be put in service. The company has completed a local line to Macy and a direct line to Rochester by way of Santa Fe. A new switchboard will be installed, as the present board of 1,500 capacity is overtaxed.

A long-distance telephone and telegraph line is being constructed from Clay City to Louisville by the American Telephone and Telegraph Company.

Judge Heaton of the Superior Court at Fort Wayne denied the application for a receiver for the Monroeville Home Telephone Company, filed by stockholders, on the ground that the company was by no means insolvent. The court also decided that the amounts voted to the directors for alleged service in building and operating the plant for five years, in lieu of stated salaries for their services, is excessive, and entered a decree requiring them to refund certain portions of the amount to the company. S.

Grand Rapids Automatic Telephone System.

The annual report of the Citizens' Telephone Company of Grand Rapids, Mich., was presented at the annual meeting September 11th. It discloses a satisfactory condition of affairs and is of particular interest, as this company uses an automatic system. There was an increase of 3,902 telephones in the system during the last year, 1,190 of which were in Grand Rapids. This is the largest net gain in the Grand Rapids exchange since it has been built. The growth outside of Grand Rapids has been almost entirely in established exchanges, only a few new ones having been added during the year.

The report says that farmers in several parts of the state have organized co-operative companies, built their own lines and installed their own telephones. The policy of the Citizens' company has been to connect with these rural companies wherever equitable terms could be agreed upon, with the result that the company is connected with and does switching for many rural subscribers besides those where the company owns the lines and apparatus. There were added during the year 91 miles of poles and 348 miles of No. 10 copper wire.

Earnings and expenses are shown as follows: Earnings—Exchange rentals, $388,153.90; tolls, $102,614.27; other income, $7,919.50; total, $498,687.67. Expenses—Operating, maintenance, reconstruction and depreciation, $244,661.36; general expense, interest, taxes, etc., $55,123.98; dividends, $168,902.33; carried to surplus, $30,000; total, $498,687.67.

The number of telephones in the entire system is 23,644. The number in the Grand Rapids exchange is 7,823. The toll-line mileage is 1,444. The earnings of the toll lines per circuit mile show a gain from $27.95 to $30.57, an increase of $2.62 per mile. During the previous fiscal year the gross earnings were $22.45 per telephone, with a net earning of $8.35, expenses being $14.10. This report shows gross earnings of $22.62; gross expense, $13.86; net earnings, $8.76 per telephone.

The capital stock was increased after the last annual meeting from $2,000,000 to $3,000,000. The total amount of stock outstanding on June 30th last was $2,324,940.

GENERAL TELEPHONE NEWS.

About $30,000 has been subscribed by the local people of Jonesboro, Ark., for the new telephone company, and the company will build an exchange at once.

Among recently incorporated telephone companies are the following: Valleyview Telephone Company, Arapahoe, Okla.; Urich Telephone Company, Urich, Mo.; Boland Telephone Company, Higginsville, Mo.; Mutual Telephone Company, Little River, Kan.; Hamilton Telephone Company, Hamilton, Kan.

The Canadian Independent Telephone Association, organized a year ago, in the first report, presented at the meeting of the association held at Toronto a few days ago, shows that there are 73 absolutely independent companies or private systems in Canada. They have 3,248 shareholders, 12,073 subscribers and an invested capital of $850,000. The annual report of the Bell company is said to show that on December 31, 1905, it had 78,195 subscribers.

Plans are being drawn for the new South Dallas (Tex.) telephone exchange which is to be built to provide for the increased number of telephone patrons in that section of the city. About 12,000 telephones are to be connected up with the exchange in the beginning. J. E. Farnsworth, president and manager of the Southwestern Telephone Company of Dallas, announces that the company is preparing to make extensive improvements in the local plant.

A feature in farm life in Manitoba, Canada, is the number of farmers who are installing telephones. The Bell Telephone Company is making strenuous endeavors to meet the demand that has sprung up for rural telephones. The Bell company has some 25 gangs engaged in the construction of rural-telephone lines in Manitoba alone. Between 30 to 40 men are employed on each gang, so that the work is proceeding rapidly. It is said that over 6,000 new telephones will be placed in farm houses before winter sets in.

A deed transferring property of the Inter-State Telephone Company of Trenton, N. J., from the trustee in bankruptcy for the Court of Chancery has been filed in Paterson, N. J. The consideration mentioned in the deed is $575,000. The mortgages covering the properties were filed with the deed. The second mortgage is drawn in favor of the Mercer Trust Company and is a general mortgage securing a loan of $4,000,000. The filing of these mortgages, together with the deed, is a part of the reorganization plans of the company.

CORRESPONDENCE.

Continental Europe.

Paris, August 25.—The question of running a direct electric railroad between Rome and Naples is one which has been much discussed, and it will no doubt be realized in the near future. According to the most recent reports, an Italian syndicate has applied for a concession to the Minister of Public Works. The terms of the concession relate to a 120-mile electric road, which will be covered by the express trains in one hour and 40 minutes. These trains will run direct between the two cities with but few stops. The regular fast trains will cover the distance in about two hours. Hydraulic power is to furnish the current, and it will be taken from the Volturno River or its affluents. The concession is to be held for a period of 70 years, after which the line will be turned over to the government.

A system of electric omnibus using an overhead trolley and running over the ordinary road is in operation in Italy between Spezzia and Portovenere, a length of over two miles. The overhead line is double and is held, as usual, upon poles or brackets. Current is taken by a trolley of the Cantons pattern, which is a modification of the bow form, using small rollers to run on the wire. One of the overhead wires is connected to ground, and the system works on 500-volt current from the city plant. The omnibus holds 14 passengers and uses two six-horsepower motors in driving the rear wheels.

A project of considerable importance has been brought out by M. René Koechlin, a well-known engineer, which relates to establishing two large hydraulic plants upon the Rhine in order to distribute current in the region of upper Alsace and the neighboring districts. The river will give a very steady supply with a small fall and a great volume, and it is proposed to utilize the portion lying between Basel and Breisach. Current would be sent to Strasburg, Mulhausen and other localities. The first hydraulic plant uses some 35,000 horsepower with a fall of 36 feet. Twelve turbines are to drive three-phase alternators working at 3,000 volts. Transformers are to raise this to 30,000 volts for the overhead lines. The second hydraulic plant will be laid out on the same lines, and the total amount of power from the two plants is to be 62,000 horsepower. Should this project be realized it will be one of the largest in Europe.

The report for the year 1905, which was presented at the last meeting of the Paris Subway Company, gave some interesting figures as to the financial condition of the company, which I mentioned briefly not long ago, and also some technical data as to the construction and operation of the lines. For the new line in the southern part of the city two sub-stations have been erected, the Denfert and the Lamotte-Picquet. The latter station as well as the already existing Opera and Etoile sub-stations on the other line are now connected by underground cable with the St. Denis electric plant in the suburbs of the town. The cable is run in some cases in the Subway Tunnel. As to the new Denfert sub-station, it is equipped with three converting groups of 1,000 kilowatts each and a large battery of accumulators. Place is left to receive two other groups which will be needed later on for one of the new sections. The sub-station of Lamotte-Picquet is constructed in like manner to receive five main groups of rotaries and a storage battery. The Metropolitan central station on the Seine is receiving the eighth main engine-alternator set which will complete the present plant. The total capacity of the station will be 15,000 kilowatts.

As regards the rolling stock now in use upon all the Subway lines, we find a total of 305 motor cars and 378 trailers. These are of the former two-axle type, or the new double-truck pattern. There are 56 motor cars and 93 trailers in construction, making 149 cars in all. At the end of the year the total length of the lines in operation was about 20 miles, but we must now add the southern section which was opened last April and will increase this figure.

The system of hauling canal boats by electric traction is now working successfully on the Teltow Canal in Germany. It has been carried out by the Siemens-Schuckert firm. In general the boats are drawn by a specially designed electric locomotive which runs on a track along the canal, and at present there are 20 locomotives in use. A number of lakes are found on the canal, and here it is impossible to use the electric locomotives. Here the canal boats are towed by an electric motor-boat having a battery of accumulators, or in some cases an overhead wire is used, and the boat carries a trolley like a motor car. The Lombard-Guerin system of motor-driven hanging trolley is also used on the wire and a cable connects the trolley with the boat.

A suburban tramway line is to be established between Santander (Spain) and Asterillo. The concession for the new line has been granted to the Nueva Montana Sociedad of that city. A steam traction line was installed by the company between the iron works of Isla de Oleo in the neighborhood of the city and the Comargo iron

works. This line is now to be electrified, according to a decision which the company made recently.

The question of modifying the existing legislation as to hydraulic power has been discussed for some time past in Switzerland. It is now proposed to insert a clause in the constitution which will give the federal government a more direct control over such matters, and the future concessions for hydraulic plants are only to be granted by the government. Power cannot be taken into other countries without the consent of the Federal Council.

A prize is to be awarded by the Agricultural Society of France for the best paper upon the production and distribution of current for light and power in the rural districts. The central station is either to be independent or to be operated in connection with a sugar factory or a distillery already existing. The paper is to be read at the annual meeting of 1907. A. DEC.

Great Britain.

London, August 29.—Great activity at the present moment is displayed in connection with the tramway systems in and around London, and the consummation devoutly desired for many years past seems at hand. The London County Council has displayed more than its wonted energy in putting into force the powers which it has just received for building tramways over Westminster and Blackfriars bridges and along the Embankment. An estimate for this work has already been passed, amounting to $480,000, and with other lines on the south nearing completion the network on the south will soon be out of hand so far as construction or reconstruction is concerned. The decision of Parliament this year, incidentally, for the first time in its history, enables the connecting up of the northern and southern systems, and this work has also been entered upon. The short length of subway tramway owned by the council comes from the north and ends in the Strand. By continuing this subway a few hundred yards the Embankment is reached, and by linking up with the new tramways there, a northern and southern connection is given. The work of continuing the subway has been entrusted to the London County Council's own works department, the estimated cost being $325,000. In addition to these works practically all the horse lines in the north are under reconstruction and a good portion will be completed by 1907. A series of other important lines around London has also been completed during the last few months, with the result that many pleasure resorts several miles outside have been made accessible. In fact the year 1907 should see the reproach removed that London's means of communication are behind other large cities. The "city" proper, of course, will always lack tramways until some expeditious and inexpensive mode of street-widening is evolved.

The National Telephone Company's business in the provinces is increasing to such an extent that new telephone exchanges, each having a capacity of 10,000 subscribers, are about to be erected in Birmingham and Manchester. The company is also issuing some new capital which is to be offered to existing stockholders.

Many reports are again appearing in the financial papers as to the possibility of large British interests in the contemplated power scheme for the South African Rand. Reading between the lines it would seem that the very long-distance overhead transmission from Victoria Falls to Johannesburg is rather overshadowed by the more feasible and less fanciful proposal to erect a power station at Vereeniging, where the waters of the River Vaal could be made use of. On the other hand, it is not clear whether it would be advisable to do this or to generate by steam, coal in the Rand district not costing more than a little over $1 a ton. Some plan after the nature of the Vereeniging suggestion, however, seems the most likely to meet with financial support.

An electrically operated transporter bridge over the River Usk, at Monmouth in Wales, is to be opened early next month. In principle it will be more or less identical with that already described and illustrated in the Western Electrician between Widores and Runcorn in Cheshire. Exact details, however, will not be available until the opening.

A short time ago I suggested that no doubt the American engineers who visited this country in July noticed the absence of any public arc lighting in a few of our important cities, and I mentioned Sheffield as an example. The electricity works at Sheffield are in the hands of the municipality and the gasworks are in the hands of a company. Gas in Sheffield is as cheap as any reasonably minded person can expect, and so it is that having a contract at a low price the Sheffield council has been content to adopt a non-possumus attitude in the matter of street arc lighting. The electrical engineer at Sheffield has other views and has tried all he knows to get public arcs installed. He has even been what the Scotch call "pawky," but entreaties have been of no avail hitherto. At last, however, he has succeeded in inducing the council to discuss the whole matter, with the consequence that in interested circles the liveliest anticipations of an exciting debate next week are entertained. Something of the same sort is to take place in Dundee also.

A proposal to form a municipal workers' union is viewed in many quarters as an extension of socialism too far-reaching in its possible effects. The suggestion, however, is to be put forward at a meeting of the Trades Union Congress which will be held next week. Municipal electricity and tramway undertakings are particularly interested in this. G.

Dominion of Canada.

Ottawa, September 8.—The Ontario Railway and Municipal Board is coming to Ottawa to hear the application of the city for approval of its by-law to expend $50,000 on extensions of the city's electric-lighting system.

It is announced that William Marconi is engaged in perfecting a device that will make it possible to determine the location of a ship at sea in any kind of weather. The inventor expressed the opinion that the importance of the invention would be felt nowhere more than in the Gulf and River of St. Lawrence, where the present enormous risks of navigation would be minimized by the application of this device.

Five of the largest and most attractive street cars ever made in Canada have just been built in Ottawa for the Windsor, Essex and Lake Shore Rapid Railway Company. The cars are 55 feet long. The motive equipment will also be an innovation in street-car construction in Canada. The cars will run on single-phase alternating current. The cars are built on the Pullman style, and have observation ends and all other modern conveniences. The line on which they will operate is not yet complete.

During the next few months the Ottawa Car Company will ship 50 new electric cars to Montreal for use by the street railway there. These cars are of a novel design, being the first made to suit the new system of collecting fares from passengers as they enter the cars. The street-railway company has tried the method pretty thoroughly in the old style of cars and found it very satisfactory.

An inquiry is now being made into the available waterpowers and deposits of iron ore in the Ottawa Valley, and if the report be as favorable as is anticipated, it will probably lead to the establishment of a large electric smelting plant in this vicinity. The capitalists interested in this proposal are most of them in Canada. It is said that at Chats Falls, a few miles from this city, on the Ottawa River, power can be generated for less than $10 per electric horsepower per year. If this proposal, as well as the plan of a Pittsburg company, comes to realization, there will soon be two electric smelting plants in Ontario.

William Marconi states that he has been quite successful in transmitting and receiving messages between Ireland and Canada, but he could not say how soon he would be in a position to handle business commercially. At the station at Glace Bay, in the province of Nova Scotia, two new engines have just been installed, the electrical apparatus has been greatly enlarged and a fine new building is in course of erection. Aside from the transatlantic business, the wireless is meeting with great success. The service under control of the Dominion government is giving entire satisfaction. W.

New England.

Boston, September 8.—The Twin State Gas and Electric Company of Hartford, Conn., has assumed control of the Brattleboro (Vt.) street railroad and the gas and electric-light plants in that place.

The New England Investment and Security Company has given promissory notes, all its preferred stock, amounting to $10,000,000, and all its common stock, amounting to $10,000,000, to the Consolidated Railway Company in payment for the electric railways in Massachusetts formerly owned by the latter company.

The Imperial Storage Battery Company of Quincy, Mass., has been incorporated under the laws of Massachusetts. It has a capital of $5,000. Edward C. Ekstromer, Edward H. Angier and George M. Angier are the incorporators.

The Consolidated Railway Company has called for bids for material for its proposed interurban electric railway between Middletown and Meriden, Conn. Much of the way the cars will run over the steam railroad tracks of the Waterbury, Meriden and Middletown road, which will be equipped with an overhead trolley.

Samuel H. Hudson has been named as Boston's representative in the arbitration of the street-lighting contract with the Edison Electric Illuminating Company as assignee of the Boston Electric Light Company. The Edison company has appointed Herbert A. Wagner of New York as its representative. He was the company's representative when the contract was arbitrated in 1901. Mr. Wagner was formerly employed by the Edison company of St. Louis. These arbitrators will select a disinterested person for the third arbitrator.

The United Electric Light Company of Springfield reports for the year ending June 30th as follows: Gross earnings, $380,839; operating expenses, $200,468; net earnings, $180,371; dividends, $80,000; surplus, $100,371.

Hon. J. Manchester Haynes, president of the Augusta, Gardiner and Hallowell Electric Railway Company, died at his home in Augusta, Me., on September 1st after a long illness. He was born in Waterville, Me., 67 years ago and has been interested in many business enterprises. He was largely interested in shipbuilding and railroads and was president of the Maine Senate in 1879 and speaker of the Maine House of Representatives in 1882.

F. P. Pfleghar & Son will install an electric plant in the large hardware and special machinery manufactory which they are building in New Haven, Conn. They will use electricity for motive power and lighting.

The Roslindale Citizens' Association has voted to oppose the Boston Elevated Railway Company's plan for its Forest Hill terminal because it will take 14,000 square feet of land in Forest Hills Square. The association wants the company to build the terminal on its own land. The West Roxbury Citizens' Association also objects to this plan, partly because it will use so much land that is now used by the public and partly because the elevated and surface cars are not to be brought to the same level in the terminal.

The Boston and Worcester Street Railway Company has put into service six semi-convertible cars 53 feet six inches long and 8½ feet wide. Each car is equipped with 30 lamps of 25 candlepower each and 11 double seats. The motorman controls the outside doors and the raising and lowering of the lower steps by an air lever. Each car has motors capable of developing 300 horsepower. Each car weighs 33 tons and the truckwheels are 34 inches in diameter. B.

New York.

New York, September 8.—The contract between the city and the Richmond Light and Railroad Company for the lighting of Staten Island has been signed, involving about $100,000 and dating to March, 1907. Controller Metz held up the contract because he considered that the company had not furnished adequate service. The company promised, however, to give better service to the citizens by cutting off some of the current furnished to the Staten Island beach resorts. There is no other electric power company on Staten Island. Acting Mayor McGowan, while not in favor of municipal ownership generally, thinks it would be best for the city to establish a plant for the lighting of the island. It would cost about $750,000.

The local branch of the Commercial Telegraphers' Union of America met at the Borough Park Club in Brooklyn on September 2d and elected Joseph F. Ahearn president. The new executive board of Local 16 contains J. F. Burke, Edward F. Fagan, James A. Griswold, H. A. Green, A. S. Hughes, E. R. Henderson, George Kearney, J. I. Marsh and C. V. Snow. R. M. McLennan and George H. Wiser are the vice-presidents, C. P. McInerney is secretary-treasurer, and P. O. Purcell is recording secretary.

The annual report of the Brooklyn Rapid Transit Company, issued Thursday, for the 12 months ended June 30th, shows gross earnings of $18,473,328, compared with $16,333,444 in 1905. The net earnings were $8,031,951, compared with $6,529,574. Fixed charges were larger by $534,442 than they were in 1905. The balance after the payment of fixed charges and taxes was $2,742,952, as compared with $1,603,218 in 1905.

The directors appropriated $580,343 for betterments and additions. The surplus, after deducting these charges, was $2,162,609, an increase of $1,012,676 over the surplus reported for the previous 12 months. The year's operating expenses amounted to $10,441,277, compared with $9,803,870. The charges of maintenance of way and structures and for maintenance of equipment showed a slight falling off compared with the previous year. The cost of operating the Brooklyn Rapid Transit car building and repair plant was $1,605,934, included in which is the cost of completing the work of rebuilding the company's cars for operation by electricity. The Brooklyn Rapid Transit Company now has on its elevated lines 558 motor cars and 269 trailer cars.

Chief Engineer Charles H. Jacobs of the North River tunnel work of the Pennsylvania Railroad stopped work on the Pennsylvania Hudson River tunnels a week ago in order to check the alignment of the tubes. The engineers found that the tubes are only one-eighth of an inch off line and three-quarters of an inch off grade. That means that when the east-bound and west-bound shields of either tube meet, the rings of the cast-iron lining will fit together so closely that the difference between them will be hardly perceptible. It is expected that the tubes will meet on September 18th, thus completing one of the most difficult engineering feats ever undertaken. The two steel tubes driven 6,000 feet under water are 23 feet in diameter. It has required extreme care and accuracy to insure the perfect joining of the two sections when they come together.

Inability to sell its 20-year four per cent. bonds

for the construction of the $161,000,000 Catskill reservoir and aqueduct has forced the city to call a halt on all proceedings for the extensive improvement of its water supply. When Controller Metz offered $500,000 worth of the bonds he received a bid for just $100 worth. It developed that bond dealers hardly wanted the bonds at any price.

Success in the use of radium in the treatment of superficial cancer is announced in a report to the American Medical Association by Dr. Robert Abbe, attending surgeon to St. Luke's Hospital. Dr. Abbe believes that in 20 cases out of 35 that he has treated in three years he has obtained success. It may be that the disease will recur from time to time, but a renewed application will again drive it away, he says. He used only strong specimens of radium and applied them in small cells covered by a thin layer of mica. Under their influence the cancerous growths have been gradually burned away and replaced by healthy tissue. At the Flower Hospital the same method is in use for lupus and epithelioma. As radium is exceedingly expensive and scarce it is applied in the form of small pieces of gelatine on which the radium powder is dusted. These are inserted in the growths, which are then covered with adhesive plaster. Experiments are also under way looking toward the extirpation of goitre by radium.

C. I. C.

Southeastern States.

Charlotte, N. C., September 8.—On account of recent freshets in western North Carolina much damage has been done and the electric plants have not escaped.

In the condemnation proceedings instituted by the Susquehanna Electric Company against the McCall Ferry Power Company to value a strip of land along the river the jury has decided that the McCall company receive $56,000 damages, the railroad company $500, and each tenant who will be compelled to vacate, $50. The Hartford company required the land of the McCall company for backwater purposes for its proposed dam to develop 25,000 horsepower to supply electricity to Baltimore. The Susquehanna company proposes to build a plant in Maryland. There is also the Susquehanna Electric Power Company, which as yet has made no move to develop its property.

The stockholders of the Anthony Shoals waterpower in Wilkes County, near Washington, Ga., have ratified the action of the directors to increase the capital stock to $5,000,000. J. H. and T. M. Fitzpatrick of Washington are the principal stockholders. The electric power will be transmitted to many nearby towns, and mills of Augusta, Ga., have already contracted for one-third of the power to be developed.

At the plant of the Whitney company at The Narrows on Yadkin River, near Salisbury, N. C., recent floods wrought about $25,000 damage to the company in its work of developing this immense electrical waterpower.

The Southern Power Company has finally submitted to the town of Statesville, N. C., a proposition to bring electric power to that place if $16,000 is guaranteed the first year; $20,000 the second year, and $24,000 the third year. There is plenty of desire on the part of the town to secure the power and a satisfactory outcome is believed to be in sight.

The Kentucky Electric Company has paid in all of the $100,500 required by the city for its recently granted franchise. The Kentucky Traction Company is also seeking a franchise in Louisville.

A new electric railway across the state of Georgia, 170 miles east and west, is proposed by the recently chartered Atlanta and Carolina Railway. M. T. Edgerton and M. Mason of Fulton County are on the list of incorporators.

The owners of Piedmont Heights, a suburb of Greensboro, N. C., have made a contract with the Greensboro Electric Company to extend the latter's lines to the suburb.

E. D. Steele, attorney for the North Carolina Electric Company, has announced that the contract has been let for grading 11 miles of the roadbed. The line will be built from Thomasville, N. C., to High Point and thence to Greensboro, a distance of 18 miles.

The new electric-light system of Rockmart, Ga., has just been placed in commission and is highly satisfactory.

It is proposed to take up the extension of the Norfolk and Portsmouth traction lines from Norfolk to Suffolk immediately upon the return of President R. Lancaster Williams from Europe, this being preparatory to handling a part of the crowds to the Jamestown Exposition.

L.

Ohio.

Cleveland, September 8.—Thomas R. Brooks, Scranton, Pa., has applied for a 50-year franchise for a plant for furnishing street and commercial lights in Akron when the Northern Ohio Railway and Light Company's contract expires in two years.

The Cleveland Electric Railway Company is advertising its proposition with posters in the cars. Some of them contain cartoons that are very clever. They all appeal to the advantages of the present well-equipped system in comparison with one not yet built and of the saving that will result from the proposed reduction in fares.

The Indiana, Columbus and Eastern Traction Company has applied for a renewal of franchises in Springfield that will extend them 25 years from the present time. President W. Kelsey Schoepf has indicated his intention of erecting a depot at that point at a cost of $50,000 that may be used by all the interurban lines.

It is now announced that the Mann Street Car Indicator and Advertising Company will locate its shops at Alliance. It is said the company has orders for a year ahead.

Traction men suggest a holding company for the consolidation of the interurban roads entering Cleveland. There has been talk for some time that such a consolidation would come sooner or later, and, of course, there has been speculation since as to just how the plan could be consummated.

Some of the stockholders of the Lake Shore Electric are claiming that the purchase of the Lorain street railway and the Avon Beach and Southern was not legally approved, for the reason that the matter was not mentioned in the call for the meeting of stockholders. The approval was made by a two-thirds vote, and there is an opinion among some that to make the approval legal it should be done over.

The Toledo, Port Clinton and Lakeside Electric Railway Company is endeavoring to gain an independent entrance to Cleveland.

In compliance with the city ordinances, the Cleveland Electric Railway Company has placed jackscrews upon its cars. All other ordinances will be complied with as closely as possible.

An ordinance is pending in Cincinnati that will allow the Baltimore and Southwestern Railway Company to use an electric locomotive in switching cars from its main line near Brighton to the factories between Spring Grove and Colerain avenues.

In the ward postal-card vote conducted by Councilman Hitchens of Cleveland to ascertain how his people stand on the proposition of the Cleveland Electric, there were four votes for accepting the offer to one against it. It is believed that the city vote would be very much the same way if people had an opportunity to vote on the matter.

The consolidation of the Canton-Akron lines and the others operated in connection with them will take place before the meeting of Northern Ohio Traction and Light stockholders on September 18th. They will be combined under the name of the Canton-Akron Consolidated Railways Company.

It is said that an electric mail car has been ordered for Cleveland and will be put into use if a contract can be secured with the city lines. The railroad would have to furnish a motorman for the car, but otherwise it would be manned by postoffice employes.

The Oak Point and Elyria Railway Company has been incorporated with a nominal capital stock of $3,000 by E. S. Cook, F. S. McGowan, A. R. Manning, Jr., M. Dickey, Jr., and M. L. Fowles, all of Cleveland. The object is to build a line from Elyria to Amherst and then to Oak Point.

It is said that the committee of stockholders of the Toledo and Western will endeavor to have the property sold as soon as possible. They believe that it will bring more this fall than later on.

O. M. C.

Michigan.

Grand Rapids, September 8.—A committee of the St. Johns Business Men's Association has been appointed to secure $15,000 and the right-of-way over the surveyed route of the Detroit, Saginaw and Grand Rapids Railway as St. Johns' share in the enterprise. Work will commence as soon as the subscriptions are made.

According to a statement submitted to the Saginaw City Council, the Saginaw Valley Traction Company lost $94,000 last year. The gross receipts were $171,000, or $6,000 less than the cost of operation. The rest of the deficit came as taxes, interest, depreciation, etc. Four million passengers were carried. The loss was due principally to the 10 weeks' strike last summer.

Gorman Bros. of Toledo have filed a bill of complaint in the Monroe Circuit Court in Chancery to foreclose their mechanic's lein on the power house at Petersburg of the Toledo, Ann Arbor and Detroit electric line which they constructed. They ask for a receiver. Grading from Toledo to Ann Arbor has been completed and ties and rails laid for 28 miles. Over $300,000 has been put into the road up to this time.

The new electric-light plant being built to replace the one destroyed by fire at Bronson is nearly completed. It is 52 by 64 feet, two stories high and constructed of cement blocks. The roof is of slate and the whole building fireproof.

The Detroit United Railways has been conducting an extensive advertising campaign of education through the Detroit papers and those of neighboring cities touched by its lines in its efforts to secure a satisfactory renewal of its franchise in Detroit.

L. W. B.

Indiana.

Indianapolis, September 8.—The commissioners of Floyd County have granted the Louisville, New Albany, French Lick and West Baden Traction Company a right-of-way through the county for an electric railway. The company has a petition pending before the Board of Public Works for a right-of-way through New Albany, for a street-railway system in the city and a line from New Albany to Louisville. The company will absorb the electric road of the Kentucky and Indiana Bridge Company, which will be extended at both ends to the business centers of New Albany and Louisville.

There is complaint on the part of electric-railway promoters because of the high rate of railroad taxation in this state. They assert that it prevents capitalists from investing money to construct electric roads, and unless taxation is reduced, electric-railway construction will cease.

A rear-end collision between interurban cars near Peru on the Indiana Union Traction Company's line, September 4th, injured 18 passengers on a local car. The motorman of this car stopped on a curve to make some repairs on the trolley, when the Indianapolis and Fort Wayne limited car came around the curve at a high speed and crashed into the local. A similar accident occurred on the same curve a week previous, and there is some criticism of the neglect of the train crew to send a flagman to stop approaching trains.

The Indianapolis Superior Court has granted Charles L. Henry, receiver of the Indianapolis and Cincinnati Traction Company, permission to sell at five per cent. discount the $300,000 of certificates which he was authorized to issue for the purpose of maintaining the road and paying off existing indebtedness. The certificates will draw six per cent. interest.

The Indiana traction lines known as the merger lines have just promulgated a new rule providing for the transportation of children between the ages of five and 12 years at half-fare rates. Heretofore children over five years of age were charged full fare.

A company headed by Charles A. Chapin has secured a franchise to build a dam in the St. Joseph River, 14 miles north of South Bend. The purpose is to erect a plant to generate electric power and light for South Bend and the surrounding towns and cities.

The Town Board of Byrnville, Ind., has decided to reconstruct the old waterworks system of that place. The stone pipes laid in 1853 are found to be in excellent condition. The board will advertise for expert labor, material and equipment.

The Garret Machine Works Company has filed articles of incorporation, capitalized at $50,000, to establish a factory in Garret, Ind., to manufacture gasoline engines and repair motor cars of all kinds. John Bloom, F. K. Morris and Halford Strouse constitute the board of directors.

The new power plant of the Indianapolis Union Railway Company for lighting and heating the Union Station in Indianapolis, Ind., is in operation and giving excellent satisfaction. The plant comprises two 165-horsepower engines, three 165-horsepower boilers and three 125-kilowatt generators, all of which are housed in an artistic brick building at the east end of the station and train sheds. The new power plant will furnish electricity for 85 arc and 800 incandescent lights. New Westinghouse lamps on 110-volt circuits have been hung throughout the station and train sheds. The company is offering the equipment of the old plant for sale.

S. S.

Illinois.

Peoria, September 8.—Articles of incorporation have been granted to the East St. Louis, Columbia and Waterloo Railway to be built from Waterloo, Monroe County, to East St. Louis, Ill. The principal office will be in Columbia, Ill. The incorporators are headed by Joseph W. Rickers of Waterloo.

Mayor Irving of Metamora and others are forming a company to build a lighting plant for the city of Metamora.

The Beardstown Light and Power Company will inaugurate a day circuit in a few days.

The following changes have been made by the Illinois Traction Company: T. T. Thompson will have charge of the traffic of the St. Louis and Springfield Railway between Springfield and Staunton; M. T. Smith has been made cashier at Springfield; S. K. Halland will have charge of lines between Springfield and Decatur as district traffic agent, with headquarters at Springfield; R. D. Drennen will succeed Mr. Halland, who had charge of the passenger, express and buffet service.

The Springfield-Pana Interurban has secured the necessary signatures for its entrance into Pana, and will present an ordinance at the next council meeting for the necessary franchise.

The Springfield, Clear Lake and Rochester Railway has secured all the right-of-way between Rochester and Pawnee, and the actual work of construction from Springfield to Rochester will commence at once.

The Belleville and Pinckneyville Traction Company has been granted incorporation papers to construct a line from Belleville to Pinckneyville. The capital

is $100,000 and the incorporators include Lucius D. Turner of Belleville and George F. Mead of Pinckneyville.

The Kenny Electric Company of Kenny has been incorporated by Andrew Harkyard and others, to furnish light and power.

The Chili Mutual Telephone Company of Chili has been incorporated by David G. Toff, John O. Carlin and D. H. Carlin.

A new company is being organized to build an interurban road to Rock Island. The line of the Tri-City Railway and Light Company, as the new or merged company will be known, will be extended to Carbon Cliff.

The De Forest Wireless Telegraph Company in Springfield is dismantling its old plant, preparatory to erecting a new and more powerful station.

The city of Moline has appealed the case of the city of Moline vs. Central Union Telephone Company, in which Judge Humphrey granted the telephone company an injunction restraining the city from interfering with its removal to the new building.

The plant of the Illinois Watch Company at Springfield has been equipped with motors, the engine being held as reserve. Current will be furnished by the local lighting company.

The Burlington Railroad has been experimenting with various kinds of motor cars and has built one at the Aurora shops that seems to have overcome all the faults of the former ones. The officials are having enough of them built to put on the Peoria-Galesburg line and run all the trains with them to give them a fair trial.

The board of directors of the Terminal Railroad Association will consider at the next meeting the Illinois Traction Company's proposition for a permit to operate its cars across the Merchants Bridge, St. Louis. This will give through passenger and freight service to Central Illinois from St. Louis. The cars are now carried by ferry from Venice to North St. Louis.

The St. Louis Electric Terminal Railway has asked the Municipal Assembly for a franchise to operate on certain streets and form a terminal road for the system in St. Louis.

S. S. Nelson of Fort Wayne, Ind., is to be the successor of John Tinley as general manager of the Peoria railway properties.

Mayor Devereux has vetoed the franchise recently granted the railway company in Springfield for an extension.

The council of Springfield has granted an ordinance for the extension of the railway line in Fifth Street. There is some talk of the mayor vetoing the ordinance. V.

Mexico.

Mexico City, Mexico, September 6.—The utilization of the waterpower afforded in various parts of Mexico for the generation of electrical energy has shown wonderful progress during the last year. Many concessions of this character have been granted by the federal government and several large hydro-electric plants have been established, aiding materially in mining and manufacturing development.

The government recently granted a concession to Messrs. Norcross and Taylor of Mexico City for the installation of a hydro-electric plant near Orizaba, in the state of Vera Cruz. The waterpower will be obtained from either the Salado River or from the Nogales lagoon. The concession also carries with it the right to build and operate electric transmission lines.

William J. Storms, an American business man of Victoria, state of Tamaulipas, Mexico, is arranging to establish a series of hydro-electric plants on the Rio Blanco in that state. He has applied to the federal government for a concession, in which he says that he intends to utilize the falls in the Rio Blanco for generating the electrical energy. These falls, he states, would yield from 8,000 to 15,000 horsepower. It is planned to transmit the power to the cities of Monterey, Victoria, Linares, Montemorelos and other towns of that section. Monterey is the principal manufacturing city in Mexico.

Juan de Velasco and Carlos Bello of Mexico City have acquired title to a waterfall on the Cantarranas River in the state of Puebla. They will install a large hydro-electric plant at the fall and transmit the power to Atlixco, which is an important industrial center.

Engineer A. B. Adams of Mexico City, who has large mining interests in the state of Guerrero, has applied to the federal government for a concession to install a large hydro-electric plant on the Balsas River, near the town of Balsas. The main transmission line will be built to Mexico City. There are many industries, mines and large sugar mills in the vicinity of the proposed plant, and these will be supplied with electric power.

The hydro-electric plant that is being built near Tepic for the purpose of furnishing Tepic with power and lights will be placed in operation in a few days. The plant will also supply cotton mills and other industrial concerns at Tepic with electric power.

The Mexican Light and Power Company has purchased the electric-light and power system owned by the firm of S. Roberto y Cia., and which has been serving the people of a number of suburban towns. The consideration was $70,000. It is announced that the acquired system will be greatly improved and enlarged.

The Sultepec Electric Light and Power Company is installing a large hydro-electric plant at Temascaltepec. Power will be supplied to the mines and mills at that place and also be transmitted to the towns of Sultepec, Los Arcos, Mina de Agua and other places in that region. The persons who are interested in this project also own the Toluca Electric Light and Power Company at Toluca.

United States manufacturing concerns have been awarded contracts for equipment and construction material, aggregating $500,000, by La Electra, S. A., the Spanish light, power and street-railway company of Guadalajara. This company is constructing one of the most extensive and up-to-date electric-railway systems in Mexico.

H. E. Matton, chief engineer of the Puebla, Atlixco and Metepec Electric Railway Company, states that he has located the first 15 miles of the line and that the most difficult engineering feats have been accomplished. The line between Puebla and Atlixco will be about 22 miles long. The work of construction will be commenced some time next month. W. D. H.

Northwestern States.

Minneapolis, September 8.—The Northern Traction Company has secured a right-of-way for its proposed trolley line from Buhl, through Hibbing, Minn., to Stevenson, and has petitions for franchises pending at Virginia and Eveleth. The contracts for grading have been let for the greater portion of the work.

The Fort Dodge (Iowa) Light and Power Company is planning the construction of a power plant to utilize the power of the Des Moines River.

Trolley connection between Minneapolis and Chicago is thought to be assured by the recent formation of a company to build a railway from the Twin Cities to Dubuque, Iowa, where it will connect with the road now building from Dubuque toward Chicago. William P. Mason, president of the San Francisco, Idaho and Montana Road, is the promoter of the new company, and work will be done under a charter granted several years ago to the Minnesota, Preston, Decorah and Iowa road. The distance of the proposed road is 208 miles.

Dodd & Struthers of Des Moines, Iowa, manufacturers of electrical apparatus, are considering the building of three additional stories to their building at a cost of about $20,000.

The council of New Ulm, Minn., will take bids shortly for the installation of electrical power equipment at the city waterworks plant. The cost will be about $2,000.

The City Council at Oshkosh, Wis., has ordered all high-potential wires in the city placed underground. R.

Pacific Slope.

San Francisco, September 6.—The Feather River Power Company, which has just been organized in the East with an authorized capital stock of $25,000,000, is to acquire the stock of the Western Power Company of California, which has extensive water rights, partly developed, in Northern California, and is preparing to install a large electric power-transmission plant, with San Francisco as its objective point. The stock of the Eureka Power Company is also to be acquired by the new concern. A. C. Bedford, who is close to the Standard Oil Company, is one of the syndicate directing the new project. Edwin Hawley, F. H. Ray, J. N. Wallace and Philip Stockton of Boston are also interested.

Articles of incorporation have been filed by the Spokane Western Power and Traction Company with a capital stock of $3,000,000. The directors of the company are F. O. Adams, Chicago, Ill.; A. A. Dunphy, H. S. Stoolfire, G. C. Rhodehamel and L. L. Albaugh of Spokane.

North Central Idaho is to be opened within 18 months by an electric railroad that will be operating 115 miles of road by the beginning of 1908. About 10 miles of the Lewiston and Southeastern is graded and ready for the rails, and work is going steadily forward. The entire line from Lewiston to Grangerville, with a branch to Nez Perces, is financed and will be built within 18 months. About six miles of the lower and four miles of the Nez Perces branch are graded. The bonds have been taken in New York and Philadelphia and the company has secured a water right on the Salmon River that is reported to be capable of producing more power than that secured from Spokane Falls. It is estimated that 30,000 horsepower will be developed at the low-water stage, and that this power can be greatly increased by building a second dam.

The Gold Mountain Mining Company, operating the Grand Central claims on Money Creek, near Berlin, King County, Washington, has decided to install at once a power plant on its property for the operation of electric drills. A dam for furnishing power to the plant will be constructed; also a 25-ton smelter.

The Handy Electrical Company has been incorporated in San Francisco with a capital stock of $50,000 by Walter G. Anderson, John H. Handy, Charles G. Gardner, F. J. Behneman and A. C. Webber.

The Union Home Telephone Company of Los Angeles, Cal., has filed its certificate of the creation of a bonded indebtedness. The capital stock of the corporation is $10,000,000. The indebtedness will be secured by a trust deed executed to the Title Insurance and Trust Company of Los Angeles. This action marks the completion of the organization which has acquired most of the Independent telephone companies in Southern California, and expects to extend its operations to other parts of the state. J. C. Marble is president and James V. Baldwin secretary. A.

PERSONAL.

R. G. Hunt, formerly manager and engineer of the San Diego Consolidated Gas and Electric Company of San Diego, Cal., has joined the engineering staff of H. M. Byllesby & Co. and will be located at the Chicago office.

Melvin W. Koons of Minneapolis has been appointed manager of the Citizens' Telephone Company at Mankato, Minn., succeeding Charles K. Willard, resigned. Mr. Koons has been in charge of the South branch of the Tri-State Telephone Company in Minneapolis.

O. A. Farrar, formerly engineer of the Allis-Chalmers Company, has joined the engineering staff of H. M. Byllesby & Co. and has charge of the reconstruction work of the large modern electric-light plant which the latter company is constructing at Mobile, Ala.

Mr. William M. Brodie has been appointed manager of sales of the Edison Manufacturing Company of Orange, N. J. Mr. Brodie has been connected with the company for the last six years in the manufacturing department and is therefore thoroughly familiar with the Edison battery. He succeeds William S. Logue, who died last April.

G. F. Coit, assistant chief operator in the office of the Western Union Telegraph Company at Indianapolis, Ind., has been promoted to the position of chief operator in the Denver (Colo.) office. Mr. Coit has been in the employment of the Western Union for 28 years. He will take his new position on October 1st. The Denver office is one of the company's most important ones.

Howard E. Troutman, for over 10 years connected with the Buckeye Engine Company and for several years manager of its Chicago office, has resigned to accept the sales management of the Corliss and high-speed-engine department of the Atlas Engine Works, Indianapolis. Mr. Troutman's headquarters will be at the home office. J. M. Broucher of the Brownell Company, Dayton, Ohio, has resigned his connection with that company to accept the position of assistant general managership of sales for the Atlas Engine Works.

John O. Backus, assistant superintendent of the Central Illinois Traction Company, Charleston, Ill., committed suicide by shooting on September 7th. His action followed the verdict of a coroner's jury fixing on him the blame for a wreck on the road two days earlier, in which the motorman was killed and several passengers seriously injured Mr. Backus was 28 years of age. He stood well with the company, with which he had been for the last six months, having gone to Charleston from Chicago. Formerly he lived at Ashland, Ohio, where his family resides.

P. W. Sothmann of Denmark has been appointed chief engineer of the Hydro-Electric Power Commission of Ontario, Canada, and will have charge of the estimating, constructing and managing of such municipalities as may apply to the commission for power under the law recently passed. Mr. Sothmann is 36 years of age and a graduate of the Institute of Technology, Charlottenburg. He has been constructing and managing engineer of various waterpowers and stream developments in Germany, Russia and South Africa. In 1905 he was a consulting engineer in New York city.

Norman McD. Crawford, ex-general manager of the Hartford (Conn.) Street Railway Company, has been elected vice-president of a chain of interurban electric railway companies in Indiana and Ohio, including the Indiana, Columbus and Eastern Traction Company, the Lima and Toledo Traction Company and the Cincinnati Northern Traction Company, which operate nearly 1,000 miles of railway. Mr. Crawford resigned his position with the Hartford company when that corporation passed under the control of the Consolidated Railway Company. His headquarters will be in Cincinnati, Ohio.

Mr. C. C. Bruckner, general manager of the Boca Ancha Mining Company of Guadalajara, Mexico, of which Mr. C. E. Lee is president, is in Chicago buying electrical and other machinery for the development of his company's silver-mining property. Mr. Bruckner was connected with the electrical business several years ago and Mr. Lee is well known as a representative of the Electric Goods Manufacturing Company of Boston, Mass. Both are thoroughly convinced of the great possibilities of the mining industry in Mexico when

modern methods are applied. A small waterpower exists on the property which may be developed for electrical transmission in the future.

A. E. Harford of Minneapolis has succeeded J. F. Wathey as manager of the telephone exchange at Northfield, Minn., Mr. Wathey taking a position in the engineering department of the Northwestern Telephone Exchange Company in Minneapolis.

It is reported that Patrick Calhoun of Cleveland has decided to resign as president of the United Railroads of San Francisco. As president of the United Railroads Investment Company, Mr. Calhoun has charge of the United Railroads at Pittsburg, lines in Cleveland and in many of the larger cities of the South. It is supposed he is giving up his office with the San Francisco company in order to give more attention to some of the other properties. It is said that Thornwell Mullally, his assistant, will succeed him as president. Mr. Calhoun will still be a member of the board of directors.

ELECTRIC LIGHTING.

W. A. Curtis will establish an electric-light plant in Cambridge, Iowa.

Bids will be received September 24th for constructing an electric-light system at the Madison Barracks, Sacket Harbor, N. Y.

Mayor Irving and a number of citizens of Metamora, Ill., have interested themselves in the formation of a company for the construction of either a gas or electric-light plant for the city. Several propositions have been received.

The Village Board of Charlotte, N. Y., will consider the question of improving the village water and electric-light plants, which are badly in need of repairs. New generators are needed for the electric plant, and it is deemed necessary to extend the intake pipe of the waterworks system out into the lake.

Cincinnati men are said to have an option on the Richmond Electric and Power Company of Richmond, Ky., until October 1st. Their plan is to extend the lighting wires to Berea, a town 15 miles from Richmond, with a population of 2,000. The line would pass through three villages. The farmers along the line are interested.

ELECTRIC RAILWAYS.

The Claremont Railway Company of Jackson, Miss., has been incorporated for the purpose of building an electric railway from Jackson to Clinton, Miss. R. K. Kane and M. Culbertson are among the incorporators.

The opening of the new mountain electric railway from Vernayaz to Chatelard and Chamonix, in Switzerland, took place last month. This line, which passes through some of the most picturesque scenery in Switzerland, joins the valleys of the Rhone and the Mont Blanc.

Surveys are being made for an electric railway between Paducah, Ky., and Hickman. Eastern capitalists are said to be back of a plan to construct the road.

PUBLICATIONS.

Attractive mailing cards and printed slips from Pass & Seymour, Solvay, N. Y., are devoted to P & S sockets, which the company highly recommends. Special attention is called to P & S No. 57 standard brass sockets.

The Chicago Pneumatic Tool Company announces that it will receive from the printers on September 15th its new compressor catalogue, consisting of 118 printed pages, printed in two colors, in which several new types and sizes of compressors are shown, including the new Hamilton-Corliss machines. Those interested will receive a copy of the catalogue upon request.

Results of an investigation by the Bureau of Labor, Department of Commerce and Labor, into wages and hours of labor in 1905 in the principal manufacturing and mechanical industries of the United States are given in Bulletin No. 65 of the Bureau of Labor, dated July 1906. Comparative figures are given back to 1890. Information as to the principal food commodities is also given, and laws of various states relating to labor are given. It is shown that in 1905 the average wages per hour in the principal manufacturing and mechanical industries were 1.6 per cent. higher than in 1904. The average hours of labor per week remained the same, and 6.3 per cent. more persons were employed. Of eight electrical establishments reporting, the wages increased 9.5 per cent., and there was a considerable increase in the number employed.

TRADE NEWS.

The officers of the Aiton Machine Company, 126 Liberty Street, New York city, are now as follows: President, Arthur S. Beves; vice-president, Thomas A. Aiton; secretary, John S. Showell.

Owing to the rapidly increasing demands for its products throughout the southern states the Chicago Pneumatic Tool Company has opened an office in the Memphis Trust Building, room 1012, Memphis, Tenn., in charge of Mr. J. Francis Small.

H. M. Byllesby & Co. have been retained as consulting, designing and supervising engineers for the modern gas plant being built by the Indiana Steel Company, a subsidiary company of the United States Steel Corporation, at Gary, Ind., the city it is founding for the location of its new steel works.

The copartnership of Langstadt & Meyer of Appleton, Wis., has been succeeded by the Langstadt-Meyer Construction and Supply Company, a corporation with a capital stock of $50,000, of which H. W. Meyer is president, A. C. Langstadt, vice-president, and Aug. H. Meyer, secretary and treasurer, with offices at Appleton, Wis. The special field of the company will be the building and equipping of complete steam, electric and waterworks plants, long-distance power transmissions and electric railways. It will also do a general jobbing business in electrical supplies of every kind, dynamos, motors and kindred apparatus.

A company has been formed at Spokane, Wash., under the name of the Rice Electric Switch Company, with E. J. Rice, president; A. C. Shaw, secretary and treasurer, and R. A. Freese, vice-president. The company has a capital stock of $1,500,000. A factory will be started in Spokane for the manufacture of a device for working switches on street-car lines without stopping the car.

J. G. White & Co. of New York city have been appointed by the government to draw new plans and specifications and to assist the federal engineers in the selection of designs for the new power plant to supply light, heat and power to the congressional buildings in Washington, D. C. As stated in the Western Electrician of July 14th, a government commission met on July 2d to pass on bids prepared for such a plant under specifications drawn in 1905. All bids were rejected and the architect of the capitol was instructed to prepare new plans and specifications and invite new proposals. It is this work in which J. G. White & Co. will now assist. Details of the original plans for the power plant were given in the Western Electrician of October 7, 1905. The plant may have a capacity of 8,000 kilowatts.

BUSINESS.

The Holden Anchor Company of Des Moines, Iowa, manufacturer of the Holden earth anchor for telephone, telegraph, electric-light and street-railway companies, says that its product has met with an encouraging reception by users of anchors. This anchor has several features not found in any other. The company issues a folder giving interesting details.

The Central Electric Company of Chicago enjoys the distinction of having a room fitted up and devoted exclusively to the display of fixtures. It is located on the first floor of the company's new building at 264-270 Fifth Avenue, in connection with the retail department, and all the latest styles and finishes of electric and combination fixtures are to be found therein. No more complete line of portables and table lamps is shown anywhere, and anyone interested is cordially invited to visit the Central Electric Company's establishment when in Chicago.

The Excello Arc Lamp Company of 24 and 26 East Twenty-first Street, New York, reports that an order for 81 flaming arc lamps was placed a week or two ago by the British representative of the Excello arc lamp for lighting Oxford Street, London. This order was the outcome of elaborate tests of various types of lamps. Excello lamps are used for street lighting in many English cities as well as in Australia, South Africa, Argentina and Japan. The same type of lamp may now be seen burning in considerable number in the more important towns of the United States.

ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued (United States Patent Office) September 4, 1906.

829,951. Illuminated Sign. John L. Dawes, Pittsburg, Pa. Application filed September 29, 1905.

An electrically illuminated sign box for removable signs is described.

829,968. Railway Signal and Safety Appliance. Charles J. Kintner, New York, N. Y. Application filed June 6, 1904. Renewed December 28, 1905.

A source of electrical energy is connected to current-feeders extending over the route. A series of rotary electric motors have their armatures connected to a series of signals. There are additional sources of energy adapted to act upon the signals in opposition to the motors, together with circuits, circuit connections and locking devices whereby any signal may be set in a definite position through the agency of its motor and the latter automatically disconnected from the circuit when the signal is set and locked.

829,969. Safety Appliance for Railways. Charles J. Kintner, New York, N. Y. Application filed January 27, 1905. Renewed May 9, 1906.

In a railway system are a track-circuit-controlling conductor located closely adjacent to but out of contact with one of the track-rails and an electrical circuit including a signal device and a source of electrical energy, the conductor being provided with supporting means which will permit it to yield laterally when the flange of a car-wheel enters between it and the adjacent rail.

829,974. Electrically Operated Mine-door-actuating Mechanism. John C. Lincoln, Cleveland, Ohio, assignor to the Lincoln Company, Cleveland, Ohio. Application filed April 10, 1903.

Features of this device are a door-operating mechanism, an electrical circuit for controlling the mechanism, a switch for opening and closing the circuit, and a switch-operating circuit including a single insulated rail-section only.

830,011. Marine Propulsion and Lighting. George G. Schroeder, Washington, D. C. Application filed March 27, 1905.

The main propellor shaft and the shaft of the engine-dynamo for lighting the ship are in alignment, and by means of a friction disk the dynamo may be thus driven.

830,025. Dynamo-electric Machine and the Like. Ludwig Torda, Barking, England. Application filed June 2, 1905.

One feature of this machine is that the main magnets are combined with a number of commutating magnets arranged in a common plane parallel to the plane of the main magnets, the cores of the commutating magnets being of a length greater than the cores of the main magnets thereby allowing for a decrease in the length of each winding and an increase in the number of windings thereon to produce the necessary commutating field. (See cut on next page.)

830,041. Electric Time Switch. Clayton A. Ballou, Providence, R. I. Application filed June 30, 1905.

A pair of poles is located in an electric circuit, and there are means movable with a wheel of the mechanism for engaging a lever at predetermined intervals to prevent the current-conducting member at the free end of the lever from contacting with the poles and closing the circuit.

830,051. Apparatus for the Electrolytic Extraction of Metals. Courtland F. Carrier, Jr., Elmira, N. Y., assignor to the Elmira Electrochemical Company, Elmira, N. Y. Application filed January 30, 1905.

An anode compartment is combined with a cathode compartment comprising a closed metallic bell, both compartments being supported with their open ends downward and sealed by a body of molten metal. (See cut on next page.)

830,093. Apparatus for Galvanizing Wire. Guy L. Meaker, Evanston, Ill., assignor to the American Steel and Wire Company of New Jersey. Application filed June 18, 1902.

An electrolytic process is used to coat the wire with metal.

830,109. Mail Carrier. Thaddeus S. Smith, Indianapolis, Ind., assignor of one-half to Frank W. Flanner, Indianapolis, Ind. Application filed June 28, 1905.

A mail conveying and distributing carriage is suspended from a pair of conducting rails. The carriage has a motor compartment and a mail-sack compartment. The motor takes current through brushes contacting with trolleys on the conducting rails.

830,119. Control of Apparatus Governing the Passage of Cars or Vehicles Along a Railway. Herbert A. Wallace, New York, N. Y., assignor to the Union Switch and Signal Company, Swissvale, Pa. Application filed June 13, 1906.

There is an open circuit for the motor used to move the trip (normally in its inoperative position) and two circuit-controllers in the circuit, one operated to close the circuit only when one of two signals in the system indicates danger and the other operated to close the circuit only when the other signal indicates safety.

830,131. Electric-railway System. William M. Brown, Johnstown, Pa., assignor to the Lorain Steel Company. Application filed April 27, 1905.

In an electric-railway system a sectional third rail is adjacent to one of the track-rails, and a series of magnetically actuated circuit-closing devices or switches are situated between the third rail and the adjacent track-rail. Lateral arms are connected to the third rail and the adjacent track-rail form magnetic connections to the switches.

830,158. System of Motor Control. Axel Magnuson, New York, N. Y., assignor to the Otis Elevator Company, Jersey City, N. J. Application filed July 6, 1905.

There are three sources of current-supply, one of which is led to the motor, another of which is generated by the movement of the motor, and the third of which is in a battery and is derived from the second source of supply, the three sources of supply being adapted to control the motor.

830,161. Telephone. John Z. Miller, Erie, Pa. Application filed October 30, 1902.

A selective telephone system is described.

830,164. Electrically Operated Line Indicator for Railways. Claud D. McPhee, Armprior, Canada, assignor of one-half to James Robinson, Montreal, Canada. Application filed October 2, 1905.

In a signaling system combined with a detecting current superimposed on a telegraph wire are signaling means operated by the superimposed current intermediate of the sending and receiving stations to automatically indicate the condition of the line.

830,209. Automatic Transformer Cut-out. De Witt C. Conkling, Hoboken, and John E. Winn, Weehawken, N. J., assignors to the Electric Economies Company, a corporation of South Dakota. Application filed November 14, 1904. Renewed February 17, 1906.

The combination embraces an alternator, a transformer, translating devices in circuit therewith, means

NO. 830,025.—DYNAMO-ELECTRIC MACHINE.

energized by an alternating current from the secondary coil of the transformer for breaking the circuit of the coil upon the cutting out of the translating devices, and a controller for the means for breaking the circuit thereof upon including one of the translating devices in circuit with the coil.

830,217. Electrically Controlled Optical Appliance. John C. Fredell, Pocatello, Idaho. Application filed August 25, 1905.

Momentarily energized solenoids are included in the device, one of which effects the opening of a shutter in the lens-tube and the other releases the shutter at the end of a predetermined period. There are means for automatically locking the shutter in open position during a predetermined period.

830,224. Incubator. George L. Guyer and Arthur C. Gamble, Wessington, S. D. Application filed December 30, 1905.

Electrical contacts in the incubator are energized by a battery for ringing an alarm bell when the water regulator requires attention.

830,242. System of Motor Control. Axel Magnuson, New York, N. Y., assignor to the Otis Elevator Company, Jersey City, N. J. Application filed September 20, 1905.

The patent covers an accelerating device for the motor, a brake, an electric brake-applying means, a generator connected to the motor and electric circuits and connections to effect the operation of the accelerating device immediately upon the starting of the motor and to effect the actuation of the brake-applying means upon the motor attaining a predetermined speed.

830,247. Selective Signal System for Railways. Frank R. McBerty, Evanston, Ill., assignor to the Western Electric Company, Chicago, Ill. Application filed July 24, 1905.

The combination consists of a main selector arm at the central office, a test-circuit adapted for connection to one of a number of substations, the test-circuit having two points of control, one located at the substations and governed by the movement of the semaphores, the other being operated by the movement of the selector arm, the test-circuit being connected with a source of current in the operation of the semaphore at the connected substation, and a local circuit at the central office adapted to operate a signal through the energization of the test-circuit.

830,249. Seal and Terminal for Electric Apparatus. Henry N. Potter, New Rochelle, N. Y., assignor to the Cooper Hewitt Electric Company, New York, N. Y. Application filed January 11, 1904.

A gas or vapor electric device consists of a fluid-conductor, the vapor of the fluid, an inclosing chamber of silica and electrical connection through the containing vessel contacting with the fluid or vapor, consisting of silicon.

830,253. Telegraph Key. Jesse T. Sheets, Covington, Ky., assignor of one-half to Sol. P. Kineon, Cincinnati, Ohio. Application filed November 9, 1905.

An improved telegraph key is described.

830,254. Fire Protection Signal System. John E. Shepherd, Chicago, Ill. Application filed April 25, 1904.

An automatic extinguisher system comprises elements wherein the practical commencement of activity upon the actuation of the system is sequential. An electric alarm system comprises means associated with the extinguisher elements for transmitting signals in proper sequence indicative of the practical commencement of activity in the elements, and signal-responsive apparatus suitably connected with the transmitting means.

830,258. Combined Reflector and Cluster Frame. William H. Spencer, Brooklyn, N. Y., assignor to George Frink Spencer, Newark, N. J. Application filed May 2, 1905.

The patent covers a frame including a reflector and sockets for inserting incandescent electric lamps.

830,262. Continuous-current Electric Motor and Generator. Ludwig Torda, Barking, England. Application filed May 6, 1905.

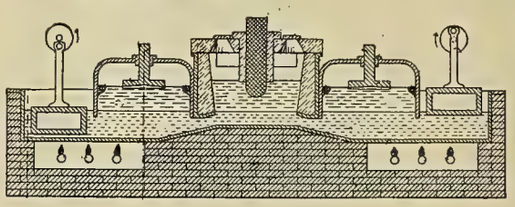
In a dynamic machine the patent covers a yoke, a number of field-magnets arranged therein, a ring slidably connected with the yoke and movable toward and from the same, a number of paramagnetic plates secured to the ring, each of the plates being movable transversely of the yoke between a corresponding one of the field-magnets and the yoke, and means for moving the ring.

830,271. Telephone System. David H. Wilson, Chicago, Ill., assignor to Robert Bines, Chicago, Ill. Application filed January 2, 1906.

A telephone system is described comprising a primary and a secondary circuit wound upon a core and a receiver circuit electrically independent of the primary and secondary circuits and wound about a core located in proximity to the first-mentioned core so as to be influenced thereby.

830,272. Telephone Apparatus. David H. Wilson, Chicago, Ill., assignor to Robert Bines, Chicago, Ill. Application filed January 2, 1906.

One claim has reference to a transmitter-circuit, two separated iron cores about which a portion of the transmitter-circuit is wound, a main-line circuit having a portion also wound about the cores, two separated iron cores interposed between the first-mentioned cores, each provided with a coil, and a receiver connected in circuit with both of the coils.



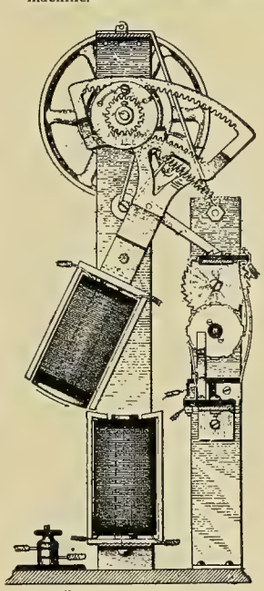
NO. 830,051.—APPARATUS FOR ELECTROLYTIC EXTRACTION OF METAL.

830,279. Telephone Transmitter. Henry F. Albright, New York, N. Y., assignor to the Western Electric Company, Chicago, Ill. Application filed October 21, 1904.

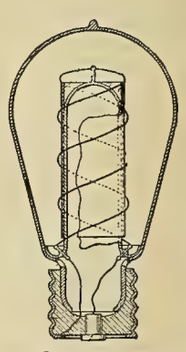
A bridge-piece is mounted in the opening, an electrode is carried by the bridge-piece immediately behind the opening, a diaphragm is pressed at its outer edge against the plate, a cup is carried upon the rear side of the diaphragm, an electrode is secured within the cup, and there are granules of conducting material in the cup between the electrodes.

830,306. Electric-light and Power Controller. Fredrich C. Damm, St. Louis, Mo. Application filed September 18, 1905.

Combined with the electric light and power circuits of an electrically operated and lighted machine are fixed contact-points in each of the circuits, yielding contact-points arranged adjacent the fixed contact-points, and adjustable connections from the yielding contact-points to the leg of the chair occupied by the operator of the machine.



NO. 830,347.—ELECTRIC MOTOR.



NO. 830,477.—INCANDESCENT LAMP.

830,316. Junction Box. Edwin T. Greenfield, Monticello, N. Y. Application filed October 10, 1904.

A junction box constructed of three pieces of sheet metal and having inleading holes near the bottom is described.

830,317. Junction Box. Edwin T. Greenfield, Monticello, N. Y. Application filed October 28, 1904.

Inleading openings for the cables are provided with individual clamps and there are means for giving to the clamps movement against the sides of the cables together with means integral with the clamps for protecting the insulation of the cables from abrasion.

830,347. Electric Motor. David Mendelson, New York, N. Y. Application filed November 8, 1905.

An electric motor is described comprising a stationary and a movable electromagnet, both symmetrically constructed with a core, a helix surrounding the core and one or more flanking magnetic poles connected magnetically to the back end of the core of the electromagnet and extending to the attracting polar face of the core. An automatic switch for intermittently sending a current through the helix and connecting mechanism for operating the switch are included. (See cut.)

830,364. Watchman's Electric Time Controller. Pedro Reitz, Munich, Germany. Application filed March 6, 1905.

An electrically operated alarm for watchmen, including a clock mechanism, is described.

830,391. Electrothermal Device. Charles E. White, Chicago, Ill., assignor to Frank B. Cook, Chicago, Ill. Application filed June 22, 1903.

The device is for use in protecting electrical apparatus against abnormally strong currents and comprises a flexible metallic diaphragm, a confined body of air adapted to act on the diaphragm, a switch-contact engaging the diaphragm, a heat-concentrating member for heating the body of air, and means for connecting the diaphragm, contact and heat-concentrating member in series in a circuit.

830,409. Trolley. Herschel L. Bryant, Tonkawa, Okla. Application filed October 31, 1905.

There are means for automatically throwing the trolley wheel outwardly when it has a tendency to leave the wire.

830,419. Field-coil Insulation and Process of Forming Same. Louis W. Downes, Providence, R. I. Application filed October 22, 1904.

An electromagnetic coil consists of an insulating covering therefor comprising inner and outer jackets of non-combustible insulating material. The process of insulating consists in applying an inner jacket of fibrous insulating material, then water and moisture proofing the jacket by impregnation with a non-oxidizable substance, applying an outer jacket of fibrous insulating material, and then rendering the outer jacket water and moisture proof by impregnation with a high heat-resisting substance.

830,441. Insulating Means and Method of Manufacturing the Same. George Kelly, Hinsdale, Ill. Application filed October 30, 1905.

A method of manufacturing insulating material is described which consists in combining liquid glass, gum and mineral wool and vulcanizing the same.

830,457. Electric Brake. Frank L. Sessions, Columbus, Ohio, assignor to Joseph A. Jeffrey, Columbus, Ohio. Application filed January 17, 1905.

A compound-wound electromagnet has its core arranged to lift a weight to release the brake-band, and one of its energizing-coils is connected in series with the armature of the motor and its other energizing-coil is connected directly across the current-supply line. There are means for switching the current so as to energize the shunt-coil of the magnet prior to connecting the series coil thereof and the armature of the motor into the electrical circuit.

830,472. Controller for Automatic Railways. Benjamin F. Carpenter, Roselle Park, N. J. Application filed May 12, 1904.

The combination, with a body to be moved, consists of a shifter having a detachable engagement therewith, means for actuating the shifter to move the body, and a guard-bar with a magnet for operating the same to disengage the shifter from the body, whereby the movement of the body is controlled by the actuation of the magnet.

830,473. Electrical-wound Clock. Percy L. Clark, Bristol, Conn., assignor to the National Self-winding Clock Company, Champaign, Ill. Application filed October 13, 1902. Renewed January 8, 1906.

Mechanism for electrically winding clocks is covered by the patent.

830,475. Potential-indicating Device. George N. Eastman, Chicago, Ill., assignor to the Minerallac Company, Chicago, Ill. Application filed May 5, 1904.

The device includes a tube, a closure at one end thereof, electrostatic devices carried by the closure, and a sheath inclosing the tube.

830,477. Incandescent Lamp. James W. Forster, Chicago, Ill. Application filed March 24, 1905.

Combined in the lamp are a heat-absorbing substance arranged close to the filament, and means to retard the emission of heat from the side of the heat-absorbing substance which is remote from the filament. (See cut.)

PATENTS THAT HAVE EXPIRED.

Following is a list of electrical patents (issued by the United States Patent Office) that expired on September 10, 1906:

410,586. Electric Lighting for Railway Cars. T. M. Foote, Boston, Mass.
410,637. Insulator. W. M. Davis, Plymouth, Mass.
410,656. Method of Determining the Shape of Pole-pieces for Dynamos. J. G. Statter, London, England.
410,663. Regulator for Dynamo-electric Machines. J. M. Bradford, Portland, Me.
410,670. Brush Holder for Dynamo-electric Machines. C. D. Jenncy, Indianapolis, Ind.
410,680. Secondary Battery. J. T. Van Gestel, New York, N. Y.
410,683. Burglar Alarm. E. M. Carhart, Providence, R. I.
410,689. Electric Light Fixture. J. C. Hollings, Boston, Mass.
410,786. Electric Registering Deep Sea Sounder. A. J. Cooper and E. W. Wigzell, London, England.
410,860. Electric Meter. M. M. M. Slattery Fort Wayne, Ind.
410,871. Electric and Cable Railway Cars. S. A. Bemis, Springfield and L. Pfingst, Boston, Mass.
410,876. Process of Separating Magnetic from Non-magnetic Particles. G. Conkling, Glens Falls, N. Y.
410,877. Magnetic Separator. G. Conkling, Glens Falls, N. Y.
410,953. Air-tight Covering for Electric Cables. D. Brooks, Jr., Philadelphia, Pa.
410,964, 410,965, 410,966. Magneto-electric Machine. A. S. Fitch, New York, N. Y.
410,976. Diaphragm for Electrolytic Apparatus. G. Kerner, Frankfort-on-the-Main, and J. Marx. Ulm-on-the-Danube, Germany.
410,987. Dynamo-electric Machine or Motor. F. J. Patten, New York, N. Y.
410,988. Method of Operating Electric Motors. F. J. Patten, New York, N. Y.

WESTERN ELECTRICIAN

EVERY SATURDAY

Vol. XXXIX. CHICAGO, SEPTEMBER 22, 1906 No. 12

The Evolution of Marine Dynamos.

By Dr. Alfred Gradenwitz.

While electricity has been most rapidly adopted on practically all seagoing steamers, special types of dynamo, not a little different from those used on land, had to be designed in order to comply with the special conditions of the case.

Owing to the violent shocks produced in maneuvering the vessel and in the case of a rough sea the use of belt transmission from the prime mover (which in most cases is a steam engine) to the dynamo was quite out of the question. Direct coupling to the engine, therefore, is quite generally the only admissible solution, which obviously results in a low speed of rotation of the dynamo, as in the case of the multiple-pole types described below. Owing, furthermore, to the limited space available on board, the dimensions of the generating sets should be reduced to a minimum, especially in the direction of the shaft. These dynamos are therefore designed without outside bearings and flange shafts. As their weight should be as small as possible, the frame or pole casing is made of cast steel; moreover, such parts as are subject to wear and tear should be so placed as to be readily exchanged with reserve parts. The high surrounding temperatures obtaining, especially in the tropics, on board emigrant ships, should exert no detrimental influence on the behaviour of the machine.

A striking illustration of the evolution of ship dynamos is afforded by the pictures reproduced herewith (for which I am indebted to the courtesy of the Siemens-Schuckert works), showing how the above conditions have been gradually complied with in the course of the last two decades.

One of the oldest types of machine which has been employed on board small warships is the double-pole Schuckert dynamo represented in Fig. 1 and which has an output of 4.5 kilowatts at 65 volts and 450 revolutions per minute. The coils of this dynamo, being unprotected, were rather exposed to mechanical damage, while, owing to its construction, a special foundation plate and a pillow block as outside bearing proved indispensable. The pole-casing being divided into two parts, the closure of the magnetic circuit was a rather poor one. In order to protect the dynamo against the projected oil from the steam engine, the latter was provided with a sheet lining.

A considerable advance will be noted in Fig. 3, the dynamo there represented dispensing with both foundation plate and outside pillow block, being screwed directly to the foundation plate of the steam engine. The bearing here was designed as a double-arm bow-bearing. Owing to the high numbers of revolution of double-pole machines, an immediate combination, even with quick-running steam engines, would have proved unfavorable, in so far as these dynamos, which could most likely be operated at only half their normal speed, showed a considerable weight in proportion to their output.

Fig. 4 illustrates the same type of machine as a more powerful four-pole dynamo, the mechanical design being the same as in the one just described.

A more modern design is represented in Fig. 2, which shows the type brought out by Siemens & Halske about five years ago. Whereas the machines described as Figs. 1, 3 and 4 are provided with copper brushes, these machines have carbon brushes, a special advantage being that no damage is produced to the collector and brushes in the event of the steam engine starting in an opposite direction, the armature running backward.

Further features of this type of machine are the three-armed bow of the bearing, which bow is continued in a ring or casing which protects the magnet coils against mechanical damage. Another feature is the ball-bearing in the bow. In constructing the armature of this dynamo it was fitted on the conical shaft with thread and nuts.

The most recent type of the ship dynamo which at present is being generally used by the Siemens-Schuckert works is the multiple-pole machine represented in Fig. 5 and which embodies all the features enumerated above. This machine is generally coupled directly to the steam engine with flange shaft and outside bow-bearing. Whenever the armature is mounted direct to the extension of the steam-engine shaft, the dynamos are provided with a lighter type of bow, viz., a so-called collar-plate, which supports only the brush bridge. Should, however, an additional load, due to flywheels, necessitate an alteration in design, these machines may as well be fitted with pillow blocks. In case they are to be coupled to explosion engines the arrangement of two bows and a shaft trunk will be found preferable, one-half of an elastic leather-disk clutch being fitted to the latter in order to damp any oscillations in the prime mover.

Ship dynamos are designed either with compound or shunt windings, the former being preferable in the case of a single machine, while in the opposite case the use of shunt dynamos, which are susceptible of connecting up in parallel, will be preferred.

It is probably safe to say that all large and important seagoing vessels of all nations are now electrically lighted. And not only is this the case but many coasters and river and lake steamers are also equipped with the improved method of illumination. Indeed, in the United States at least, one of the earliest of electric-lighting equipments was placed on board ship. Scattered on the navigable waters of the earth are thousands of these marine electric lighting sets, many of them of the latest type.

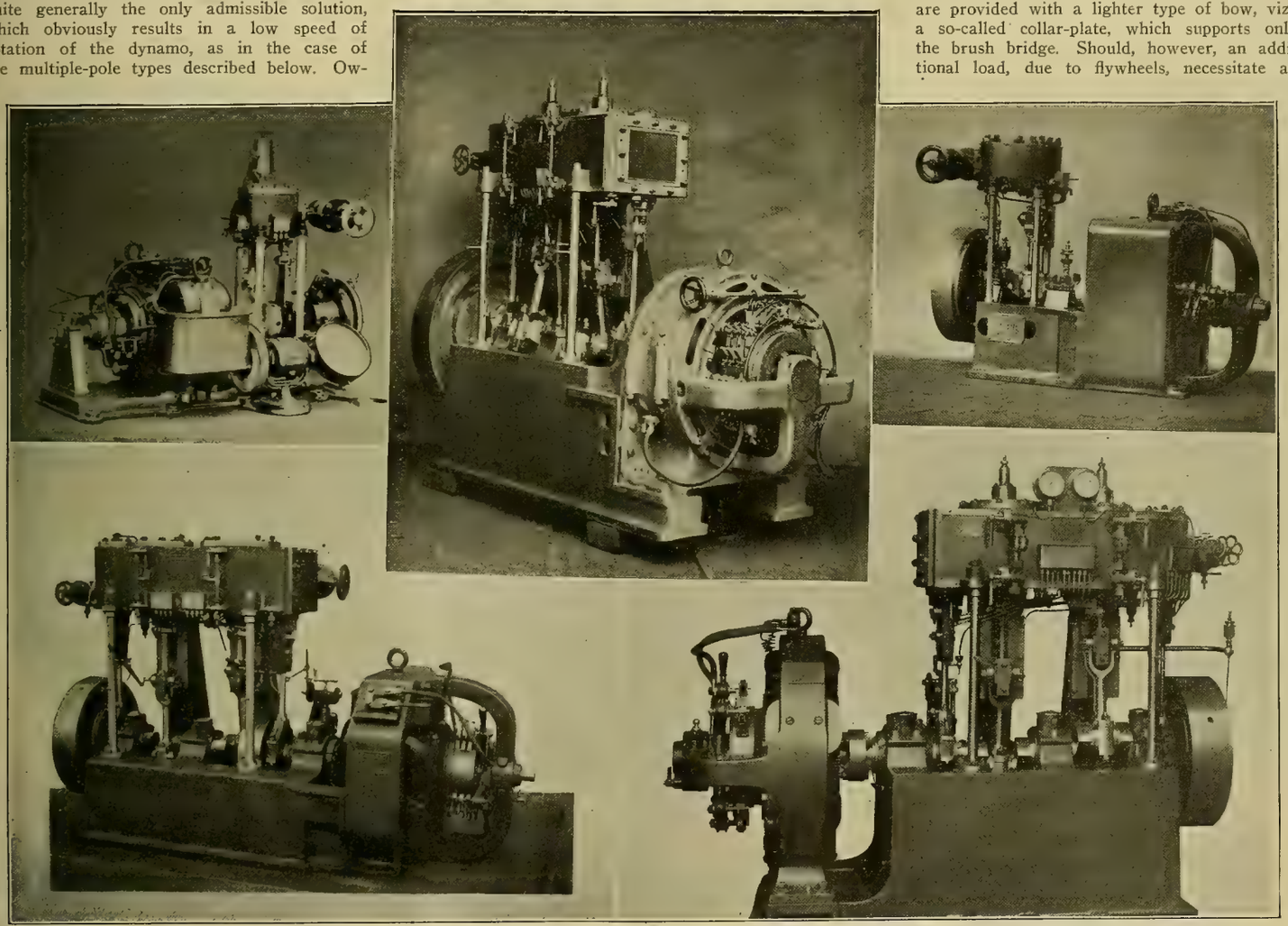


Fig. 1. One of the Older Types.

Fig. 4. A Four-pole Type.

Fig. 2. A Design about Five Years Old, with Carbon Brushes.

Fig. 3. A Set without Foundation Plate and Outside Pillow Block.

Fig. 5. A Recent Multiple-pole Type.

THE EVOLUTION OF MARINE DYNAMOS.

The Tantalum Lamp.[1]

By Francis W. Willcox.

At your last session you had the pleasure of hearing about the tantalum lamp in the interesting paper of Prof. Ambler. Since then the manufacture of this lamp has been undertaken in this country, and the lamp has been listed at a price of 75 cents each, or 60 cents net in lots of 500.

The lamp is at present supplied in but one size—about 44 watts, giving 22 mean horizontal candlepower (English Parliamentary standard), and with a useful life on direct current of 700 to 800 hours. Unfortunately the life on alternating current is only about one-third of this value—too short to be commercial.

While the first cost (say 60 cents) of this lamp seems high, if we prorate the useful life on direct current (750 to 800 hours) on an equal basis with that of the ordinary carbon filament lamp of 3.1 watts per candle, we find that it is reduced to about 40 cents. This is only about 25 cents more than present 3.1-watt lamps cost, and companies now supplying free renewals of the latter could furnish renewals of the tantalum at 25 cents each without any increase of renewal costs. This would give consumers the chance to use tantalum lamps at no greater costs than are paid for a Welsbach mantle and thus place the electric service with the tantalum lamp on an excellent competitive basis with Welsbach lamps.

The tantalum lamp, by reason of the relatively small end candlepower and the fact of its burning to better advantage in a vertical position, can be used to marked advantage in the form of a "unit" with a suitable Holophane reflector.

Table 1 gives the cost of an equal amount of light (1,000 candle-hours) with tantalum (at two w. p. c.), Gem filament (at 2½ w. p. c.) and ordinary carbon at 3.1 and 3.5 w. p. c., including cost of renewals in each case and power at various rates per kilowatt-hour shown.

Table 1.

Cost of 1,000 Candle-hours of Light in Cents, Including Cost of Power and Lamp Renewals for Different Lamp Efficiencies at Various Rates per Kilowatt-hour.

Rates per Kw.-hour in Cents.	Ordinary Carbon Lamp. 3.5 W. P. C.	Ordinary Carbon Lamp. 3.1 W. P. C.	Gem Lamp. 2.5 W. P. C.	Tantalum Lamp. 2.0 W. P. C.
1	4.5	5.1	4.5	5
2	8.0	8.2	7.0	7
3	11.5	11.3	9.5	9
4	15.0	14.4	12.0	11
5	18.5	17.5	14.5	13
6	22.0	20.6	17.0	15
7	25.5	23.7	19.5	17
8	29.0	26.8	22.0	19
9	32.5	29.9	24.5	21
10	36.0	33.0	27.0	23
11	39.5	36.1	29.5	25
12	43.0	39.2	32.0	27
13	46.5	42.3	34.5	29
14	50.0	45.4	37.0	31
15	53.5	48.5	39.5	33
16	57.0	51.6	42.0	35
17	59.5	54.7	44.5	37
18	64.0	57.8	47.0	39
19	67.5	60.9	49.5	41
20	71.0	64.0	52.0	43

From these results it can be seen at straight costs per kilowatt-hour for current and an equal amount of light just how the different lamps stand.

It should be noted that in spite of its high renewal cost the tantalum lamp gives the lowest cost of any of the lamps at above three cents per kilowatt-hour. With free renewals of ordinary carbon lamps and free renewals of Gem filament lamps and tantalum lamp renewals at 25 cents, as suggested herein, the resulting cost for an equal amount of light at various rates per kilowatt-hour will be for the different lamps as shown in Table II.

Table II.

Cost of 1,000 Candle-hours of Light in Cents, with Free Renewals of All Lamps Except Tantalum, for Which a Renewal Charge of 25 Cents Is Made.

Rates per Kw.-hour in Cents.	Ordinary Carbon Lamp. 3.1 W. P. C.	Gem Lamp. 2.5 W. P. C.	Tantalum Lamp. 2.0 W. P. C.
1	3.1	2.5	3.25
2	6.2	5.0	5.25
3	9.3	7.5	7.25
4	12.4	10.0	9.25
5	15.5	12.5	11.25
6	18.6	15.0	13.25
7	21.7	17.5	15.25
8	24.8	20.0	17.25
9	27.9	22.5	19.25
10	31.0	25.0	21.25
11	34.1	27.5	23.25
12	37.2	30.0	25.25
13	40.3	32.5	27.25
14	43.4	35.0	29.25
15	46.5	37.5	31.25
16	49.6	40.0	33.25
17	52.7	42.5	35.25
18	55.8	45.0	37.25
19	58.9	47.5	39.25
20	62.0	50.0	41.25

1. An extract from a paper read before the Ohio Electric Light Association on August 21, 1906. Mr. Willcox is assistant to the manager of the Lamp Works of the General Electric Company at Harrison, N. J.

The Industrial Exposition at Nuremberg, Germany.

By Frank C. Perkins.

Besides the Milan Exposition of 1906 in Italy, this year is signalized, in Europe, by an important industrial exhibition at Nuremberg, Germany, which was opened under the patronage of Prince Leopold of Bavaria.

Machinery Hall at Nuremberg Exposition.

The accompanying illustrations show the interior and exterior of Machinery Hall, one of the principal exhibit buildings on the exposition grounds. As will be noted by the interior view, the framework is entirely constructed of steel, and is in welcome contrast to the wooden frames of exposition buildings, as usually constructed.

It will be noted from the exterior view that outside electric illumination is supplied by arc lamps on iron ornamental poles, the conductors being carried entirely underground. The interior view shows a large number of electrically operated machines, steam turbines, direct-connected horizontal and vertical steam engines, and direct-current and alternating-current generators of various types. On the right, in the foreground, will be noticed an exhibit of searchlights of high power, electrically controlled by motors, for raising and lowering as well as turning the beam of light, and consisting of parabolic reflectors with automatic focusing arc lights of the latest construction.

The exhibit of the Felten & Guilleaume wire works is noted at the right and the electrically operated presses of the General Anzeiger newspaper on the left. Just back of this may be seen the exhibit of the United Machine Works of Augsburg and Nuremberg.

The lighting of the half million square meters of the exposition of Nuremberg is accomplished with satisfactory results by 500 arc lamps and 20,000 incandescent lamps, while the interior lighting includes 300 arc lights and 3,200 incandescent lamps.

Machinery Hall is 50 meters wide and 180 meters long and contains exhibits of more than 100 manufacturers of electrical machinery, engines and other mechanical devices. The power is provided by steam turbines, gas engines, oil engines and vertical and horizontal steam engines, driving electrical generators of several thousand kilowatts capacity.

The exhibit of the Siemens-Schuckert Works is extensive and most interesting, as this company has a Nuremberg factory of large size and importance. The Braun system of wireless telegraphy is shown at this exhibit, with a station at the state exhibit as well.

The city of Nuremberg has an exhibit, with illustration of the municipal lighting and railway system and power plants, while the Bavarian Trades Museum in Nuremberg is also represented, together with the technical schools, which are of great prominence and importance in Germany.

In Machinery Hall there are many electrically operated machines, including paper manufacturing apparatus, printing, spinning, weaving and other machinery, as well as electrically driven machine tools, which, together, use from 80 to 100 motors of nearly 2,000 horsepower total capacity. An electric harbor crane is on exhibit, as well as electric traveling cranes and two passenger elevators, employing electric power.

There are two three-phase generators of 3,000 volts for lighting service, which is also supplied by a steam turbine and alternator operating at a speed of 1,500 revolutions per minute, with a capacity of nearly 700 kilowatts, the service plant also including an internal-combustion engine and generator having an output nearly as great, operating at a speed of 125 revolutions per minute. Current for lighting is supplied from a number of transformer sub-stations equipped with more than a score of transformers, reducing the voltage from the transmission pressure of 3,000 volts on the underground cables to 115 volts for distribution. Further exposition lighting is accomplished by a dozen or more dynamos ranging from 35 kilowatts to 500 kilowatts, supplying direct current.

A Zoelly steam turbine is on exhibition, operating at a speed of 2,500 revolutions per minute and supplying a current of 220 volts, with a total output of nearly 500 kilowatts. Two tandem compound engines have been installed operating at 125 revolutions per minute and driving dynamos of over 300 killowatts, each supplying a current for three-wire distribution at 220 volts and 440 volts.

Another unit of about the same capacity supplying a current of 440 volts is driven by a Diesel motor directly connected to the generator and operating at a speed of 115 revolutions per minute. There are a number of other units supplying current at 110 volts and also on the three-wire system at 220 volts for interior lighting and 440-volt three-wire for exterior lighting.

An electric-railway service has been provided which operates with a voltage of 550 and is supplied with current from two units. One of these sets consists of a steam-turbine-driven generator of 110 kilowatts, operating at a speed of 2,500 revolutions per minute. The other unit consists of a 550-volt 110-kilowatt dynamo, directly coupled to a gas engine operating at 150 revolutions per

minute. The electric-railway cars are each equipped with two direct-current motors of 30-horsepower capacity each, having a normal speed of 545 revolutions per minute.

Electric underground cables are about 25 kiloeters in length, and the other conductors are about 10 kilometers long.

An electric fountain is in operation every night. It is supplied with water by electrically driven high-pressure pumps installed in an underground chamber. Each of these pumps operates against a head of 40 meters and is driven by a 200-horsepower electric motor of the direct-current type at a speed of 1,200 revolutions per minute. These direct-current motors are operated from the 440-volt power mains, and the pumps deliver to the fountains about 15 cubic meters of water per minute for each unit.

Water supply is provided by a number of high-pressure Kriesel pumps, operating under a head of about 25 meters, a water tower of 100 cubic meters capacity being used. The three electric pumps for this service deliver 10 liters, 25 liters and 35 liters of water per second and are operated by 15-horsepower, 25-horsepower and 35-horsepower motors, respectively.

The steam provided for the vertical and horizontal steam engines, as well as the steam turbines, is generated in a boiler house adjacent to Machinery Hall, which is equipped with a number of water-tube boilers as well as an electrically driven chain-grate boiler, provided with a superheater. The total heating surface is somewhat less than 2,000 square meters. A number of electric motors are employed for driving feed-water pumps. These electrically driven pumps take about 120 horsepower and supply somewhat less than 2,000 cubic meters per hour. There are also a number of steam feed pumps installed. A cooling tower is provided having a capacity of 800 cubic meters an hour for condensing service, the water tower being about 30 meters in height. The chimney for the boiler house is 2.5 meters in diameter and 50 meters high.

As will be noted by the accompanying illustrations of the exterior and interior of Machinery Hall, a large amount of glass is used in the construction of the building in connection with the steel framework, very little wood being employed, making it almost free from danger from fire. It will be noticed that the exterior of the building is pleasingly decorated, a number of paintings having been executed over the various entrances. Machinery Hall as well as the other exposition buildings are outlined with incandescent lamps as usual in modern expositions, but these decorative effects have not been carried out so extensively as at St Louis and other American expositions.

Mueller Law Held Constitutional and Certificate Ordinance Valid.

Judge T. G. Windes of the Circuit Court in Chicago decided on September 15th that the Mueller municipal-ownership law of Illinois is constitutional and that the ordinance recently passed by the Chicago City Council, based on the Mueller law and authorizing an issue of $75,000,000 in certificates by the city to acquire the street railways, is valid. The contentions of Mayor Dunne and his adherents have thus been upheld in the lower court. Arrangements were made at once to carry the case to the Supreme Court.

Lawyers for the complainant, a protesting taxpayer, arguing that the Mueller law was unconstitutional and that the ordinances do not comply with the act, were overruled by Judge Windes in a long opinion, the following being the conclusions, as summarized by the Chicago Daily Tribune:

The Mueller law does not violate the provisions of the state constitution.

The law is not contrary to public policy for the reason that the legislature determines what is public policy.

The provisions do not go beyond the title of the act.

The provision permitting the street-car companies to carry parcels is not unconstitutional.

The Mueller law does not conflict with the provisions of the cities and villages act with respect to frontage consent for the extension of lines.

The argument that the act permits the taking of property without due process of law is untenable, inasmuch as proper compensation is provided for and the condemnation for high public purposes is just.

The act confers no special privileges or immunities because it applies to all cities in the state alike.

Complete provision for the consent of the local authorities to municipalization is made in the act.

Neither the city nor the state incurs any liability under the act, the Mueller certificates being a lein wholly upon the street-car properties and their revenue.

The ordinances providing for the issuance of $75,000,000 Mueller certificates and the purchase and operation of the lines comply in all respects with the directions and intent of the Mueller law.

Upon hearing of the decision Mayor Dunne announced plans for securing ultimate public operation of the street railways. These plans contemplate that the City Council shall continue to negotiate with the present companies for reconstruction of the properties and their operation until the city is able to purchase them. In the event of a higher court decision upholding the municipal-ownership plans, the Mueller certificates will be issued and the roads purchased or an independent system constructed. The people will be asked at the election next spring to authorize the municipal operation of street-car lines.

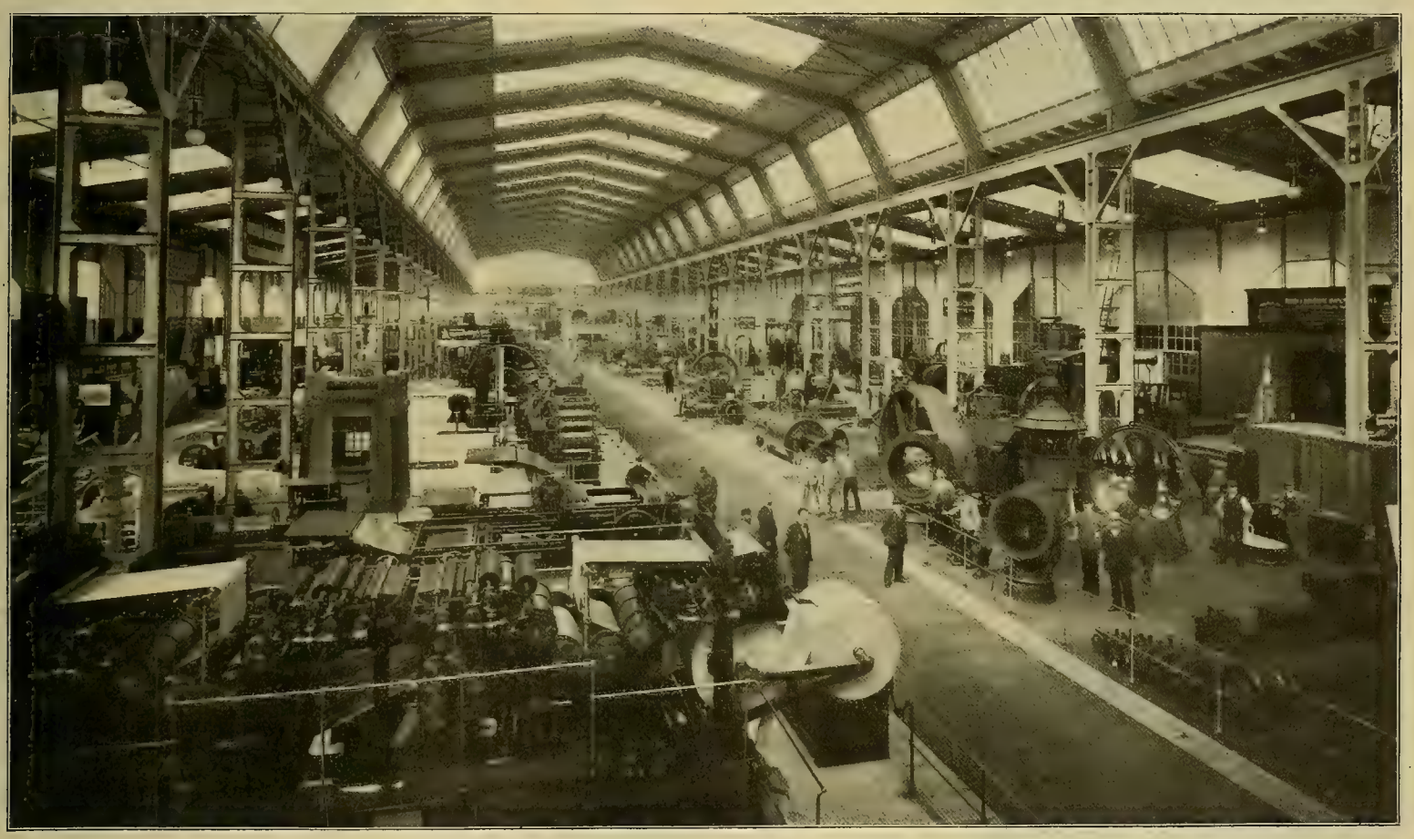
The leading counsel for the complainant in commenting on the decision is quoted as follows: "Judge Windes took up the various points seriatim and decided most of them adversely to the taxpayers. His course, as he said candidly, was largely based on the theory that the general intent on the part of the Legislature in passing the Mueller law was to authorize the general municipalization of the street railways in Chicago and elsewhere. He held many things which we regarded as unconstitutional to fall within the rule that the general purpose of a legislative act must be given effect. On that theory he seemed to slide over a number of unconstitutional details."

The Chicago Union Traction Company and the Chicago City Railway Company on September 17th presented to the city an estimate of the value of their intangible properties—remaining franchise rights. The companies had previously told the city what they would take for their tangible properties. The grand total is $73,545,676. The items which make up the total are:

	Union Traction.	City Railway.
Tangible property	$29,294,472	$20,103,936
Intangible property	13,825,040	10,322,228
Totals	$43,119,512	$30,426,164
Grand total		$73,545,676

These figures do not include prices on the Consolidated Traction Company, the Calumet Electric Company, the Chicago General, and other minor companies.

Mayor Dunne thinks the figures excessive, but did not state what plan he had in view. Previously he has advocated condemnation proceedings or the granting of rights in the streets to a rival company. On the other hand, the traction companies state that they are ready to go to court to prove their figures fair.



INTERIOR OF MACHINERY HALL AT NUREMBERG EXPOSITION.

Meeting of Units Standardization Commission Postponed.

The meeting of the International Commission on Electrical Units and Standards, which was to have been held in London next month, has been postponed for one year. This delay will permit of more leisurely and thorough investigation of the questions in relation to which the commission must have very definite information, such as the adoption of specifications for the silver coulometer and the Weston normal cell. By October, 1907, the international gathering should be reasonably sure of having satisfactory data before it.

Prof. H. S. Carhart of the University of Michigan, the official delegate from the United States to the forthcoming conference, with his colleague at the university, Professor Patterson, is engaged at present in making a determination of the electromotive force of the Weston cell by means of of his absolute electro-dynamometer.

A resident of Chicago seeks $2,000 from a telegraph company as damages resulting from the alleged changing of the message. "Mother and I arrive Thursday" to "Mother died; I arrive Thursday." The plaintiff alleges that he was in poor health, and the erroneous telegram gave him a severe shock.

Practical Hints on Illumination.[1]

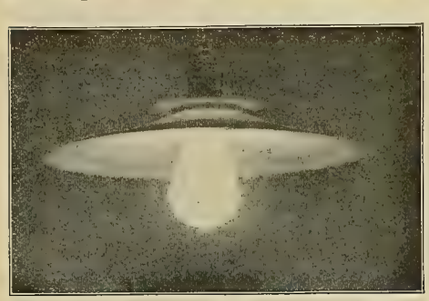
By Stephen B. Burrows.

The value of illuminating engineering is being more thoroughly understood with the development of this recently recognized science, for companies are realizing as they have not done before that the satisfaction and good-will of the customer, which is a most important asset of any company, can best be secured by giving all the illumination possible from every kilowatt-hour of current used.

The illuminating engineer's duty does not cease when an installation has been planned and installed, but he must seek to educate the consumer to the proper use of his light units, so that he will get the greatest efficiency out of his lighting service.

Practical illumination must include usefulness, economy in distribution and control, artistic and esthetic arrangement, and harmony with optical laws.

Reversing the order and referring to the last



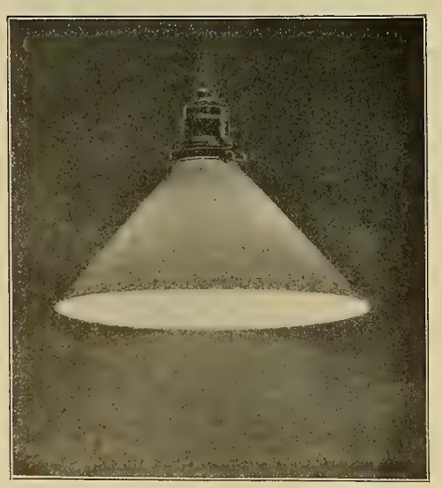
WHITE PORCELAIN SHADE.—POOR FOR READING.

first, opticians insist that the majority of weak and strained eyes are due to artificial light, such being either too intense or not properly shaded. On this point the following law should be followed in practically every illumination: No light should enter the eye direct from the luminous center.

In treating the several heads, it may be well to generalize, rather than outline minute details of arrangement, because persons' tastes differ, and the illumination must not only comply with general rules, but must also please the taste of the customer; therefore, fixed rules cannot be established, except along general lines.

The most recent development of general illumination has been toward the larger and more intrinsically brilliant units, for, while there has been a marked increase in the efficiency of lamps consuming from 100 to 600 watts each, the smaller units have not made corresponding progress.

In the paper, however, presented by Mr. Willcox



READING OR WRITING SHADE, GREEN EXTERIOR, WHITE PORCELAIN INTERIOR.—THE BEST FOR THIS PURPOSE.

at the National association convention at Atlantic City, data was presented on the new metallic-filament lamp in sizes ranging from 25 to 100 watts with an efficiency of 2½ watts per candle, and a life of 800 hours. This lamp indicates encouraging and immediate prospects in the smaller units, and it is to be hoped that the rumors of greatly increased efficiency in incandescent units will in the near future be fully verified.

Reflectors, globes and shades play a very important part in illumination both for reflecting and diffusing the light; and very often the effect of well-distributed units is spoiled by the unnecessary or improper use of reflectors or globes.

To illustrate the wide differences in this class of ware the accompanying illustrations are presented. [The comments are the author's.]

The best uniform illumination is obtained by distributing small units over the space to be lighted; but this is not always practicable, for one must consider the architecture and purpose for which the space is used.

Many features must be considered, and one of the most important is the color scheme.

We know that colors are noticeable simply on account of the reflection of certain rays of light, others being absorbed; and this will make a wide difference in the illumination of two rooms of opposite colors, with the same source of light.

For instance, white will reflect 85 per cent.; yellow, 45 per cent.; light pink, 35 per cent.; light blue, 25 per cent.; brown, 15 per cent.; black, five per cent.; chocolate, four per cent. So that the number of candle-feet necessary in a room decorated in white would have to be increased for a yellow or other colored room in proportion to the light absorbed.

The question as to which scale is the best to follow in figuring a given illumination is a moot question; but, in the writer's opinion, the best standard is the candle-foot, though he has satisfactorily used the scales of watts per square foot and watts per cubic foot, the former when the object to be lighted was on a plane surface, and the latter in general illumination, such as church lighting.

Of course, as the source of light is raised, the light on an underlying surface will diminish according to the law of inverse square, i. e., that the light from a given source varies inversely as the square of the distance; so that the scale of watts per square feet will vary with the height of the lamps and their efficiency.

Theater Lighting.

In every building the illumination and acces-

OPAL REFLECTOR.—USELESS AS A REFLECTOR OR DIFFUSER.

sories must correspond with the architectural lines and the decorations.

The quality of light in a theater must be soft, well distributed and shaded from the eye in all instances, for the eyes are tired and distended after having looked upon the brilliant footlights, and the mellow light is needed as a restful contrast. It will be noticed that the decorations are usually in some dark color to correspond with this idea, as also to give the appearance of space.

Every lamp should be concealed from view or equipped with a globe. Frosted lamps will also serve the purpose of diffusion.

Studded lights are the most appropriate in this class of illumination, as they can be made to carry out the line of the buildings and the distribution is of the best.

The incandescent lamp in the 16 or 32 candlepower is the best lamp for this purpose on account of the quality and quantity of light in each unit.

Electroliers should be tabooed, as they tend to concentrate the light.

Under the balcony the units can be best arranged by concealing them in hemispheres, and on the forward side of the balcony units can be best arranged throwing the light forward, the units being high enough to be out of the range of vision. The same arrangement is good for the extreme rear of the theater, the units being placed at the junction of the ceiling and wall.

Frosted four-candlepower lamps placed around the usual arch of the boxes will add materially to the artistic effect.

The lighting of the lobby is a different proposition, as brilliancy is desired. Electroliers can be used to advantage with side-wall brackets, or the brackets placed around the top of the pillars, or the units themselves can be artistically imbedded in the decorations.

Churches.

In this class of lighting the engineer encounters a great diversity in architecture, and therefore a great diversity in the styles of illumination exists. For instance, there is the Grecian or Corinthian, where studded lights would be out of place, as, in fact, they would be in most of the ancient types of architecture. But in the Gothic and modern this style of lighting can be used to advantage, as the general lines of the building are plainer than in the Grecian.

The denomination of the church will often make a difference, for you would not plan to illuminate an Episcopal or a Roman Catholic church with studded lights. These two church bodies are symbolic and present to the worshiper the Almighty in symbols, making the chancel beautiful and esthetic, and denoting some attributes of the worshipped. So the general illumination must be along the same lines, with fixtures appropriate to the building, keeping out the more modern styles.

There is the other extreme, as in some of the Protestant churches, where the puritanical ideas

WHITE PORCELAIN.—SHOULD NEVER BE USED.

of plainness and severity find expression; here the studded lights can be used, arranged in the shape of a cross, a star, a circle, or a Maltese cross, each denoting some religious theme, but in plain lines.

A good style of illumination for the church is cove lights in conjunction with a general illumination, the hidden light to be switched on when the sermon begins and the visible sources to be dimmed, which will shed a soft light over the church, appropriate and not injurious to the eyes.

The control of these lights should be elastic, so that from one-eighth to the whole can be used, as desired.

Incandescent or Meridian lights are the best units, but I hear of satisfaction with the Nernst.

Dance Halls and the Like.

To take the other extreme in lighting, let us consider the dance halls and ballrooms.

The first requisite is uniform illumination, with no shadows, and this can best be accomplished by studding small units over the ceiling and upper walls, and then, if there are any recesses, lights to be arranged in these in conformity with the other lighting.

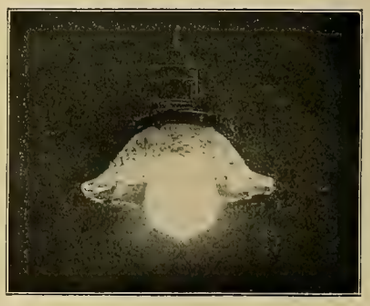
Arcs or Nernst are not permissible, for they give an impression of light and shadow rather than of uniform illumination, and their effect upon the face is not so pleasing as the incandescent light.

Banks and Office Buildings.

The lobbies of this class are generally of the same style as theater lobbies.

In all cases of bank and office lighting there are two considerations, one the general illumination and the other the placed lighting over the desks.

The general illumination in banks should be designed not only to illuminate the lower region of the public space but to throw enough light on



FANCY GLASS REFLECTOR.—A POOR REFLECTING SURFACE.

the ceiling and upper side walls to bring out the decorations and lines of the building.

Studded lights can be used to good effect.

There are three points to be noted in the placed lighting for use of the clerks. The light source should be shaded from the eye by a dark-colored shade, preferably green on exterior and white porcelain finish inside. Frosted lamps should be used to prevent striations, and the light source should not be too intense. An illumination of from two to four candle-feet is plenty. In other words, an

1. Condensation of a paper read before the Association of Edison Illuminating Companies at Frontenac, Thousand Islands, N. Y., September 5, 1906. The author is connected with the Edison Electric Illuminating Compan of Brooklyn.

eight-candlepower lamp 18 inches to two feet from the surface to be lighted.

This illumination is the correct standard for reading. The light should come from behind the left shoulder. For writing, also from the left, but more out forward, so as to prevent shadow from the pen or hand.

The writer has not seen anything but incandescents used satisfactorily for the illumination of banks.

The arc and similar illuminants would not give satisfaction on account of the size of the unit

HOLOPHANE REFLECTOR.—A GOOD TYPE TO USE.

and its tendency to cast shadow, certainly not enhancing the appearance of the interior.

The lighting of an office building is practically the same as in a bank.

For the desks, etc., a line could be run around the room at a distance of two feet from the floor, with plug outlets at intervals to accommodate a given number of desks. This would arrange for the placed lighting.

The general illumination should be preferably from above, as side lights would tend to throw shadows when one is writing at the desk, and, while the bank's working force is enclosed behind a partition, the office buildings or rooms are usually open, and the general illumination will affect the light on the desk to some extent.

In our Brooklyn office we use the arc concentric diffuser, with no placed lights, and the illumination for writing or reading is as near perfect as it could be and is free from shadows. This lamp, however, is not attractive in appearance and might not be acceptable in a bank or small office; but for large office rooms the illumination is good.

Stores.

Perhaps the largest part of our light load comes from this class of business, and the writer has specialized somewhat on this field of illumination.

The first point we notice in talking with a storekeeper is that he wants all the light he can get for a given sum of money. It is all right to talk about artistic effects to him, but he is more interested in dollars and cents and economy in lighting. The advantages of an attractive store are recognized, but the storekeeper wants to be sure that he can get them at a reasonable cost.

What general rules can be followed to this end?

HOLOPHANE GLOBE.—A GOOD DIFFUSION.

First, we will consider the several kinds of stores as to interior lighting.

The writer has found that in cases where economy is the first consideration, the best result is generally obtained from incandescent units at a height of from eight to 10 feet from the floor, and with the arc from 12 to 15 feet feet high; the units between these in size range correspondingly.

Furniture Stores.—One of the latest propositions dealt with has been a furniture store, and the installation consists of high-efficiency units in the several sizes.

Furniture shows up better under a yellow light than under a white light, and when a patron purchases he will in most cases use the furniture in a home with the first quality of light, and wants to know how it is going to look when there.

Then, again, the high-efficiency or other incandescent lamps are easily renewed, while in all cases the lamp shedding white light must be trimmed, making it necessary to move the furniture, with the liability of scratching.

For carpets, also, the yellow light is preferable, and a unit of about 100 candlepower or more, fitted with a reflector to throw the light on the carpet (which is usually hung on a movable form) will prove satisfactory.

The units in this class of business should be of individual control, with the possible exception of the main floor, for many times the salesman will need only one or two lights at a time, and they can readily be used as required without wasting current. A good arrangement is to have a row of pilot lights, controlled by a switch, at the entrance to each floor.

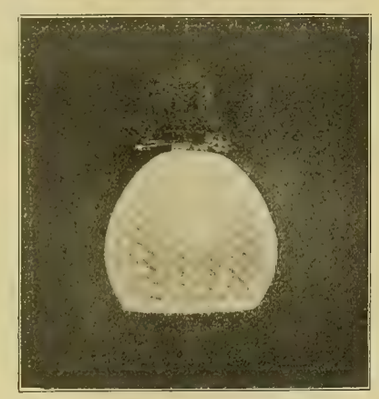
In using the new high-efficiency unit it is advisable to hang the units 10 to 12 feet from the floor and have them fitted with the style C shade, as the light will diffuse of itself below a certain plane and at the same time give greater efficiency with the C reflector than with style D reflector.

Millinery Stores.—The arc or Nernst should be used for this business, as the white lights show the delicate colors to best advantage.

The writer's belief is that the arc is better than the Nernst for this class of illumination. The concentric diffusers are used in Brooklyn millinery stores with satisfaction.

Men's Furnishings.—The same principle as to color will apply to clothing stores, though perhaps evening clothes, since they are to be worn under the incandescent light, should be fitted under the incandescent unit.

For a men's furnishing store the cluster, either the arc burst or the pagoda arc, is a good arrangement; and such units are attractive and efficient.



OPAL GLOBE.—POOR DIFFUSING SURFACE.

In one such store we have recently changed three arcs to four Benjamin arc bursts, and with a saving of 400 watts the resultant illumination is a big improvement.

The Nernst lamp or the high efficiency lamp is being used in Brooklyn in this class of stores. The Nernst gives the better color value, and in the two and three-glower size the illumination is good.

The arc should not be used in small stores for two reasons. First, the size of the unit and the usual height of ceilings in small stores will not permit of good diffusion; and, secondly, unless a number are installed, shadows are frequent.

Jewelry Stores.—There is a diversity of opinion as regards this style of illumination, some engineers claiming the white or bluish light should be used; others that the incandescent is best.

The advantage claimed for the arc lamp is that it accentuates the bluish tinge in diamonds, and that the larger the unit of light the more intrinsic brilliancy the diamond will have.

As to the other classes of jewelry, the incandescent unit is, in the writer's opinion, decidedly the best light.

A good arrangement of units is to have a cluster of 187 to 250-watt high-efficiency lamps with D shades in the center of a store, placed high to give the store an appearance of brightness, and have special lighting either on cord pendants over the cases or reflectors inside the cases, the latter being the better, for the two-fold reason that the observer cannot be between the light source and jewelry and that less light is necessary.

Studded lights make a very pretty store if the decorations will allow them to be used.

Other Stores.—Most other stores are in the one class in so far as interior illumination is concerned, and the principles presented will apply to cigar stores, drug stores, butcher shops, groceries, saloons; practically all call for the same illumination, and if there is any difference at all it is in the brilliancy desired. For instance, a drug store, saloon or cigar store may need more light than the butcher or grocer, and the lights range from 1½ candle-feet to five candle-feet, or, if watts per square foot, from one to three watts per square foot, determined by color of store, height of room and units used. The number of lamps required for a given service equals the above factor multiplied by the area in square feet divided by the wattage per lamp.

No definite rule can be made as to the watts per square feet or candle-feet needed in an installation, for so many things must be taken into consideration that no definite figures can be given until these factors are known; therefore, no scale is presented in this paper.

Department Stores.—It would seem at first

PROPER MERIDIAN REFLECTOR.

glance that as the department store is a consolidation of the smaller stores heretofore considered, the illumination for each department would coincide with the corresponding small store; but there is a factor which governs this, i. e., uniformity. For large spaces of this kind the arc lamp without doubt is the unit to be used, as the color values are good and the majority of goods shown are "day goods," though department stores are providing separate rooms for the exhibition of evening goods. Incandescent and arc lamps should not be used in the same space for the same purpose. That is, while arc lamps may be used for the general illumination, incandescent units should not be used also for general illumination in that room, but may be used for special purposes, such as lighting show cases; to alternate the general illumination between arcs and incandescents would be very poor arrangement. An opalescent globe should be used with arc lamps to remove the glare and improve the color values by filtration.

Window Lighting.

There are two distinct divisions in window lighting—the concealed and the open—and each serves its purpose. One is to attract attention to the store itself, the other is to show the goods in the window.

It is obvious that the usual border arrangement of the lights would not show goods to the best advantage, first, because most of the light which is on the horizontal is being thrown on the street, and, secondly, the rule which was presented in the first of this paper, that the light should not enter the eye direct from the luminous center, is being violated. When one looks at a window lighted

GROUND-GLASS INTERIOR GLOBE.—A FAIRLY GOOD DIFFUSION.

with visible units, the light itself attracts the eye, and the sight is for the moment blurred, so that when we look at the goods they are not distinct; it has been the light units which attracted us, not the goods.

Take the opposite, concealed, reflected light; the window is bright, but the light is centered on the goods, which reflect the light to our eyes, attracting our attention to the display and not the source of light.

When the open-border lighting is used, a frosted lamp should be utilized to reduce the intrinsic brilliancy, and an eight-candlepower unit is large

[*Continued on page 230.*]

WESTERN ELECTRICIAN

EVERY SATURDAY.

PUBLICATION OFFICES:

507 Marquette Building, - CHICAGO.

TELEPHONE, MAIN 1746.

Eastern Office, 150 Nassau Street, New York.

Telephone, 5220 Beekman.

Trade Supplied by Western News Co.

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DATES AHEAD.

Central Electric Railway Association (first fall meeting), Robison Park, Fort Wayne, Ind., September 27th.

Old Time Telegraphers and Historical Association, and United States Military Telegraphers (annual meeting), Arlington Hotel, Washington, D. C., October 9th, 10th and 11th.

American Street and Interurban Railway Association (annual convention), Columbus, O., October 15th to 19th.

Railway Signal Association (annual meeting), New Willard Hotel, Washington, D. C., October 16th, 17th and 18th.

A SERIOUS condition of affairs is reported by our London correspondent as existing in the electrical manufacturing trade in Great Britain. Competition is reported as excessive, and it is asserted that there are too many concerns eager to do the work that offers. Marked improvement in home trade is not anticipated for some time to come, inasmuch as the trading municipalities, which constitute such an important factor in the United Kingdom, are not likely to buy at the same rate in the future, owing to the large amount of work carried out, and also, no doubt, to the onerous burden of debt already carried by the municipal corporations. The export trade is more profitable, and British electrical manufacturers are apt, from present indications, to go after foreign trade with more zeal than ever before.

STANDARDIZATION of electrical units is such an important matter that all necessary deliberation should be had before conclusions are laid down to be enacted into law, very likely, by the parliaments of the leading countries of the world. Therefore, the news that the meeting of the International Commission on Electrical Units and Standards, to be held in London, has been postponed from October, 1906, to October, 1907, while it may occasion some surprise, should excite little adverse criticism. Let the delegates, who officially represent their respective governments (Professor Carhart appearing for the United States), take what time, in reason, they require for preparation. Their conclusions should then be based on data of a very close degree of accuracy. And, once formulated, we trust that they will command the respect and adhesion of the world-wide body of electrical scientists and electrical engineers.

SOME interesting investigations on "The Effect of the Electric Spark on the Actinity of Metals" were described by T. A. Vaughton at a recent meeting of the Physical Society in London. It has been pointed out by several observers that some metals, such as aluminum, cadmium, zinc, magnesium, etc., although not radioactive in the ordinary sense of the word, yet have the power of affecting a photographic plate. The electric spark has a remarkable influence on this "actinity," in some cases causing an increase, and in others apparently diminishing it. The alteration is not merely momentary, but remains for months. It is, however, quite superficial, and may be removed by slightly rubbing the surface of the metal with emery paper. The penetrating power of the rays emitted from metals subjected to the action of the electric spark varies considerably. The author points out that the greatest increases in "actinity" caused by sparking are produced in sparking together two metals the sum of whose atomic weights approaches that of a radioactive element, thus suggesting a synthesis of these elements.

IN THE legal warfare over the legality of the proposed "Mueller-law certificates" the first battle has been won by Mayor Dunne and his adherents; and in consequence another step has been taken toward the municipal ownership and operation of street railways in Chicago. But the advocates of the change have still a long and difficult road to travel. Although Judge Windes of the Circuit Court of Cook County has decided in favor of the city ordinance providing for the proposed issue of certificates on every point, an appeal has been taken to the Supreme Court of Illinois. Even if the legality of the measure is finally affirmed, a market must still be found for the debentures, which, it must be remembered, are not a lien on all the assets of the city, but only on such street-railway property as the municipality may acquire by the proceeds under the Mueller law. Again, the electorate has given the city authority only to own the street railways and not to operate them. Finally, if all these points are cleared away, the great practical difficulties of operating a large street-railway system successfully by a political municipal administration will be encountered. Still, when all is said, it cannot be denied that Judge Windes' decision, which was a very sweeping one, gives reason to the municipal-ownership advocates to rejoice. But the end is still far distant. In the meantime the companies have made estimates of the value of their tangible property and unexpired franchises, which are, perhaps, excessive, and which will no doubt give rise to another long wrangle.

REFERRING to the proposal that a renewal charge be made to customers in the case of tantalum lamps, Prof. H. E. Clifford of Boston, at the recent Atlantic City convention, made an interesting point: "It seems to me that, in view of the delicacy of the situation existing today between the central-station man and the public, to tack anything more on the customer would be fatal. The suggestion is made to draw an analogy from the gas situation. When the Welsbach mantle was introduced, people paid for it, and the gas business expanded. The analogy is not good, because the gas people, until recently, at all events, were not giving free renewals. They are not giving free renewals of Welsbach mantles or even gas tips in some places in the district in which I live. You get very little from the gas company free. The electric-light man has given free light renewals in the great majority of cases, and it seems to me if you attempt to depart from that policy, you will give the greatest argument that you can give in the present situation for the public ownership of these quasi public-service corporations." This objection is certainly worthy of careful consideration. The free-renewal policy should not be abandoned lightly.

ALTHOUGH the facts in the case are not very clear, it appears that the death of Professor Popoff, the well-known Russian scientist and inventor of wireless apparatus (which occurred last January, we believe), was hastened by the anxieties and distractions due to the turbulent condition of affairs in the czar's dominion. Popoff was a professor in the Electrotechnical Institute of St. Petersburg, and between an absolute government on the one hand and progressive, perhaps revolutionary, students on the other, it may easily be believed that his life was made a burden during the acute political disorders that followed the war with Japan. We publish this week an interesting article on the life and work of Popoff, from the pen of Mr. C. D. Kubicki, now a resident of Paris, and the last sentence is a mournful one: "Lately, when reaction took a new lease of life, Popoff's health sunk very rapidly, and, after a very unpleasant conflict with his superiors, he was struck by apoplexy, and died after an illness of two days." One may imagine that something of a tragedy lies behind the "unpleasant conflict." Popoff's name and work were well known in other countries, and it is pitiful that at the early age of 47 his life should be thus cut off.

PROPER PACKING of goods shipped for export is one of the things which the foreign consuls of the United States repeatedly insist must be done unless the growing foreign trade of this country is to be discredited. Many American shippers are said, and no doubt with truth, to be more careless in this respect than the exporters of other nations; and the fault must be safeguarded against before annoyance at this carelessness grows into a determination not to submit to it. Mr. J. C. Caldwell, the United States consul at San José, supplies one of the recent admonitions of this character. He writes: "American exporters cannot be too careful in regard to the packing of their products. While all packages should be as light as possible, without any undue filling up with dead material—all duties being levied on the gross weight—this light packing must be such as properly to safeguard the goods. Proper packing and credits, such as are freely given by European exporters to trustworthy merchants, are two important 'trade agents' for the enlargement of American business in Costa Rica. The prevalence of a general progressive spirit, embracing railways and highways especially, is noted, and as American men and capital will have much to do in the development of the republic, the American exporters and manufacturers should not neglect the opportunities that are offered them." Other American observers in other parts of the world write in a similar strain, and the subject is one to which all manufacturers or traders engaged or desiring to engage in the foreign trade should give careful attention.

Life and Work of A. S. Popoff, Russian Inventor of Space Telegraphy.

By C. D. Kubicki.

By the recent death of A. S. Popoff Russian science and electrotechnics have lost a conspicuous figure and the Electrotechnical Institute of St. Petersburg one of its best professors.

A. S. Popoff was born in 1859 in the little town of Bogoslowsk, in the Ural Mountains, where his father was an Orthodox priest. He obtained his primary education in a seminary of the city of Perm, and in 1877 he entered the University of St. Petersburg, where he studied mathematics, de-

A. S. POPOFF.

voting his leisure time to laboratory work. During the electrotechnical exposition at St. Petersburg, while still a student, he was appointed as instructor. Graduating the next year, he was left at the university on a government fee in order to prepare for the position of professor, but, notwithstanding his scientific vocation, he still devoted a great deal of his time to practical work at electric plants, being associated with the first industrial association in Russia, the "Electrotechnics." At that time the new theory of dynamos, based on a magnetic circuit, was just making way in Russia, and it interested greatly the inquiring and independent mind of the young scientist, although applied science could by no means keep him away from pure science.

In 1883, after the death of Professor Petroushevski, a position was offered to Popoff as assistant professor of physics and of "galvanism," as it was called in Russia, in a military school at Cronstadt, where he married and was definitely settled. Shortly after he succeeded the deceased Professor Stepanof. The eclipse of the sun in 1887 having caused great interest in Russian society, Popoff and some of his friends started on a scientific expedition to the city of Krasnoyarsk, in Siberia.

In 1888 Popoff was offered a position as a professor of physics, with the special purpose of considering such questions of physics as are closely allied with chemistry, with explosives and with military operations. To these questions he devoted the whole of his time during winter, while in summer he superintended the illumination of the celebrated fair of Nijni Novgorod. Here he acquired much practical skill. In the military school he first started lecturing on the construction of dynamos, and he superintended the practical work of his pupils.

In 1893 Popoff was delegated by the minister of the navy department to the World's Columbian Exposition at Chicago, and soon after he founded the Russian Imperial Technical Society, of which he was vice-president until 1898.

Both in the military school and in the society above mentioned, Popoff was constantly demonstrating newly discovered phenomena, while he often used apparatus of his own make. While repeating Hertz's experiments Popoff was first to find the application of electromagnetic waves to wireless telegraphy, for which, in 1898, he obtained a prize from the Russian Imperial Technical Society. In 1900 he was named honorary member of the Electrotechnical Institute of St. Petersburg and in 1901 honorary member of the Russian Imperial Technical Society.

The discovery of the coherer by Professor Branly of Paris directed Popoff's mind toward practical applications of Hertzian waves, and as early as 1895 he presented a paper to the Russian Society of Physics and of Chemistry on "Some Properties of Metallic Filings in Transmitting Electric Vibrations." The paper was accompanied with a scheme which might truly be considered as a prototype of all the existing receiving stations in space telegraphy.

The first application of this theory was realized in an apparatus constructed in 1895 and named the "storm recorder," in which the coherer was to bring to evidence the discharges of atmospheric electricity, obviously much stronger than those which were at Popoff's disposal in his laboratory. The apparatus, provided with an antenna about nine meters high, was placed on the roof of the meteorological station of the Agronomical Institute of St. Petersburg.

This was the starting point of Popoff's system of wireless telegraphy, and in the summer of 1895 the inventor started a new series of experiments on a wider scale, sending messages over a distance of five miles. During the winter of 1899-1900 he succeeded in making the first useful application of his system while proceeding to the rescue of the Russian battleship General-Admiral Apraxine. On that occasion signals were transmitted over a distance of 37 miles.

The storm recorder, illustrated diagrammatically herewith, consists essentially of a relay and a coherer. A metallic rod placed on the roof is supported on insulators and connected inside the room to a point (A). The electric waves enter the ground, following the antenna and the coherer (A B). The effect of the waves on the coherer is to make it a good conductor of electricity, and the battery (P Q) sends its current to the relay (R). Although weak, that current is strong enough to actuate the armature of the relay, which closes the circuit at (C). The newly established circuit is of a low resistance; therefore the battery sends through it a strong current, which acts on a pencil to make a record on a revolving drum and also on an electric bell. The hammer of the bell strikes against the coherer, and, the circuit being broken, the apparatus is ready to receive a new set of waves.

Records so obtained showed a number of discharges imperceptible to the observer without the help of the storm recorder. Some of the records have been made by storms occurring at a distance of 30 miles from the point of observation.

In 1899, according to a special arrangement, Ducretet of Paris started to construct wireless apparatus of Popoff's system, and the whole Russian fleet was provided with Popoff-Ducretet wireless stations, using a telephone receiver. The re-

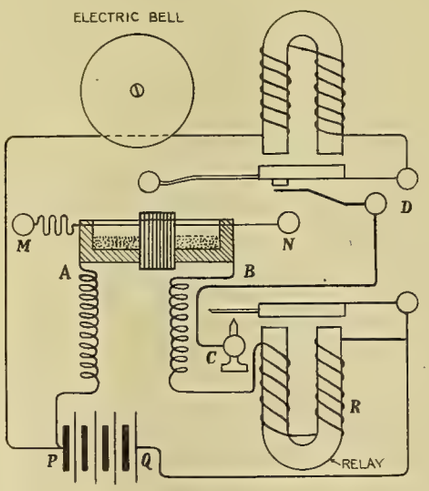


DIAGRAM OF POPOFF'S HERTZIAN-WAVE STORM RECORDER.

ceiving station as devised by Popoff was constructed by Ducretet and demonstrated by him during the electrical congress in 1900 at Paris.

Accounts of Popoff's experiments were published in the Journal of the Russian Society of Physics and of Chemistry in 1896, and later on, during the same year, news arrived as to the first experiments of Marconi. Due to the fact that the Russian language is so little known abroad, it would be presumptuous to suppose that the Italian engineer appropriated Popoff's idea of the receiver, but that the priority of the invention belongs to Popoff seems to me incontestable. Moreover, Popoff organized at Cronstadt a special shop for the construction and repairs in Russia of the wireless apparatus, and the whole equipment of the ill-fated fleet of Admiral Rojestvensky was personally installed by the late Professor Popoff.

In 1901 Popoff began lecturing on physics at the Electrotechnical Institute, and the new position afforded to him a good opportunity for scientific investigations; but first of all he had to arrange to secure a laboratory for the new institution. Notwithstanding the poor provisions afforded for that purpose by the government, he succeeded in founding a laboratory very nearly up to date. In 1904-1905 he was finally able to set to work; everything seemed to promise that soon science would be enriched by new thoughts and by new discoveries; in fact, Popoff started on several important investigations. Then came the troublesome time of the Russian-Japanese war and other political events, which called everyone to do his share for the benefit of the body politic.

As a director of the Electrical Institute, which was started on new principles of autonomy, Popoff had to meet with the most unfavorable conditions in academic life. The students were constantly in opposition not only to the government but also to the whole body of professors, and poor Popoff was exposed to a cross-fire between the students and the government. Lately, when reaction took a new lease of life, Popoff's health sank very rapidly, and, after a very unpleasant conflict with his superiors, he was struck by apoplexy and died after an illness of two days.

An Electric Self-registering Target.

A target for rifle practice in which the position of each shot is at once registered on a dial at any desired distance has been invented by Col. George A. Peters of Toronto, Canada. The advantage of the device is that it avoids the cost of constructing a screen for the protection of the markers, and saves the heavy wages bill involved with ordinary balanced canvas targets, which require two men each for marking. The principle of the apparatus resembles that of the ordinary hotel annunciator, the impact of the bullets being received by hammers behind the target, which close electric circuits, and thus register the results on the dial. Further particulars are from Engineering of London, abstracted by the Literary Digest:

"When the target is brought into use, it is raised by means of suitable levers worked from behind the target (or by a wire attached to these levers, and worked from the firing point), until the hammers rest against the back of the target plate, at an angle suitable to the weight and velocity of the bullet. When a bullet strikes the target, its force is communicated to one or more hammers within the area affected by the blow, and these are raised until the back strikes the bearer plate, and contact is made by the projecting lugs at the lower ends of the hammers, and the position of the shot is thus recorded at the firing point. . . . The form of the hammer is such that when it is stopped in its backward movement by the bearer plate its center of gravity is well in front of the bearing pin, so that it immediately falls back again to its original position, resting against the back of the target plate. When the position of a shot has been ascertained, the indicator board is 'cleared' by a frame . . . worked electrically by a push-button placed near the marksman on the firing point.

"The arrangement by which the target is carried on a swinging frame has been designed with a view to its adjustment to suit the force of bullets of varying weight and velocity, and with regard to the length of the range. Thus with a service rifle at 200 yards the target plate is lowered until the hammers rest with their lower sides at an angle of about 50 degrees with the bearer plate. At longer ranges or with lighter charges, the target is raised, and with it the series of hammers, until the angle is such that on a bullet striking directly over a hammer only that hammer is affected. Each hammer will, however, respond to the impact of a bullet striking within three inches of the point on the target against which it rests. Thus each forms the center of a circle six inches in diameter, and will record the position of a shot striking within that circle. The hammers are so arranged that these circles overlap in all directions, so that no part of the target can be struck without one or more hammers being affected. Should a bullet strike where two, three or four circles overlap, all the hammers within those circles will be operated, and a corresponding number of disks on the indicator will fall. It is quite easy to determine from these disks the exact point of the target struck by the bullet."

Cleveland Street-railway Talks.

Each day in a four-column space in a newspaper the Cleveland Electric Railway Company presents something new on the street-railway situation in that city. The company invites readers who disagree or care to make suggestions to make themselves heard. In a recent issue the company says: "Certain men are promising you three-cent fares eight years from now, with absolutely no certainty that they can carry out their promises. We don't ask you to wait eight years or eight days. We will give you 3½-cent fares the very day you extend our rights to serve you to such a length of time that we can afford to do it."

FUEL COMBUSTION AND BOILER MANAGEMENT.

A Brief Exposition for Practical Men.

By C. H. Williams.

Part II.

Three Points to Be Remembered.

The three points to be sought for the best utilization of the energy of fuel under the boiler are:

First—Perfect combustion.

Second—The use of the least possible excess of air.

Third—The greater difference in temperature between the firebox and the stack.

Use of Producer Gas.

More or less experimenting has been done in firing boilers with producer gas made from both bituminous and anthracite coal, with quite satisfactory results. Better results are looked for by a more careful application of the gas—using, perhaps, a water-jacketed producer for heating the feed water.

The principal gain in using bituminous producer gas over direct firing results from the more perfect combustion of the volatile matter, with but little more than the theoretical amount of air. This prevents smoke and saves fuel otherwise used in heating a large amount of useless air.

The Dutch Oven.

The only reason why the so-called "Dutch oven" can be used to advantage in connection with the boiler furnace is that it gives a large chamber for the proper mixture of the gas and a large surface of radiating walls to maintain the temperature necessary for combustion, while on the other hand it introduces serious losses by presenting large external walls for the dissipation of heat from the highly heated furnace.

Draft and Construction of Stack.

Another effect which the admission of too much air can and does produce is that of creating a poor draft in the boilers, and this is brought about by two causes. The first one is that in designing a smokestack the amount of fuel which is to be burned per hour is first estimated and the quantity of air necessary for the burning of this fuel is computed, allowing a certain excess, which is always necessary to insure a sufficient amount for each atom of carbon to find its two atoms of oxygen. The volume of gas is determined at a certain temperature, and engineers have determined that the air can be made to pass through the stack at a certain speed to best advantage.

If, instead of the proper quantity, two or three times as much air is admitted, which is often the case, the passage of the stack is found to be too small for the passage of the increased amount, and excessive friction is the result, and as a consequence, the boiler does not have sufficient draft to carry away the gas, and if the gas cannot be carried away the other air will not find its way in, and the boiler will not work up to the capacity for which the makers recommended it, as it will be impossible to burn the amount of fuel on which they figured.

Another result is that the excessive air cools the volume of gas, and when the gas reaches the base of the stack the temperature is below what it should be and the draft is lessened on account of this decreased temperature. This statement may not be perfectly clear, and a word of explanation will assist in its understanding.

The only reason that air is drawn into the furnace is because of the temperature in the stack being higher than that of the air outside. Air has a certain definite weight. Twelve cubic feet of it weighs one pound at ordinary temperature. If, however, the air is heated and allowed to expand, one pound will occupy much more than 12 cubic feet. We ordinarily speak of atmospheric pressure as being 15 pounds to the square inch This means that if we consider a column of air one inch square extending up from the earth as far as the atmosphere extends (which is but a few miles) the entire weight of the column of air is 15 pounds.

If we have a boiler stack 180 feet high filled with hot air, the pressure on the bottom of the stack is less than a similar stack containing cold air. It does not make any difference whether the stack is one foot in diameter or 10 feet in diameter or 100 feet in diameter, the pressure per square inch at the base would be the same, provided the temperature is the same. The weight of the outside air at the point where the stack ends would be the same as the weight of the air anywhere alongside of the stack the same distance from the ground.

We have, then, two columns of air to take into consideration—one 180 feet high at the temperature of the outside air, and one 180 feet high at the temperature of 400° or 500° F. The air in the one at 500° temperature is very much lighter than the air in the one at the temperature of the outside air; consequently if an opening is made at the base of the stack, the heavier air will tend to rush in and push the lighter air out of the stack. This is exactly what happens; but instead of making the opening in the side of the stack to the outside air, in boiler work the opening is made from the bottom through the firebox to the outside air in the boiler room. The cold air rushes in and tries to bring the pressure of the firebox to equal that of the outside air, but as the air passes through the firebox, it is heated and expands, and so the process continues. We are very apt to think of the stack as drawing the air through the firebox when we should think of the outside air pushing in through the firebox to the stack.

Two factors which enter into the design of a stack are, first, its diameter, which is determined by the volume of gas which is to be handled; the stack must be designed so that it presents sufficient area without making the gas travel at too high a speed. Second, the height of the stack is determined largely by the temperature which will be found at the base, and the length of the column of hot air determines the tendency of the flue gas to rise.

A mistake can be made of building the stack too high. For every foot which is added to its length a certain amount of friction is added to the passage of the gas. The same is found in the passage of gas or water through pipes, and a point may be reached where the increased friction is greater than the increased draft obtained by increasing the length of the stack.

Analysis of Flue Gases.

The principal reason for taking up this subject of the combustion of fuel is that of being able to secure the best possible results in the handling of our boilers. In order to accomplish this, I believe that it is absolutely necessary to go at the matter in a thoroughly practical way, and not only know the draft under which the boilers are operating, the fuel results in watts per pound of coal and watts per pound of combustible (after the ash has been removed), and pounds of water evaporated per pound of coal, but also to know what results are actually being obtained in the combustion of the fuel by analyzing and showing the gases which leave our boilers and travel off into space every hour of the day.

In order to do this, it is necessary to analyze the flue gases, and to do this chemically. The word "chemical" is liable to scare men at first introduction, but my own experience in the boiler room has proven to me so conclusively that material improvements can be secured by going after these matters thoroughly, that I have introduced it in a number of plants.

The handling of this apparatus is not at all difficult as soon as one becomes acquainted with it, and I shall endeavor to explain its principles and its use.

Chemical apparatuses for analyzing flue gases depend for their working largely on the fact that almost all gases can be absorbed by some substance or other. Probably the most common example with which you are familiar is that found in ammonia water or "hartshorn," which is ordinarily used in households for cleaning purposes. This substance, which we get commercially in the liquid form, is a gas which comes from coal, and is found in large quantities at the gas works, and is put into its commercial form by allowing the gas to bubble through water. In doing this, the gas is absorbed, and a cubic foot of gas can be made completely to disappear by allowing it to pass into water.

Water also has the property of taking up air, and large quantities of air are contained in water. This is frequently brought to notice where suction pipes to pumps are carried up over a hill, in which case the air will separate out from the water and form a trap which prevents the pump from operation until the air is removed. In an analysis of flue gas this property of absorption is made use of in almost every step.

An analysis of chimney gas will show whether the furnace is being properly handled. A lack of air will result in the incomplete burning of the fuel, to CO, and produces but 4,500 heat units to the pound of coal instead of 14,000 when burned to CO_2. Too much air will over-ventilate the fire and dilute and cool the flue gases, causing the needless heating of large quantities of air, which escape up the stack, and too much or too little air will defeat all of the advantages that might be gained by the use of the best kind of fuel, patented grates, damper regulators and high-priced boiler settings.

In the analysis of flue gas the first thing to be determined is the quantity of carbon dioxide present, ordinarily represented by CO_2. The presence of this gas demonstrates the completeness of the combustion which takes place, as CO_2 is formed when fuel is burned in the presence of sufficient or excess oxygen. In the CO_2 gas the carbon has united with all the oxygen which it is capable of taking up, and for this reason no further burning can take place, and combustion is complete. This gas is not poisonous, but will not support life or flame, and it can be taken into the lungs or the stomach without danger. This is the gas which is absorbed in water to make soda-water or sparkling water.

If the fuel on the grate bars is entirely consumed with just the right amount of air present, an analysis of the flue gas would show the presence of 21 per cent. of this CO_2 gas, the remainder, 79 per cent., being nitrogen, which acts only as a diluent, acting in no way to assist in the burning of fuel. For this reason the greater the percentage of CO_2 gas which can be shown in the analysis, the better we may know the results of the firing to be.

Although this CO_2 gas is readily absorbed in water, water having the ability to absorb 1.23 times its volume of gas, the best absorbent which can be found and which can be used in the testing apparatus is known as potassium hydroxide (KOH). This is what is ordinarily called "caustic potash," and is the same material which the barber makes use of in a 10-cent shave when he accidentally sticks the razor in too deep for the improvement of personal appearance, but not sufficiently to call the ambulance.

The reason that CO_2 gas is taken out first is because the materials that are used to take out the other constituents would also absorb the CO_2, whereas the KOH has the capacity for CO_2 gas only. For this reason the next gas which is taken out is the free oxygen which is present, and the presence of free oxygen means that more air containing this oxygen has been admitted to the furnace than is necessary. If the oxygen were the only thing present, the introduction of it would not be so disastrous, but when we consider that in every five cubic feet of air there is but one foot of oxygen and four feet of nitrogen, the presence of a small percentage of oxygen means the presence of a large amount of useless gas. The oxygen is quite easily absorbed by a strong alkaline solution of pyrogallic acid, and the method of bringing about this absorption will be explained.

The last gas for which the test is made is known as carbon monoxide, CO, which is produced when only one part of oxygen is taken up with each part of carbon. Under ordinary circumstances but a small percentage of this gas will be found to be present, as boilers are usually over-ventilated rather than under-ventilated. This last-named gas is most easily absorbed by cuprous chloride.

The Orsat Apparatus.

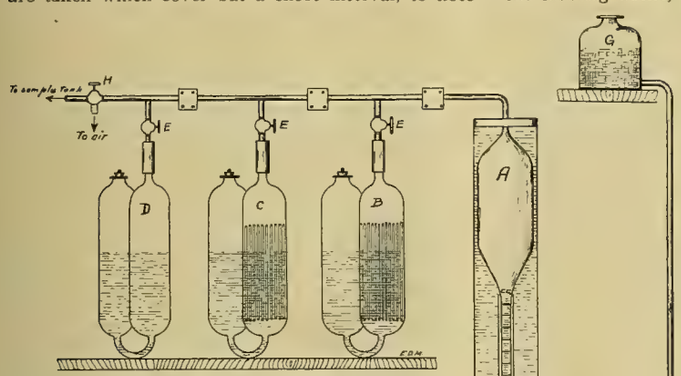
The following is a description of the Orsat apparatus and the method of handling it:

First, to secure the sample of gas which is to be tested, a hole is tapped into the stack about three feet above the upper row of boiler tubes, through which a 4½-foot collection tube draws off the gas. This tube should be water-jacketed, to prevent any chemical action taking place between the walls of the tube and the hot gases. The idea is to get a continuous pipe for drawing off the gas, and have it surrounded with circulating water not in contact with the gas. At the end of the gas-collection pipe there is a Y connection fitted with way cocks, which will connect either of the branches to the main pipe without opening the connection to the other. To the two branched pipes are attached rubber hose, connecting with galvanized-iron tanks. These tanks, of about a quart capacity, are fitted with stop cocks at the top and bottom.

When preparing to take a sample of gas, the upper cock is open, and the tank is filled with water by connecting it to the hydrant at the bottom of the tank, and the water, by displacement,

drives off all the air in the tank, hose and collecting pipe. The pipe is then entered into the stack, and the way cock turned so as to put one tank in connection with the gas tube; the cocks at the top and bottom of the tank are opened, and as the water runs out of the lower stop cock, it siphons the flue gas over into the collecting tank. When the water is nearly out of the first tank, both the cocks leading to it are closed, and those leading to the other tank opened, and the gas which is collected in the second tank is then a fair sample of the flue gas in the stack, as any air which might have gotten into the collecting tube, or into the connecting hose, has been led away into the first tank.

By means of the stop cock at the bottom of the collecting tank the length of time over which the gas sample is taken can be varied to suit the conditions, and care should be exercised, if samples are taken which cover but a short interval, to note the conditions existing in the furnace, and see that the sample is not collected just at the time when the firebox door is open, for example, allowing great over-ventilation, and it is probably better to let the time of taking extend over several minutes, as this will give better average conditions.



ORSAT APPARATUS FOR TESTING FLUE GASES.

After the samples of gas are collected, they should stand in the room in which they are to be analyzed long enough to take on the temperature of the surrounding air. This will prevent any expansion or contraction, due to the change of temperature after the gas is led into the tubing and testing apparatus.

As stated before, in testing flue gases, the things which are to be determined are:

First—The amount by volume of the carbon dioxide (CO_2) present, for when the carbon in the fuel is burned to carbon dioxide complete combustion has taken place, and all of the heat available has been liberated.

Second—The amount by volume of the oxygen (O) present, for the presence of oxygen shows that too much air is being admitted to the furnace, more than is needed for the complete combustion of the fuel, and if it is present at the same time at which carbon monoxide is present, it is an indication that it has leaked in somewhere and mingled with the furnace gases at a point beyond the zone where the temperature is sufficient to support the chemical composition, or the burning of the carbon monoxide to carbon dioxide.

Third—The amount by volume of the carbon monoxide (CO) present, for when this is present the carbon of the fuel has been but partially consumed, or only the first stage of combustion has been carried out, and in this first stage but one-quarter of the available heat has been liberated.

Fourth—The amount by volume of the nitrogen (N) present. The volume of nitrogen is kept only as a check to see that the aggregate volumes of the several constituents are equal to the original volume of the gas which is being analyzed.

As only one-quarter of the heat is liberated in the first stage of the combustion—that of burning the carbon to carbon monoxide—it is an indication of very poor economy to find any quantity of this gas in the escaping flue gases, and, again, there is an indication of a direct loss when the test shows up a considerable quantity of free oxygen, for this indicates that besides supplying all the oxygen necessary for complete combustion, the grates and other air openings are admitting this useless amount of oxygen and about four times as much inert nitrogen, which is heated up in passing through the furnace, which might otherwise be doing useful work on the water and steam of the boiler.

Probably the simplest form of apparatus which answers the requirements for analyzing flue gases is that known as the Orsat gas-testing apparatus, a sketch of which is given. It consists of a water-jacketed measuring tube, graduated to cubic centimeters. Three pipettes (B) (C) (D) are connected to the tube by means of rubber hose, and each is supplied with a stop cock. There is a three-way cock (H) opening to the connecting tube, to the tank containing the sample of gas and to the air. A leveling bottle (G), which has a pinch cock at (F), is also provided.

Operation of the Device.

By closing the way cock to both air and gas tank, and by opening the pinch cocks above the pipettes, one at a time, and opening the cock to the leveling bottle, the reagents in the pipettes can be drawn up so as to stand in the capillary tubes at the top of the pipettes. After this is done, the three-way cock may be opened to the air, and by raising the leveling bottle all of the air may be driven out of the apparatus by completely filling the measuring tube and connecting pipes with water. After this is done the three-way cock to the tank containing the sample of gas to be tested is opened, and a full charge of gas is drawn into the measuring tube. As an extra precaution against getting a mixture of gas and air, the first charge may be expelled to the air, and the second sample taken, which is then ready to be tested. A little more than 100 cubic centimeters is drawn into the measuring tube, and the three-way cock closed against the connecting tube. The gas is then compressed to 100 cubic centimeters by raising the leveling bottle; the three-way cock is again opened to the air, and the water in the leveling bottle and the water in the measuring tube are brought to the same level, which coincides with the 100-cubic-centimeter mark on the measuring tube after the tube has been allowed to drain a minute. This gives a volume of 100 cubic centimeters at atmospheric pressure.

The three-way cock is then closed against the connecting tube, and the pinch cock to the first pipette is opened, and the gas is forced into the first pipette, displacing the reagents in the front part, laying bare a great many small glass tubes, whose office is to present a large wetted surface for the reagents to act upon the gas.

The first pipette contains a solution of potassium hydrate, which has the property of absorbing carbon dioxide. It is prepared by dissolving 500 grammes of caustic potash (KOH) in one quart of water. This makes a strong solution, which can be kept tightly corked in a bottle, and the solution in the pipette should be renewed, as it weakens in its action, due to its becoming charged with CO_2. The caustic potash, which comes in sticks, must be kept in sealed glass bottles; otherwise it will absorb moisture from the air.

The gas is passed back and forth from the measuring tube to the first pipette, until it absorbs all of the CO_2, when it is drawn back into the measuring tube, and the liquid in the first pipette brought to the same height as before.

The measuring tube is allowed to drain for a minute, and then the level in the leveling bottle is brought to the level of the water in the measuring tube, a free opening being left between them, and a reading taken. This reading gives the volume of gas at atmospheric pressure after the CO_2 has been removed, and the difference between this reading and the original reading, or 100 cubic centimeters, gives the volume of CO_2, or, as the comparison is made with 100 cubic centimeters, it gives the percentage of CO_2 gas present in the sample being tested.

The gas is then forced into the second pipette, which contains an alkaline solution of potassium pyrogallate, which has the property of absorbing oxygen. This solution is formed by taking 150 cubic centimeters of the first solution and adding to it 7½ grammes of pyrogallic acid. This solution may be kept in an ordinary bottle well corked.

The same process is gone through in the second pipette as in the first, the only difference being that a longer time is required in the latter, as the chemical action is less active. The difference in the reading obtained in the measuring tube and that obtained after the CO_2 was removed gives the volume of oxygen, or, as before, the percentage of oxygen in the flue gas.

Finally, the remaining gas is forced into the third pipette, which contains cuprous chloride, absorbing the carbon monoxide. The gas is passed back and forth until no further absorption takes place.

Subtracting the reading on the measuring tube from that obtained after taking out the oxygen gives the amount of carbon monoxide in the gas, or the percentage of CO which is in the flue gas.

The reagents for the third pipette are prepared by putting a layer of three-eighths of an inch of copper oxide in a glass bottle, then filling the bottle with copper chips or shavings and hydrochloric acid (HCl), and allowing it to stand for 24 hours. The liquid should be as clear as pure water, and will keep until needed. As the supply gives out, the necessary ingredients are added to keep up the proper solution.

After the CO has been removed, the reading on the scale should represent the volume of nitrogen present, or the volume of nitrogen plus any impurities not absorbed by the reagents.

The apparatus as described takes up but small space, is comparatively inexpensive, and can be operated by anyone, and where the apparatus is ready it takes but about 10 minutes for the average man to run off a test.

Knowledge of Theory Should be Added to Practical Experience.

Probably not the least benefit which is to be gained from the carrying on of investigations and tests of this sort is the result which is bound to follow on the part of the men who handle the work.

As soon as a man learns something in regard to the theoretical side of the work in which he is engaged, it immediately places him in an advantageous position for handling his work over a condition where he is in ignorance of the means whereby it is possible to improve his conditions.

The mere fact that any man in his work is acting only as a machine, to follow the arbitrary instructions laid down by someone else, is sufficient to cause him to lack interest in his efforts, and, on the other hand, any man who has the right stuff in him to make a proper man for handling high-grade machinery immediately is spurred on to his best efforts when real engineering work is entrusted to him, and he finds himself capable of understanding the theoretical side of his duties, and made capable of conversing intelligently on his work.

[*The end.*]

Proposed Public Works for Vladivostok.

Roger S. Greene, American commercial agent at Vladivostok, Siberia, describes at length plans that are contemplated by the municipality for the construction of a series of public works which will require an expenditure of at least $5,000,000 or $6,000,000 United States currency.

The street-railway and electric-lighting propositions are the most attractive at present, says Mr. Greene. The great amount of traffic on the one or two principal streets would make it possible for a railway to serve a very large number of people with a comparatively short and simple system, the present idea being to construct a line from the eastern end of the town, along the main street to the railroad station and to the market. One branch line northward into the country on the Aleutskaya or Kitaiskaya streets to First River, about three miles, would probably be also popular, as it would permit people to live in the suburbs of the town. There would probably be a good chance for a line around the bay as well. First and second-class cars would probably be necessary. Altogether about eight miles of line should be constructed. The streets are for the most part wide enough to accommodate a double track.

As regards lighting, there are already a number of private plants, most of which supply other houses in their vicinity. This would be an important matter to be considered if concessions were applied for. The city at present states that it will want for street lighting to begin with about 200 lights of 1,000 and 500 candlepower, and it is estimated that the private consumption will be from 5,000 to 7,000 lights of average candlepower. An increase would of course depend on the price and on the arrangements that could be made for limiting the private plants.

Practical Hints on Illumination.

[*Continued from page 225.*]

enough to serve the purpose of attracting attention.

In the concealed style there are two divisions, trough reflectors and cone reflectors, including in the last all cone-shaped reflectors, whether molded glass or silvered.

The trough reflector should be used where the window display rises from the bottom of the window in the shape of models for dresses, or where the back of the window is used, as the distribution of the reflector is toward the rear and downward.

The cone reflector should be used where the base of the window alone is to be used, so as to concentrate all the light upon the goods.

The Nernst or units of the same size are used satisfactorily in Brooklyn with reflectors to throw the light down, the unit being high enough not to interfere with the sight.

The writer has in mind a window where the trough reflector is used in conjunction with an electrolier, but the latter is fitted with holophane globes, which eliminate the intense light factor by diffusing the light. This arrangement is both attractive and efficient.

The tendency of the cone reflector is to produce spots, while with the trough reflector the illumination is uniform and even.

In lighting the window with either the border lights, trough or cone reflectors, the units should be on alternating switches for purposes of economy.

Picture Galleries.

The best arrangement for this class of lighting is the trough reflector, for the same reasons as above.

A new arrangement, at least to the writer, was suggested by the desire of a customer to light a small gallery economically, both as regards wiring and use. The arrangement installed was a Frink reflector on a pivot, run along the center of the room and placed high. A handle was attached so that the reflector could be turned to either side of the gallery, the result being highly satisfactory.

In the Metropolitan Art Gallery the luminous arc is being installed, and the experts of the gallery are of the opinion that this gives the best light of any artificial source.

Residence Lighting.

The class of residences considered will be those belonging to the "middle class," where economy is necessary. Where the person is willing to spend a large amount, the engineer can give full play to the artistic, but most of our residence business is with the people who practice economy.

Parlor.—This room is used for entertaining and receiving callers only, so the illumination should be general. In the average room of 12 by 15 feet a center electrolier with the units extending about a foot from the ceiling, and four or five eight-candlepower lamps will give good light, the units pointing outward at an angle of 45° and equipped with either an etched shade or holophane goods. One or two plug outlets can be utilized for a lamp, fan or other apparatus.

In a room of this shape the center fixtures are sufficient, but when the room is long and narrow side-wall brackets can be used to advantage.

One point in this style of illumination is to have the lights pointing downward, for it can be readily seen that otherwise the light would be thrown on the ceiling and wasted to some extent. The side-wall brackets can be fitted with holophane reflectors in ground-glass shades, and can be either pointing upward or downward. This is a great deal a matter of taste, as both arrangements can be made to conform to the other illumination by the means of proper shades.

For the lamp, which is ornamental rather than useful, a small candlepower light can be used. Two four-candlepower units will be sufficient in most cases, and in any case two eight-candlepower would be enough, which would be determined by the density of the art glass canopy.

Sitting Room.—This room is used for sewing, reading, and is the living room of the house, so that general and some special illumination is needed.

A center fixture with three or four outlets and an outlet near the desk will prove satisfactory, but each purpose must be considered.

In reading, a light of two to four candle-feet is plenty, and the same on the desk or for sewing; and while, theoretically, a light from above and behind is best, the writer's own taste is for the old-fashioned reading lamp with a white enameled interor and green exterior, first, because the resultant light is good, and second, the eyes, on being lifted from the book do not encounter the same intensity, but are rested by the soft light diffused by the green shade; while with the other style the light is practically the same whether one's eyes are on the book or not—in fact, in all home lighting, if the illumination be uneven, the eye is rested in the change from bright to less bright spots.

For sewing, an extension cord can be attached to an outlet and the lamp hung directly over the machine.

Dining Room.—The one point to be illuminated in this room is the table, and this can be done by one unit with a large reflector. The reflector can be covered with some dark material in keeping with the decorations, either crepe paper or some texture, which will serve the purpose of an expensive glass design.

Side-wall brackets are not essential, but can be used if at any time a more general illumination is desired, such as when the guests are seated around the sides of the room.

Kitchen.—The kitchen of today is not the large one our ancestors were accustomed to, and in the average home one unit in the kitchen is sufficient.

Halls.—In the halls a bright light is not necessary. In the lower hall or entrance an upright fixture from the newel post in a foyer hall gives good illumination, though the overhead light is to be preferred, for the tendency of the unit upon an upright is to throw the light up, whereas it should be thrown down.

A ground glass or opal sphere can be used and is perhaps more artistic than a common reflector or shade, the lower hall unit to be controlled by a two-way switch.

In the upper halls a light at the head of the stairs on a side-wall bracket, to serve both for the stairs and hall, and if the hall is long another unit at the opposite end will light the hall well.

Bathroom.—An eight-candlepower unit on each side of the mirror, either with a shade or frosted lamp, will suffice, controlled by a switch at the entrance.

Bedrooms.—The most economical arrangement here would be to have a center fixture of two or three lights and use the movable brackets, so that the light can be used at the dresser, or, if a reading light is desired it can be placed near the bed. In a small or hall bedroom a side-wall bracket with an eight-candlepower lamp is enough.

The most convenient arrangement is to have two eight-candlepower units on each side of the dresser, controlled by a switch on the side of the dresser or wall, the center fixture to be controlled by a switch by the door and fitted with proper reflectors.

In all houses fitted with electric light an extra switch should be provided in the bedroom controlling one light in each room on the first floor and the halls, so as to be able to light these rooms instantly in case of emergency.

The turn-down lamps can be used to splendid advantage in residences. There are many places where a bright light is not required continuously, but where a dim light is of great service. The turn-down lamps fill this need fully and at slight operating cost. Every residence using electric service should have a supply of these lamps.

Factories.

In factory or machine-shop lighting the problem is generally the same as in a large office building.

Each operator should have a unit over his machine, and this will hold true in most all factory lighting and the like. The incandescent lamp should be used for special lighting.

In foundries, etc., where the walls are dark and the light is not so much on a special line a lamp is needed to throw the light down and to be near the color of daylight. The arc does not meet both these requirements, and the lamp which has proved most satisfactory in Brooklyn is the Nernst lamp, as the unit is small and can be distributed, and the efficiency is high.

The light from the arc is absorbed by the side walls, and the Nernst distribution is below 30°.

Sign Lighting.

The tendency of a customer is to put too large a unit in a sign, thinking to make a greater display, whereas, he is more likely spoiling the effect of his sign.

The smaller the candlepower in a lettered sign the more distinct is the outline of each letter; with a unit too large the sign presents a blur.

A four-candlepower unit is large enough for any ordinary sign and a two-candlepower unit has proved satisfactory in outlining letters.

For the panel sign a four-candlepower lamp is sufficient, although eight candlepower will of course give added illumination; if a reflector is placed above the upper lights the sign will prove more readable.

Specialties.

Several types of lighting units have recently been pushed commercially for special uses.

Luminous Arc.—The luminous [or flame] arc is used quite extensively in many cities, notwithstanding the cost of the lamp, and it certainly attracts attention by the brilliancy and color of its light. It probably has a permanent field within a limited scope, but its advertising value will probably suffer as the number of lamps in use increases. For general illumination, independent of advertising uses, this lamp is not well adapted.

Cooper Hewitt Tube.—This type of unit is occupying a field in which it is giving good service. For photographic work it is very successful, and its use in factories and large buildings is becoming more general. The predominant violet rays are objectionable, although not injurious to the eyes.

Moore Tube.—The Moore tube is now being energetically pushed by the manufacturers, and is giving satisfaction in a number of places. Its color is more pleasing than the Cooper Hewitt and its efficiency is attractive, though its use is limited at present to large floor spaces. The commercial development of this type of lighting will be watched with interest.

QUESTIONS AND ANSWERS.

Exciter Trouble.

Question.

E. W. L., Waterloo, Iowa: We have a 35-kilowatt alternator excited by a bipolar exciter. The exciter was sent with the machine. Fourteen-inch brass gauze brushes were used on the exciter. The trouble came on the commutator. It did not overheat, but it cut down in about three months, so there was nothing left of it, and a set of the 14-inch brushes would only last about three nights. We tried all kinds of compound, with no results. Perhaps someone who may see this may have had some of the same trouble, and may be able to shed some light upon the subject.

Answer.

Perhaps the unusual wear upon the commutator was owing to a lack of electrical balance in the machine, due to improper armature or commutator connections. Or perhaps the brushes were incorrectly or carelessly adjusted when the machine was first put into operation. In the latter case the resulting starting would have sufficed to start the cutting, and the greater pressure by the brushes then necessary would have continued it. Another possibility is that the fault was in the brushes themselves, although as they were sent with the machine they were presumably all right at the start. Although, as in many other inquiries, the data are meager, perhaps some of the readers of the Western Electrician can extend helpful suggestions to this inquirer.

Wiring Distribution.

Question.

J. J. L., Milwaukee: By how much would the total mileage of copper for a proposed lighting plant be increased in a city if it were served from one large central station instead of from two smaller stations of equal capacity, together equaling the capacity of the larger station?

The city is about six miles long by three miles wide and would have probably about 10,000 customers, assumed to be equally distributed.

Answer.

In order to calculate the amount of copper mileage without actually laying out practical routes we need to determine the average distance from station to consumer and multiply by the number of consumers.

Although, of course, a city in practice is served by large feeders which emerge from the central station or stations and supply power to transformers and smaller feeders, nevertheless, for the present purpose, we can assume that there is an individual copper circuit to each customer.

After the total copper mileage has been obtained by proceeding from this assumption, the cost of the copper plant can be obtained by multiplying this figure by a constant which represents the difference between the assumption and actual practice.

In the case of two stations serving two districts, the city divides itself into two equal squares having sides three miles long. The average length of circuit if measured along streets, i. e., parallel to the sides of the square, is for each equal to one-half the side of the square.

Mileage for each square = 5,000 (customers) × 3 (miles) × ½ = 7,500.

Total mileage = 7,500 × 2 (squares) × 2 (wires per circuit) =30,000.

The factor ½ can be proven mathematically to represent the ratio between the average length of circuit to the length of the side of the square.

In the case of one central station serving the entire city a similar mathematical demonstration will prove that the ratio of the average length of circuit to the smallest side of the rectangle is ¾.

Mileage for rectangle = 10,000 × 3 × ¾ = 25,500. Total mileage = 22,500 × 2 (wires per circuit) = 45,000.

The gain in copper therefore from using two central stations is represented by a decrease in copper mileage of 15,000 (i. e., the difference between 45,000 and 30,000.) This, of course, is offset by economies due to having labor and equipment centralized, and other factors depending upon special features of the city would need to be studied in order to make a comprehensive comparison.

THE SMALL CENTRAL STATION.

Practical Hints on Its Construction and Operation.

CHAPTER XI.

Instruments.

Meters.—In relation to the importance of supplying the central station with first-class meters there is little or no difference of opinion. Without accurate measuring instruments the station cannot operate with any degree of success. The possibility of maintaining a low operating cost depends largely upon the reliability of the indicating apparatus. The ability to know at all times the load conditions and thereby to gauge the operating needs is entirely dependent upon meter readings, the accuracy of which immediately becomes of vital interest.

Ammeter.—The ammeter is useful primarily to indicate the safe load which may be put on the dynamo. Where two or more dynamos are run in parallel the ammeter is necessary to effect a proper division of the load. It also indicates, to a large extent, what is going on outside of the dynamo room. A short-circuit, an open circuit, abnormal load variations, the blowing of a safety fuse and other little happenings that go to break up the monotony in the electrician's existence, all produce a certain effect in the flow of current and are faithfully indicated by a good switchboard ammeter. The idea that any combination of a main coil and index will pass muster for an ammeter is not dead yet, and while it is true that the same precision is not required in the ammeter that is imperative in the voltmeter, it is also true that an inferior instrument is sometimes worse than none. In selection the following points should be carefully looked to:

Durability.—This condition excludes the use of wood or any case which is not practically dustproof. Wooden back boards are not sufficiently durable to hold working parts in proper position, and wooden covers commonly fit so loosely that the all-pervading dust finds entrance, the result being that working parts become clogged and scales in time are so grimy that they cannot be read.

Sensitiveness.—Even in instruments made with jewel bearings the combination of cheap imported jewels and badly made pivots gives results entirely lacking in sensitiveness after a short time in use. Good jewels and good pivots cost more, but not very much more, and the performance of the jewels and pivots in chronometer work is sufficient to shame the performance in most electrical instruments.

Constancy.—It is comparatively easy to make ampere indicators that will not change with time.

Voltmeter.—On the voltmeter and its intelligent use the success of electric lighting depends as much as the success of navigation depends upon the use of the compass. Analogy might go further, since the constant watch which the mariner keeps upon the compass is paralleled by the close attention which requires to be paid to the voltmeter wherever incandescent lights are run with any degree of success. If voltmeters were as reliable as ship compasses, life would be easier for attendants, and profits often more satisfactory to owners. The urgent demand for apparatus of this class brought into the field a large number of badly constructed and poorly designed instruments. A distinct change for the better, however, has taken place and instruments can now be had which leave little to be desired.

It is found more difficult to make a perfect voltmeter than a perfect ammeter, as the former carries at all times the full pressure of the system, and a small error here is fatal to good results. An increase of three per cent. above the normal pressure of an incandescent lamp will shorten its life by 50 per cent., as has been repeated often enough to be generally known; the statement is not only substantially true, but of sufficient importance to bear repeating many times. The human eye is not always to be relied upon, at least when applied to guessing at the proper candlepower of incandescent lamps. The confidence with which men of slight experience undertake to state offhand that a light is "about 16 candlepower" would be decidedly humorous if the results of such confidence were not so disastrous.

Those most experienced in photometric work understand perfectly well the entire unreliability of the eye to estimate light values. This can easily be understood if we remember the miraculous adaptability of that organ. To illustrate, it is possible to see clearly and with comfort under the noonday sun of a June day, while at other times it is possible to see satisfactorily with an illumination not more than one-millionth as great. Photographers have this fact forced upon their attention by being obliged to proportion the exposure of a sensitive plate in inverse ratio to the illumination, and accordingly produce equally bright and clear negatives by an exposure of one-tenth of a second or twenty-four hours, as the conditions may demand.

Selection of Instruments.—In selecting voltmeters and ammeters a broad distinction must be made between switchboard instruments, portable instruments and standards. In a standard instrument the all-important quality is constancy; it should, if possible, contain within itself means for verification. Portable instruments should be direct reading and easily handled; a "dead-beat" action is very desirable. Switchboard instruments may be heavy without detriment and should have large, easily read scales. On a switchboard voltmeter a "lubber line" or its equivalent is desirable. It may be necessary to explain that the "lubber line" of nautical parlance is a mark made on the ship's compass, by the help of which a "lubber" may, in case of necessity, perform the duty of helmsman. Similarly, by providing the indicator scale with an adjustable stationary index, which can be set at the point where the pressure should be maintained, it is possible easily to note a variation at a distance where the scale divisions would be invisible.

Instruments depending for their action on the extension of an electrically heated wire and on temperature variation of either carbon or metals are criticized as not remaining constant. These two kinds of action are attractive to the designer on account of the relatively large effect possible to obtain, but experience seems to prove that molecular change takes place with comparative rapidity, altering the physical values on which the accuracy of the instrument depends.

Instruments containing soft iron, acted upon by a coil to produce the motion required, have been in use from a very early day, and display the greatest ingenuity and variety in the actions produced. Instruments of this class may be very good or very bad, according to the skill and knowledge with which they are designed or constructed. This class may be divided broadly into attraction and repulsion instruments, and again into classes which may be described as armature instruments and core instruments. In each case the pointer is attached to a soft-iron needle in some form or other, which may be called the armature when acted upon by another piece of iron and the core when acted upon by the coil.

The repulsion instrument always contains an armature and a core, and when used for direct current, may be set down as unsatisfactory on account of a large error due to hysteresis. This error is the main difficulty with all instruments containing iron; to make a perfect instrument containing soft iron, the same grade of material is required which transformer builders have looked for in vain, and which has been accurately described as "an iron in which molecules turn on anti-friction rollers." Hysteresis, according to practical observations, has two distinct manifestations, which are shown by the effects exhibited by instantaneous change of magnetic value and changes which take several hours for their exhibition. To illustrate: An "iron" instrument, after reversal of the current, will show a certain difference immediately. Such difference, after some hours, may have altered decidedly in value.

It should be remarked that the quest for a perfectly pure and perfectly annealed grade of iron, which is often entered upon with zeal, had better be abandoned at the start. Perfectly pure iron can be had and perfect methods of annealing are not difficult, but the result is very far from eliminating hysteresis.

Switchboard instruments with illuminated dials are useful. To render such light fairly effective, other lights should be kept away from and out of range of vision. Light should be so placed and so shaded as to throw the light directly where it is needed, leaving the eyes entirely free from any naked incandescent carbon. This is the fundamental principle of all good effect in artificial lighting and is applicable nowhere with more force than to lighting of switchboards.

Prices of Instruments (Direct Current).

Ammeters. Capacity, Amperes.	Price.	Voltmeters. Capacity, Volts.	Price.
10	$25.00	85	$28.25
15	25.00	100	28.25
25	25.00	175	31.50
50	25.50	350	35.00
75	26.00	525	35.00
100	26.50	750	37.00
150	27.00		
200	28.00		

Wattmeters.—The most commonly used type of wattmeter, and probably the one best suited to the different needs of central-station service, is that known as the commutator-type meter.

It consists primarily of an electric motor direct-connected to a generator. The motor of this direct-connected unit consists of the field coils and the armature with its commutator. The field coils are connected in series with the load to be measured and are wound in a properly constructed meter, entirely without iron.

The armature, which should also be wound without iron in its makeup, has in some instances a drum winding. This armature is connected, through a fixed resistance, across the line like an incandescent lamp. This motor armature is rigidly connected to a shaft upon which is also mounted a thin metal disk. This disk acts as the armature of the generator alluded to as part of the direct-connected unit.

The fields of this generator consist of permanent steel magnets having a fixed position. The revolution of this disk between the poles of these permanent magnets sets up Foucault or eddy currents in the disk. The reactionary effects of this disk are made use of in the meter as a damper which tends to destroy the inertia moment of the moving element.

The metering function of this type of meter is performed in the following manner:

Assuming that we are describing a properly constructed meter, no considerations of iron saturation will occur. The torque or pull of the armature is directly dependent upon the product of the field and armature strength. The strength of the field is dependent upon the load, since the heavier the load the greater the amount of current flowing through the field coils. The strength of the armature is directly dependent upon the voltage of the system, since it is bridged across the line exactly like a voltmeter. We have therefore a pull which is proportional to the voltage of the system, measured by the armature, multiplied by the amperage of the load, measured by the fields. This product is the load in watts; hence the name of the instrument measuring it.

Friction, of course, detracts from the absolute accuracy of the mechanism, but, being extremely small and practically constant at all loads, it is negligible. Friction, however, increases with age and a good meter should be provided with some means for compensating for this variation in the loss. The satisfactory operation of a meter over a length of time is absolutely dependent upon this compensating device, and in purchasing meters the central-station manager should see to it that all meters submitted are so built.

In purchasing, select a meter with a high torque, supplied with a compensating friction device. A high torque will insure heavy permanent magnets, which in turn produce large Foucault currents, thereby reducing the work done by the meter in overcoming friction to a small percentage of the total work done.

Good meters should be capable of operating continuously on a 25 per cent. overload without damage and should read accurately on any overload up to the point of destruction.

Where inductive loads are to be carried, special meters should be provided.

Recording Wattmeters for Lighting Service, 100 to 125 Volts (Direct Current).

Amperes.	Lamps.	Price.
5	10	$13.75
10	20	15.00
15	30	17.50
25	50	20.00
50	100	25.00
75	150	35.00
100	200	40.00
150	300	50.00
300	600	65.00
600	1,200	95.00

Recording Wattmeters for Motor Service, 200-250 Volts (Direct Current).

Horsepower.	Lamps.	Amperes.	Price.
1¼	20	5	$ 16.25
2	40	10	17.00
3½	60	15	21.25
7	100	25	25.00
15	200	50	30.00
20	300	75	40.00
25	400	100	42.50
40	600	150	57.50
80	1,200	300	75.00
160	2,400	600	110.00

[To be continued.]

Problems of Underground Railway Operation in London.

[From the London correspondent of the Western Electrician.]

It cannot really be said that the electrification of the District company's underground or tube railways in London has so far been a financial success. At first sight this seems something of an enigma, but closer investigation may reveal several reasons. At any rate, the line is not paying, and the expedient of increased fares is to be tried.

One reason for this state of affairs is the exceedingly keen competition of motor 'buses, which has prevented that extra traffic being carried which was looked to in 1902, when the change-over was first taken in hand. For, be it remembered, the motor 'bus is entirely a creation of the last three years. In fact, it may be said, despite its liability to breakdown—which is getting rarer every day—that the motor 'bus is, perhaps, unconsciously solving one of the problems put before the Royal Commission on London Traffic, viz., the provision of quick through communication. A prognostication of the early days of electric traction on railways was that the omnibus would be swept off the streets. And it is being swept away—the horse omnibus—but its place has been taken by a far more formidable competitor in the motor 'bus, an eventuality rather undreamed of five years ago when electric traction was thought of on the "Inner Circle."

The newly opened Baker Street and Waterloo "tube" railway has been forced to revise its fares—as a result of bitter competition by the 'bus, which carried passengers the whole length of the railway for the same fare—four cents—and actually did the journey quicker. By its flexibility, a motor 'bus lends itself to routes where railways are not, and where a tramway is out of the question—this is to be seen all over London—and it gets traffic, in consequence, which would otherwise find its way to the railway, for instance, at some inconvenience, of course, to the passengers.

Further, the capital burdens of these 'bus companies are not to be compared with that of the District Railway, nor have they parliamentary conditions imposed upon them. One of the chief reasons for the District company having to put up its fares is that its workmen's traffic, which it is bound by Parliament under an old act to carry at fares which actually entail a loss, has increased very largely. Again, the railway companies have a genuine cause for complaint against the local authorities in respect of taxation. In spite of their going to great expense to facilitate the public, every new building which is put up in connection with that work is promptly rated to the utmost. One looks in vain for co-operation between municipalities and even such bodies as railway companies, any concessions to which are surely in the public interests.

Before long, too, I believe the type of rolling stock which has been selected will be called in question, and as some support to this view I may mention that the Metropolitan company, which is joint owner with the District company of the Inner Circle, is fitting up three trains on the old compartment system. Some of the officials of this company believe that an error was made in adopting the American saloon car, for not only has the cost of the extra train staff been higher than was expected, but the time taken in unloading and loading at each station is distinctly longer when the traffic is at all heavy. In addition, the District company is experimenting with a train having only a man in front and one at the rear, these having control over all the doors, instead of there being an attendant on each platform.

With the steam-drawn compartment trains there was comparatively little discomfort—even at rush hours—in getting in and out of the various compartment doors, and there was an absence of that continual "Hurry up, please," which is now in vogue, and which becomes somewhat irritating. Further, it was a simple matter for an active man to board the train in motion. With the electric cars, everyone wishing to get onto a train makes for the same door, which is also used as an exit by those passengers wishing to alight. The result is that not only is there more time taken up in loading and unloading but a continual pushing to get in, for fear that the doors, which are controlled by the gateman, should be prematurely closed, either to the exclusion of some, or that a passenger will be caught by the door—a circumstance which has occurred on many an occasion.

Some railway managers are of opinion that there being now in many cases electric-railways, "tube" railways and motor 'buses, all catering for the same route, a standard fare should be forced which would equally distribute the traffic. Certainly the 'bus people are hardly likely to agree to the proposition at present, although they may have to come to it in the future. On the other hand, the increased fares which will shortly come into force upon the District Railway have created a regular furore, both in workingmen circles and among other passengers. With the new regime, season-ticket fares are being increased, in some cases, as much as 50 per cent.

One other point may be referred to, viz., power-house expenses. These, of course, enter largely into the question of total expenses. All the companies that have converted steam lines to electric traction so far, with the exception of the North-eastern, have erected their own power houses. Little information, however, is available on the point of cost per unit, but figures for London have been mentioned that are certainly higher than those charged by the Newcastle Power Company to the Northeastern Railway Company, where the cost of transferred energy is 0.6d (1.2 cents) per kilowatt-hour.

Schenectady Branch of the Institute.

The Schenectady branch of the American Institute of Electrical Engineers announces a course of weekly lectures on electrical and allied subjects to be given during the season of 1906-1907. Saturday evenings have been selected as the time for the lectures. One Friday evening each month will be set aside for the regular monthly meeting of the branch, when opportunity will be given to discuss the current proceedings of the national body and present original papers. No lecture or meeting will be held on the Saturday evening of that week.

It is intended to increase the value of the lectures by stimulating discussion among members of the branch. Each meeting will include a general informal discussion of the lecture or paper presented, and active participation in these discussions is expected from all members. Members of the branch not also members or associates of the American Institute of Electrical Engineers who take a conspicuous interest in the work of the branch either by valuable contributions to the discussions or otherwise will be rewarded by having their expenses paid to the New York meetings of the Institute. It is hoped that several members may be selected each month for these free trips to New York.

The officers of the branch are: Honorary chairman, C. P. Steinmetz; chairman, D. B. Rushmore; first vice-chairman, E. H. Anderson; second vice-chairman, H. L. Smith; corresponding secretary, E. E. F. Creighton; assistant corresponding secretary, W. C. Andrews; recording secretary, E. W. Allen; treasurer, A. S. Kappella; librarian, H. E. White.

Committees are made up as follows, the chairman being a member of each by virtue of his office:

Advisory—C. P. Steinmetz, A. L. Rohrer, H. G. Reist and E. H. Anderson.

Meetings and Papers—E. E. F. Creighton, A. L. Rohrer, H. E. White and W. C. Andrews.

Reception and Refreshments—H. L. Smith, E. W. Allen, J. J. Frank, J. B. Crane, C. H. Wheeler.

Membership—E. B. Merriam, J. B. Crane, C. H. Hill, V. E. Goodwin and J. T. Flickinger.

Administrative—D. B. Rushmore, H. L. Smith, E. E. F. Creighton and A. S. Kappella.

The first meeting of the season was held at the Alpha Delta Phi fraternity house, Union College, on September 8th. The gathering was in the nature of an informal smoker, and plans were discussed for the ensuing year. During the evening addresses were made by Prof. C. P. Steinmetz of the General Electric Company and Union College, and by David B. Rushmore, the chairman of the branch. The speakers outlined the suggested programme for the winter. Over 30 prominent engineers, many of them from outside of Schenectady, have accepted the society's invitation to speak.

Prof. Steinmetz in his remarks recalled the early days of the General Electric Company, when a close acquaintanceship and exchange of ideas was possible between the experienced men and the beginners. The growth of the business has so segregated the members of the different departments that this intercourse is no longer practical, a condition greatly regretted by those who appreciated the advantages derived on both sides from the former closer relationships.

It is, therefore, intended to make the lecture nights not only of an instructive nature but to furnish thereby an opportunity for social gatherings, where acquaintances can be made between the local engineers, the students in the colleges of Schenectady and Troy, and all others interested in electricity and its applications. The general expressions of approval with which the plans were received leave no doubts as to the success of the undertaking. E. B. Merriam of the General Electric Company is chairman of the membership committee and is already getting busy enrolling new members. A special membership, with dues one-half the regular branch dues, is proposed for all men in the General Electric testing department, the American Locomotive Works testing department, Union College and the Rensselaer Polytechnic of Troy.

Electricity in Linseed Oil Manufacture.

New industries are constantly joining the ranks of those operated by electricity. One of the most recent establishments to adopt this method of drive is the Archer-Daniels Linseed Company of Minneapolis, Minn. The process of making linseed oil and cake from the raw material is interesting, and the induction motor has been found to adapt itself well to the cycle of operations.

The first step in the process in which the motor has been adopted is at the storage bins. The raw material, flaxseed, is elevated by a 30-horsepower induction motor to the cleaning room. Here the seed is freed from dust and dirt by motor-driven fans, the refuse being sucked up and carried to the waste-bins by exhaust fans driven by the same means. The flaxseed then goes to the grinding mill, the elevator and conveyors being motor-driven. The grinder is operated by a 60-horsepower 2,300-volt induction motor, and the seed is reduced to meal of about the fineness of graham flour. The flour is then cooked about an hour and a half in steam-jacketed kettles, and the oil is expressed by hydraulic presses, the pumps for which are driven by induction motors. From the presses the oil is pumped first to large vats, then filtered to tanks on a lower level, and again pumped to storage tanks. All these various pumps are driven by induction motors.

The switching and wiring arrangements in this establishment are very complete. All the motors of 35 horsepower and over are operated directly at 2,300 volts, the connections being made through three-phase lead-covered cable in iron conduit. Each motor has a controlling panel, and these are grouped on the different floors, so that all the motors in one department can be controlled from one point. The central controlling panel is located in the basement and receives the power from the transmission lines at 2,300 volts and distributes it through non-automatic oil switches and expulsion fuses to the various motors in the building. In an annex outside the main building a 56-kilowatt three-phase transformer is installed for supplying current to the 220-volt induction motors of small power. In this transformer house there is also a 20-kilowatt single-pole transformer, arranged for lighting the building. The current for the transformers is first brought to the main switchboard, and then distributed to them through oil switches. From the transformers the wires run directly to the small motor and lighting panels. The complete electrical equipment of this interesting plant was furnished by the General Electric Company.

Annual Meeting of the Allis-Chalmers Company.

The annual meeting of the stockholders of the Allis-Chalmers Company, held in Jersey City, September 6th, was marked by an unusually large attendance, more than 65 per cent. of the entire capital stock being represented. The general feeling of harmony and satisfaction that prevailed in support of the present administration was particularly noteworthy. The re-election of Mr. W. H. Whiteside to the presidency, and his election to the directory, to fill the longest term in the gift of the company, assures a continuance of his aggressive policy and will eliminate any feeling of uncertainty for some years to come. In the following unanimously adopted resolution the feeling of satisfaction felt by the stockholders is strongly expressed:

"Resolved, That the stockholders in annual meeting assembled express their appreciation of the services of President Whiteside and assure him of their cordial support for the ensuing year."

It is noticeable that the company has secured about $4,500,000 worth of orders for classes of machinery not hitherto manufactured by it, and this amount would have been very largely augmented had the completion of the improvements and extensions of the West Allis plant not been delayed by the labor troubles to which the contractors erecting the new buildings have been subjected. Notwithstanding the fact that the volume of orders taken for Allis-Chalmers steam turbines has been beyond all expectation, the demand for Reynolds-Corliss engines also shows an unprecedented increase over preceding years.

In the electrical field the large orders received have hastened the occupancy of the new shops at West Allis provided for this branch of the business, which, in spite of their unfinished condition, are already in partial operation. Some of the largest corporations in the country have awarded the Allis-Chalmers Company contracts for their complete power and electrical equipments, thus indorsing President Whiteside's policy in providing the new departments established during the last year, which now enable the Allis-Chalmers Company to take orders for complete installations. The acquisition by the company of Christensen air-brake and compressor patents rounds out the list of products required to enable the Allis-Chalmers Company to enter the electric-railway field fully equipped for that service.

"Brilliant" Flame Arc Lamp.

A flame arc lamp known as the Stanley-G. I. "Brilliant" has been placed on the market recently by the Stanley-G. I. Electric Manufacturing Company. These lamps are made for either alternating-current or direct-current circuits, both types being of the converging-carbon construction; i. e., both carbons feed downward toward each other, so as to focus the arc at the same point, thereby eliminating shadows and preventing the formation of non-conducting slag at the carbon tips.

The mechanism of the direct-current lamp is of

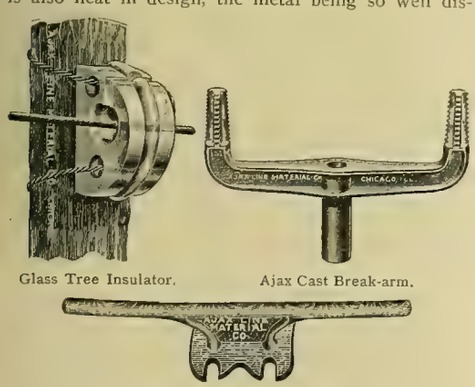
"BRILLIANT" FLAME ARC LAMP.

the differential-magnet type, while that of the alternating-current lamp is of the differential-disk motor type, the carbons in both cases being regulated by chain feed. Both types are designed to burn two in series on 110-volt circuits, standard resistance being furnished with the direct-current and a reactance coil with the alternating-current lamps. All lamps are adjusted for 12 amperes and an arc voltage of 45. Both golden yellow and white-light carbons can be used on the direct-current lamps, but golden yellow only will be furnished for the alternating-current lamps.

Weatherproof steel casings, finished in bright japan, are the same for either lamp, and are interchangeable. The accompanying cut shows the lamp complete. The feeding mechanism is contained in a separate compartment of the case, carefully partitioned off from the arc, so that it is unaffected by the heat or loose slag.

New Line Construction Specialties.

Herewith are illustrated three new line devices made, respectively, of cast iron, malleable iron and glass. The cast break-arm, which has the usual 12-inch spread, shows how a neat form can be made without sacrificing strength. The Ajax cleat is also neat in design, the metal being so well dis-



Glass Tree Insulator. Ajax Cast Break-arm.

Ajax Cleat.

NEW LINE-CONSTRUCTION SPECIALTIES.

tributed as to give a nine-inch length, or an inch more than usual. Besides, it is novel in having a rounded back, so as not to rock on the pole. The glass tree insulator, said to be the only one-piece tree insulator on the market, has the glass annealed to toughen it, and is easily slipped over wires already in place. The eccentric location of the slot keeps the wire from snapping out accidentally, and the insulator is easily lashed to the limb or trunk of a tree. This insulator is the invention of Mr. Scott C. Cutter. For electric-light work it is offered in a size taking wires up to one-half inch outside diameter.

These devices as well as other insulators and fixtures are made by the Ajax Line Material Company of Chicago.

Motors for Crane and Hoisting Service.

The Western Electric Company reports an increasing demand for its type H motor, a special design, constructed for crane and hoisting service. The demand for a motor of special rigid construction, compact in design and capable of withstanding the most severe crane and hoisting duty, led the company to manufacture the H-design motor, illustrated in Fig. 1.

The motor is equipped with two closely fitting

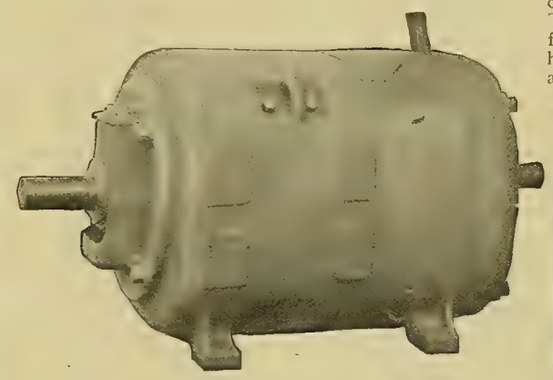


Fig. 1. View of Motor.

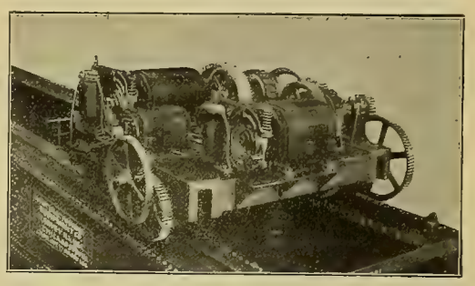


Fig. 2. Forty-ton Crane with Three Motors.

MOTORS FOR CRANE AND HOISTING SERVICE.

doors, making it perfectly dustproof, but leaving the commutator and bearings easily accessible to inspection. The motor is especially adaptable to intermittent service and will readily withstand the sudden shocks and strains which are peculiar to the service.

Cranes manufactured by the following are among those equipped with type H motors: Niles, Bement Company of Philadelphia, Whiting Foundry Equipment Company of Chicago, Alliance Machine Works of Alliance, Ohio, Case Manufacturing Company of Columbus, Ohio, Cleveland Crane and Car Company of Cleveland, Ohio. In all cases the motors are said to have proven very satisfactory, demonstrating their special adaptability to the service. Fig. 2 shows a 40-ton electric traveling crane manufactured by the Whiting Foundry Equipment Company, equipped with three Western Electric type H motors.

Hoisting service depends very largely upon torque. The torque of an electric motor is directly proportional to the magnetic flux and also to the current flowing through the armature. In a series-wound motor the flux is increased in almost direct proportion to the current. A torque is thus developed, which, up to the point of magnetic saturation, is approximately proportional to the square of the current. Beyond the saturation point the torque does not increase so rapidly. The speed of a series-wound motor decreases with an increase in the magnetic flux, resulting in a decreasing speed with an increasing load, a very essential characteristic, as it permits of using this type of motor without depending too largely on the operator for adjusting the speed to the load. The H design is said to be such that the characteristics of the ordinary series-wound motor have been accentuated. To accomplish this the magnetic circuit is of large area and low density under normal operating conditions, permitting a great increase in flux with an increase in load before the saturation point is reached. The armature has a minimum reactance upon the field, permitting operation through wide changes of load without sparking, and with the brushes in the fixed central position necessary for reversible operation.

Chicago Electrical Show.

The annual meeting of the stockholders of the Electrical Trades Exposition Company was held in Chicago on Tuesday, September 11th, for the purpose of electing directors for the ensuing year. The following-named directors were elected: Samuel Insull, Charles E. Gregory, G. H. Atkin, Stewart Spalding, Ellsworth B. Overshiner, George B. Foster, T. P. Gaylord, Homer E. Niesz, H. B. McMeal, W. W. Low, J. P. Cracraft. At a meeting of the board of directors immediately following the stockholders' meeting, the present officers were re-elected as follows: President, Samuel Insull; vice-presidents, Ellsworth B. Overshiner and Charles E. Gregory; treasurer, John J. Abbott; secretary, Stewart Spalding.

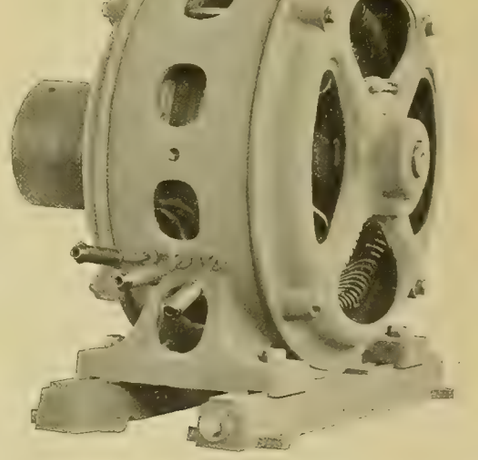
Managing Director Homer E. Niesz reports over 80 per cent. of the floor space in the main exhibit hall of the Coliseum already contracted for for the second annual electrical show, to be held January 14-26, 1907.

Bullock Polyphase Induction Motors.

The induction motor has two essential elements—the primary, or stator, directly magnetized by the supply current, and the secondary, or rotor, in which low-voltage currents are induced by the action of the primary. The primary windings are of such a character that, when supplied with alternating current, a rotary magnetic field is produced in the stator core. This revolving field, acting upon the rotor windings, induces currents therein, and rotation of the secondary is produced by the reaction between the secondary currents and the rotating field of the primary. The rotor windings have no electrical connection with any external circuit.

In the construction of Bullock induction motors, made by the Allis-Chalmers Company, the stator is of the slotted type built up of thin laminations of annealed steel, of high magnetic quality, specially treated and coated with insulating varnish. The punchings are securely mounted in a cast frame iron or yoke, which also carries the end housings and bearings. The yoke is provided with ample cored openings throughout, thus insuring free air circulation. The primary coils are made on formers of special design, which insure their absolute interchangeability; they are carefully insulated and securely held in the stator slots by wedges of tough material. These wedges are made very thin, so as to bring the coils as closely as possible to the inside surface of the stator, thereby increasing the power factor. The ends of the coils project beyond the stator core and are fully protected by the cast-iron yoke that supports the stator punchings.

The slotted rotor core, mounted on a cast-iron spider having arms shaped to act as the blades of a fan and force air through the motor, is built up of laminated steel of the same quality used in the construction of the stator and treated in the same manner. The rotor winding of the AN in-



BULLOCK POLYPHASE INDUCTION MOTOR.

duction motor is of the squirrel-cage type. Each slot contains a single copper bar bolted at the ends to short-circuiting rings which are shaped so as to present large radiating surface and insure cool running. The bars are held in place by overhanging tips of steel, which nearly close the slots, thus eliminating the necessity for wedges or band wires.

For motors of large capacity, or for those which must give a strong starting torque, the rotor is provided with a polyphase winding adapted to the insertion of resistance for starting under load; these motors are also used where variable speed is required.

These machines are provided with liberal bearing surfaces. The bearings are of the ring-oiling type and are carried in the end housings, thus insuring perfect alignment. In large motors the bearings are self-aligning and also adjustable to permit

compensation for wear and maintain a uniform air gap between stator and rotor.

Features for which the company recommends these induction motors for a wide variety of service are as follows: (1) They start under full load. The starting torque can be varied as conditions may require. (2) They run at approximately constant speed, regardless of load. The machine cannot run away when the load is thrown off. (3) They are readily started and stopped as a direct-current shunt motor. (4) No starting motor, exciter, exciter switches, friction clutch, field rheostats or field-current indicators are needed. (5) They are simple in construction (having two essential parts only), without delicate parts such as commutator or brushes. This insures absolute freedom from sparking, flashing and burning, which often accompany sliding contacts. Induction motors do not require the skilled attendance that direct-current or synchronous apparatus always needs. They are very substantial in construction and the cost of maintenance and attendance is therefore reduced to a minimum. The voltage in the rotating part is so low that insulation break-downs do not occur.

These motors are adapted to any service, but are especially suited for certain lines of work; for example, in flour mills, powder mills, paint mills and mines, or wherever there is special fire risk or danger of explosion. They are also especially adapted to purposes where constant speed is essential as in cotton mills or silk-weaving plants, paper and cement mills. If necessary, they can be installed in places not readily accessible, as they are easily adaptable to distance control.

Indiana Telephone Items.

The Lafayette Telephone Company has issued new stock to the amount of $100,000. The money will be used for the improvement of the system. The company will install a modern switchboard and make other improvements to better the service.

A hundred telephones were thrown out of service in Centerville, caused by shot from a gun in the hands of a boy piercing the cable.

The managers of the Huntington branch of the United Telephone Company, now operating with the Central Union Telephone Company, have announced that the Huntington plant would be improved extensively. This property was hastily and cheaply built.

Charles S. Norton, secretary of the Indiana Telephone Association, has gathered and tabulated some interesting statistics relative to the progress and development of the Independent telephone business in this country. Mr. Norton says few people comprehend the magnitude of the Independent telephone movement.

A new telephone plant, to be owned and controlled by residents of Huntington and Northern Indiana, will be built and equipped in Huntington within the next four months. A number of men are back of the project, and a strong stock company is now being organized and a petition for a franchise will be filed at once. It is stated that the City Council is in favor of a new system, and the people are sustaining the council in the encouragement given to the new company. An automatic system may be installed.

The New Long-distance Telephone Company has applied for a franchise to put in a toll-line station in Huntington, and this will be granted, it is said. When these undertakings are carried out, and the new plant now building in Marion is completed, the Independents will have practically regained all the territory lost some time ago.

Word comes from the coal-mine districts of Indiana to the effect that the managers are quite active in equipping their coal mines with the telephone systems. Where possible they are being wired by the local telephone companies, but in many places private telephone systems are being installed in and about the mines. S.

Telephone News from the Northwest.

A direct circuit is to be established between Crookston, Minn., and Fargo, N. D., by the Northwestern Telephone Exchange Company, which is now constructing such a line.

The Kittson Telephone Company contemplates installing an automatic exchange in Lancaster, Minn.

William Busch succeeds J. J. Maloney as manager of the Northwestern Telephone Exchange Company at Albert Lea, Minn. Mr. Maloney has gone to St. Cloud, Minn., for the company as district manager. He will have charge of 13 counties.

F. H. Peterson has resigned as manager of the telephone system at Clarion, Iowa, and James Bunn of Webster City has been appointed his successor.

J. W. Campbell, formerly contracting agent for the Iowa Telephone Company at Ottumwa, has been promoted to a similar position at Des Moines, succeeding Fred Ramsey.

The Vinton (Iowa) and Benton Telephone Company has sold out to the Corn Belt Telephone Company. The new owners plan extensive improvements to the system R

F. A. Miller, G. M. English and others have applied for a franchise to establish a telephone system in Lawton, Okla

CORRESPONDENCE.

Continental Europe.

Paris, August 30.—A sub-station of considerable size has been installed by the Compagnie Francaise Thomson-Houston for the city of Grenoble. It is designed to transform the current coming upon the overhead lines from the hydraulic plants of the Societé d'Energie Electrique de Grenoble-Voiron at 12,500 volts and 50 cycles three-phase current into direct current at 550 volts for supplying the electric traction lines of Grenoble. The outfit consists of two static transformers and two motor-generator sets. The latter groups are made up of a 350-horsepower three-phase motor coupled to a six-pole generator of 120 kilowatts.

The Societé l'Energie Electrique du Littoral Méditerranéen, which has been formed in order to operate a number of hydraulic and other plants in the southern region of France, reports a very satisfactory state of affairs. Besides the large hydraulic stations of Mescla Plan du Var, Entraygues and others which are now running in the Alpine coast region, it has a number of other plants in project. The circuits of all these plants will be connected together so as to cover the coast region extending from Menton on the eastern side to Montpelier on the west, and supplying current to Nice, Marseilles and other cities on the coast.

Among the important plants on the continent which are using steam turbines I may mention the station which has been erected at Milan by the Societá Generale Italiana Edison di Elettricitá, and known as the Porta Volta Station. At present the plant is equipped with two steam turbines and alternators of the Brown-Boveri pattern. One of these groups has a capacity of 5,000 horsepower, while the second is rated at 3,000 horsepower. In the Rheno-Westphalia Station at Essen, Germany, has been installed a large turbine group of the same make. The turbine is rated at 10,000 horsepower and it is coupled to a three-phase alternator of 5,000 kilowatts, delivering 5,000 volts at 50 cycles. The same turbine carries a direct-current machine of 1,500 kilowatts, working at 600 volts.

The new Du Pluvy diving suit for working at great depths is attracting considerable attention at Paris. It consists of a complete suit of armor, built of sheet steel, and enables the diver to go down as low as 300 feet, which is far beyond what has been done hitherto. An electrically operated device is used to renew the air. The helmet carries a set of cylinders in which a circulation is kept up by motor-operated fans, and the exhausted air is sent into a cylinder which has the proper chemicals for restoring the oxygen. From thence the air is sent again into the helmet for respiration. Thus the diver is independent of the surface for his air supply. A cable passes up to the boat containing the motor wires and telephone wires for speaking from below. Signals can be sent up to a set of colored incandescent lamps on the boat. A company has been formed at Paris for working the new invention.

The town of La Sarraz, Switzerland, is using a hydraulic plant erected upon the Venoge River for a light and power supply. The electric apparatus has been installed by the Oerlikon company, while the turbines come from the Winterthur Locomotive Company. A canal about a mile long leads to a reservoir, and from thence the penstocks run to the station. At present two turbine-dynamo groups are in use. The wheels work on a waterhead of 43 meters. The turbines deliver 200 horsepower and are coupled to three-phase alternators working at 5,200 volts and 50 cycles. Current is sent to La Sarraz, Chevilly, Penthaz and other localities in the region. Transformers lower the voltage to 125 volts.

An electrically operated car-shifting device is in use in some of the Paris railroad depots and in other railroad stations in France. It consists of a rolling platform which can pass across the ends of the tracks and so connect one of the tracks with another. The car is first hauled upon the platform by means of a rope and hook which is attached to it, the rope working upon a motor-driven drum. When the car has been drawn upon the track of the platform the latter is then moved across until it comes opposite the end of another track upon which the car is to be placed. This is carried out by simply allowing the car to run down the platform track, which is inclined for the purpose. In this way the cars can be rapidly shifted and with a saving of hand labor. An overhead trolley wire brings the current to the motorman's cabin.

The system of electric railroad lines in Switzerland known as the La Gruyère lines is to be counted among the important roads on the continent. The total length of the road, which is operated in three sections, is about 30 miles, running from Palezieux to Montbovon. A narrow gauge of one meter is used for the track. Current is taken from an overhead line by a bow trolley. The motors, of the Alioth pattern, work on 750 volts direct current. The trains are made up of a long motor car carrying four motors of 35 horsepower, or four motors of 80 horsepower. The latter are used for the long trains or for freight trains. A. DE C.

Great Britain.

London, September 5.—A fortnight hence an engineering and machinery exhibition will be opened at Olympia, in London, the scope of which will be to include every branch of engineering work. The exhibition is strongly supported, Sir William White, late director of naval construction, being president. The section devoted to electrical engineering is well representative, so far as the opportunities for exhibitors are concerned. There are a few electrical men on the advisory committee, and the exhibition generally should be exceedingly interesting and successful. Even in the absence of purely electrical work, there will be much to see on the mechanical side of electrical engineering. A permanent feature of the exhibition will be a huge electrical fountain which will also serve the purpose of an air circulator. The water in the fountain will play at the rate of 1,500 gallons per minute, and electricity will be utilized to produce a succession of brilliant light effects. At the same time the air of the building will be drawn into the base of the fountain and returned completely cleansed and cooled, at the rate of 10,000 to 12,000 cubic feet per minute. As also during the electrical exhibition last year, a series of lectures will be delivered by various experts. It may be pointed out that a replica of the electric fountain above referred to has been ordered for the lawn of an American. Exhibits from all parts of the world will be assembled at Olympia, including a good many American products. This is the first exhibition of such a character held in Great Britain for 21 years.

Notwithstanding the fact that the London Electrobus Company has been assailed equally by the technical and by the financial press and that numerous applications for the return of money sent in with applications for shares have been acceded to at the instance of the courts, the scheme is still going forward. At the statutory meeting of the company a few days ago it was stated that satisfactory arrangements were being made for placing electric omnibuses on the streets of London. Nearly 50,000 shares have been taken up and paid for. It was also stated that 30 omnibuses are on order, that 10 are being rapidly pushed forward, and that satisfactory contracts have been entered into for tires and accumulators. One rather curious statement was made that some of the contracts have been amended to the advantage of the shareholders. No one, naturally, would be more pleased to see a satisfactory electric 'bus than the electrical engineer, but the promotion of such a company as this must bear strict investigation. No explanation has been given of why the contracts have been amended since the original prospectus was issued, and the financial papers wish to know how many of the shares were subscribed for under the company's original prospectus, and how many were obtained as a matter of compromise. Further, no information has been forthcoming as to whom the firms are that have entered into contracts for accumulator maintenance. There should be no mystery about this; more harm will be done by the inauguration of a system of electric 'buses of an unstable character than the non-existence of any such service. Those most anxious to see electric propulsion of this character are dubious as to whether the time has yet arrived, so far as the batteries are concerned, for it must be remembered that there can be no comparison between the heavy work of an electric motor 'bus and the ordinary electric brougham which is to be seen running about the West End of London. However, if the company is able to put a satisfactory service before the public, it will not lack patronage. The advantages are obvious.

The directors of the City and South London electric tube railway have met several difficulties during the construction of the extension of their line to Euston. This line, it is well known, is the pioneer of electric tube railways in London, and runs from the south to the north, linking up two important districts. An extension is under construction which will connect with the three termini of the northern suburban steam railways, and thus give very useful facilities for getting from one side of London to the other. It was expected that the work would be completed this autumn, but in driving the tunnels considerable quantities of water have been met with, which has had to be kept under by pumping, while huge boulders have also been encountered. These things have retarded the rate of progress very considerably, and the extension, in all probability, will not be opened for six months yet.

As I have already mentioned, the annual meetings of our manufacturing companies this year have produced some very straight talking with regard to prospects, owing to the excessive competition now existing. The chairman of one well-known firm bluntly put it that there were too many firms to do the work, and that some of them would have to be exterminated by stress of competition. This week Messrs. Mather & Platt of Manchester held their meeting, and the view of the position taken by this company is that, owing to competition and the large amount of work already carried out for municipal corporations (which is not likely to be maintained), any further home trade could not be seriously looked for. The export trade, which is more profitable, would have to be developed, if a satisfactory position was to be main-

tained. It is a serious condition of affairs, out of which no one yet seems to see a way.

One of the most serious tramway accidents of the number that have taken place recently was that at Halifax, where, through the alleged failure of the brakes, a car ran away down a hill and finally overturned. The need for efficient training and supervision of the driver's knowledge of his brakes is well shown by some brake tests which have just been made in Halifax on the very car which ran away, with the brakes in the same condition as they were found after the accident. The car was brought to a standstill by the electric brake alone on all sorts of gradients, the steepest being 1 in 11, with a speed of 21 miles per hour. The argument is, therefore, that the wheels were locked by the hand brake before the electric brake was used. As there was also a slipper brake on the car at the time of the accident, it may be taken that in this particular case the brakes were not at fault.

The British Aluminum Company is contemplating a large extension of its operations in the West of Scotland, and further waterpower is to be utilized. The works at present erected at the Falls of Foyers in Scotland are inadequate, and a new waterpower at Kinlochleven is being controlled. The catchment basin will have an area of 55 square miles, and the average rainfall in the district is nearly 100 inches per annum. An artificial reservoir of 7½ miles length and one-half mile width is being constucted. A reinforced concrete conduit will be constructed from the dam to the penstock chamber, from whence a number of steel pipes will feed the power house. The concrete conduit will be 3½ miles long and the steel piping 1½ miles long. The head of water will be 900 feet. A further feature of the new scheme will be the erection of a model village for the employes. G.

Dominion of Canada.

Winnipeg, Man., September 15.—It is proposed to extend Ellice Avenue to Erin Street for a street-car service. A portion of the Sargent Avenue service has already been provided. The question of having an intersecting car line between the Main and Sherbrook street lines to give a quick service from Fort Rouge to Portage Avenue is to be brought before the Board of Works.

A car fender which appears to be efficient is being shown in Toronto by John O'Connor of Toronto. It is a double fender, the upper portion extending about 12 inches beyond the lower part. When the upper part strikes an object the lower immediately drops to the rails, and thus, it is claimed, it is impossible for anything to get past the fender. R. P. Fairbairn, provincial government engineer, has approved it.

The work of developing the waterpower of Kakabeka Falls, 16 miles west of Fort William, has been realized and the industrial wheels of Fort William have been set in motion by the electrical energy developed at these falls. Messrs. H. S. Holt, C. R. Hosmer and F. W. Thompson have exceeded their own expectations in making this development. In one year this company has carried out the engineering work. The work has been in the hands of R. W. Leonard. Associated with him were R. S. Kelsch, electrical engineer, and William Kennedy, Jr., hydraulic engineer, both of Montreal. The waters of the river are diverted into a large conduit pipe 10 feet in diameter, which takes the water at a point three-quarters of a mile above the falls. This pipe extends to a point some distance below the falls, where a large forebay is constructed. Steel penstocks carry the water perpendicularly 180 feet to the power house below. The whole work has been carried out mainly with cement and steel, and the plant is designed to resist anchor ice, which has been giving a great amount of trouble to water plants in the East. The initial installation is 10,000 horsepower. The work cost $2,000,000. The current is carried from the power house to the sub-station in Fort William on a heavy copper wire at 25,000 volts.

A syndicate composed of Canadian and American capitalists intends developing the waterpower on the Assinaboine River at Brandon, and has been erecting a large power house and plant at Curries Landing.

A municipal power plant is to be developed on Bird Tail Creek, near Birtle, Man. A site was surveyed last fall by the government engineers, who estimated that from 250 to 500 horsepower could be developed at an expense of $20,000. The elevators and mills will use from 175 to 250 horsepower, and the rest will be used for various purposes and as an inducement to establish industries. John Clemens of Birtle, Man., is interested.

Battleford, Sask., has voted $30,000 for the installation of an electric-light plant. R. C. Laurie is mayor.

Seven hundred new subscribers have been added to the Bell Telephone Company's list since the last issue of the local directory in Winnipeg. During the last year 1,400 new circuits have been added, making a present total of 5,000. Sixty girls are employed at the exchanges. The new addition to the building is finished. The new switchboard now in course of construction will contain 10,000 circuits and will be in the new portion of the building. Winnipeg is now the third largest user of telephones in Canada. H.

New York.

New York, September 15.—The Board of Estimate resumed work yesterday with more than 100 items on the calendar for consideration. Controller Metz got his resolution passed to appoint a commission to investigate lighting conditions in Richmond Borough, with the idea in view of having the city purchase the existing plant. All applications before the board for telephone franchises were put over until next week. The New York Telephone Company offers to give the city half rates on all city telephones and perform certain other services if it gets an exclusive franchise. The Atlantic Telephone Company also offers inducements for a franchise. The attitude of the McClellan administration has been against two companies operating in the same field.

Answers were filed in the United States Circuit Court on Thursday by Attorney-general Mayer, District-attorney Jerome, the city commissioner of gas and electricity and the city of New York to the suits instituted by the Northern Union Gas Company and the Central Union Gas Company, to restrain the defendants from enforcing the provisions of the 80-cent gas law. The answer denies that the complainants are equitably entitled to the rate under which they are doing business or that they will have to manufacture gas at a loss to comply with the 80-cent gas law.

A call was made on Wednesday for a special meeting of stockholders of the Western Union Telegraph Company for October 10th, the date of the regular annual meeting, to authorize an issue of $25,000,000 convertible four per cent. bonds. Of the new bonds, it is planned to issue only $10,000,000 at present, which will supply funds for the construction of new lines and for the purchase of new property. In the call it is stated that since the general consolidation in 1881 of the companies now composing the Western Union, and down to June 30, 1905, the company had expended for construction and the purchase of new property $39,074,066. Of this sum, $23,755,060 has come out of net earnings, $13,319,000 from the sale of $20,000,000 real-estate bonds over the amount required to pay off old bonds, and $2,000,000 from stock sold in 1897. During the last few years the rate of growth of the business and the consequent demand for increased facilities have been greater than during the previous years, and the expenditures for construction and new property have correspondingly increased. The quarterly statement of the company shows a decrease of net revenue for the quarter ending September 30th (partly estimated) of $7,593 compared with last year. The figures are $2,000,000 net revenue for the 1906 quarter and $2,007,593 for 1905. The actual returns for the quarter ended June 30, 1906, were: Net revenue, $1,740,634; bond interest, $334,075; balance, $1,406,559; dividends, $1,217,022; surplus, $189,537; previous surplus, $16,659,192; total surplus, $16,848,729.

The committee of 15 citizens named by Mayor Andrew H. Brinkerhoff of Rutherford, N. J., last spring to investigate the matter of establishing a municipal lighting plant has prepared its report and will present it to the Town Council at its next meeting. The project seems to be unfavorably thought of, chiefly on the ground of expense.

A movement for better street-railway accommodations has been begun against the New York City Railway Company by the Transit Reform Committee, the Merchants' Association, the West Side Taxpayers' Association and the Downtown Business Men's Association. Officers of these associations have received numerous complaints against the railway service. Most of them tell of the overcrowding of cars. Others call attention to the lack of cleanliness in the cars.

The state's injunction proceeding against the Brooklyn Rapid Transit system to determine the legal right of the companies to charge more than a five-cent fare to Coney Island was scheduled to come up before Justice Fitts in Albany today. An application was to be made for an order overruling the state's demurrer to the answer set up by the Brooklyn Rapid Transit attorneys. All parties to the proceeding are anxious to reach the Court of Appeals in October.

The first trip through the north tube of the Pennsylvania Railroad tunnel under the North River was made by officials of the O'Rourke Construction Company and their agents on Wednesday. The members of the party walked through the tube, and it took them three-quarters of an hour to pass from the Jersey to the New York shore. The tube was found to be satisfactory in every particular. Charles M. Jacobs, chief engineer, and John F. O'Rourke, president, of the construction company, were the first to step through the two shields which meet near the center of the river. Before the party descended all those who had not been in the habit of going under high air pressure were examined by Dr. A. J. Loomis. All passed the test, for the pressure now maintained in the north tube is not very great.

The tube is bound by a succession of iron rings 2½ feet apart and 23 feet in diameter, which stretch away in a straight line for 6,100 feet. The tube was lighted by electricity, and the eye could follow the lines of lights gradually converging to the point where a blaze of red, white and blue lamps marked the shield, which had been driven from the New Jersey shore to meet the one from New York. The tunnel was perfectly dry. A platform runs the full length of the tunnel. Amid the cheers of all present Mr. Jacobs mounted the ladder to the opening in the center of the shield. He had about five feet to go, and then passed through the New York shield, leading the way from New Jersey to New York through the first completed tunnel under the Hudson River. The next stage of the work will be to coat the entire inside of the tubes with two feet of concrete. The tunnel will then be ready for the rails. The shields of the south tube are already within 50 feet of each other. They should meet by the end of this month. C. I. C.

New England.

Boston, September 15.—Work has been begun on the illumination of the grade crossing at the Dudley Street station of the New York, New Haven and Hartford Railroad in the Dorchester district. The Boston Elevated Railway Company's surface tracks cross the railroad at this place. Some 2,000 electric cars cross the tracks every week day.

The Meriden (Conn.) Electric Light Company will enlarge its power plant in Meriden and will install a 700-horsepower turbine engine there.

A 367-horsepower boiler is being installed in the Norwich (Conn.) municipal electric-light plant.

The Norwich and Westerly Railway Company has begun running cars on its recently completed electric railway between Norwich, Conn., and Westerly, R. I. The line runs over private land a large part of the distance.

The New York, New Haven and Hartford Railroad Company is surveying for an electric railway between New Haven and Waterbury, Conn. The Connecticut Railway and Lighting Company is operating an electric line between those cities.

F. P. Phleghar & Son, manufacturers of high-grade lighting machinery, are to build a new factory of concrete blocks in New Haven, Conn. The firm will generate its own electricity with a 125-horsepower oil engine.

An electric-light plant has been installed in the Mason Building, a Boston office building.

The New England Telephone and Telegraph Company has instituted a roof garden on its building in Milk Street, Boston, which is devoted to the use of its women employes. A fine view of the harbor can be had from this garden. Tables are furnished, on which the women may spread their luncheons. The garden is to be furnished with plants, vines, steamer chairs and settees.

Owing to low water in the Housatonic River, the Connecticut Railway and Lighting Company has been obliged to use its steam power plant at Milldale, Conn., for the generation of electricity for its New Britain district. It had been using current generated by the New Milford Power Company at its Bulls Bridge plant, which was operated by waterpower.

Alonzo R. Weed has begun his duties as gas and electric-light commissioner of Massachusetts, vice Samuel A. George.

The Gillette-Wilber Company of New London, Conn., has filed its certificate of incorporation. It has a capital of $20,000, paid in in cash, and it will manufacture and sell electrical specialties.

The Cambridge (Mass.) Electric Light Company reports for the year ended June 30, 1906: Gross earnings, $264,732; operating expenses, $129,243; net earnings, $135,489; charges, etc., $150; balance, $135,339; dividends, $70,000; surplus, $65,339.

The Boston and Worcester Street Railway Company reports gross earnings of $67,136 for the month of August, against $63,209 in August last years. The gross earnings from October 1st to August 31st were $456,567, against $404,255 the previous year.

The Charlestown (Mass.) Gas and Electric Company reports $263,061 gross earnings and $226,868 operating expenses for the year ended June 30th.

The Cambridge (Mass.) City Council's special committee on municipal ownership of gas and electric-light plants has reported against municipal ownership.

The Harvey Hubbell Company, manufacturer of machine screws and electrical specialties, is preparing plans for the enlargement of its factory in Bridgeport, Conn. The new building will be three stories high, 100 feet long and 50 feet wide.

The Standard anufacturing Company, maker of electrical supplies, is building a brick factory in Bridgeport, Conn., which will be two stories high, 50 feet long and 32 feet wide, with a wing 10 by 25 feet.

The New York, New Haven and Hartford Railroad Company will install an additional 2,500-horsepower motor in its electric-railway power house at Berlin, Conn. This is a part of the plan to equip steam-railroad tracks with the trolley system.

Alfred Vivien, the wireless-telegraph electrician, was in Boston, yesterday, going from here to New York. He has been inspecting the Marconi station on Cape Cod. He will sail for his home in France in about 10 days. He says that easy wireless communication between Canada and Ireland will be established in four months. B.

Southeastern States.

Charlotte, N. C., September 15.—Louis A. Brown, one of the incorporators of the Concord (N. C.) Realty Company, announces that definite steps will soon be taken looking to the building of a local and suburban electric line, at least seven miles long, touching a number of nearby cotton mills.

A number of applications for franchises for electric lines in Waycross, Ga., have been filed with the Town Council. George W. Deen of Waycross and W. M. Toomer of Jacksonville are among the applicants.

The Georgia Railway and Electric Company has doubled the service between Atlanta and Ft. McPherson on account of complaints of inadequacy of former service.

The town of Rock Hill, S. C., is considering municipal ownership and the building of an electric-light plant. The present light contract expires July 1, 1907. On the other hand, already existing power companies will likely be heard in this connection, while an expert has been asked to go over the field and present estimates to the City Council for consideration.

The new electric-light system of Tallapoosa, Ga., was put in operation September 10th, and proved all that was expected of it.

A strong effort is being made to secure electric-railway connection from Yadkinville to Winston-Salem, N. C. Committees are working on the proposition. L.

Ohio.

Cleveland, September 15.—The Young Men's Christian Association of Cleveland has arranged to give instruction in electrical matters. Aside from the fundamental principles of electricity, the members will have instruction in the construction of motors, batteries and dynamos. The association here is constantly taking up new subjects and doing something that will prove useful to the young men.

Stockholders of the Cleveland and Southwestern have taken a large amount of the securities of the new Cleveland, Ashland and Mansfield, and it will not be necessary to offer any of them to the public, it is said. The capital stock of the company will be $1,000,000 and the bond issue the same.

The time for depositing the stock of the Toledo and Western in order to sell to a syndicate has been extended and the committee will again endeavor to secure control in order to make a private sale of the property.

The Cleveland Traction Company, promoted by Frank DeHass Robison, has been active for several weeks in having its claim brought before the City Council. The plan of the company is to build lines from the center of the city in all directions and then connect them with two belt lines, one not far distant from the business section and the other on the outskirts, connecting the parks and boulevards. Mr. Robison says that the plan of the Forest City Railway Company in securing grants for short routes and then extending them into long ones is not legal, although practiced by some companies. It looks as if he were going to make a fight both against the old lines and the new ones that are favored by Mayor Johnson.

The merged roads under the Schoepf management have decided to make no charge for carrying baggage, and about the same rules have been adopted as used in the steam-road business.

Attorney-general Wade Ellis has rendered an opinion to the railroad commission that steam roads charging three cents a mile over routes that lie mostly in Ohio is a violation of the law. The roads have been charging that amount on tickets purchased from towns in the state to points outside.

The Union Gas and Electric Company of Cincinnati a few days ago discussed a plan for building a new generating plant on the river bank. It will be equipped with turbine engines.

The Mansfield and Southern Traction Company of Mansfield has been incorporated with a nominal capital of $1,000 by R. T. Gage, H. F. Parmenter and others.

The new police-signal system for Cleveland is said to be almost ready for installation. It is claimed that it will have many advantages over the old system that has been in use many years.

The state railroad commission, it is said, will review the business of the interurban roads, and those found charging more than two cents a mile will be notified that they must observe the same laws that have been laid down for the steam roads relating to passenger fares.

Interurban roads using Water Street in Columbus have been notified that grooved rails must be used. The roads had asserted that grooved rails could not be secured until about the first of next year.

The Toledo, Port Clinton and Lakeside has started its ferry service to Sandusky.

W. H. Ogan, who has been in the East consulting with financiers over his proposed Lima-Kenton route, which is to be operated with gasoline cars, says that the plans have been accepted and that the road will be built. The Strang car will probably be used.

The Board of Public Service at Lorain has been discussing a municipal light plant for that city. There has been complaint of the lights that are furnished by a private corporation, it is said, and the board also fears that the supply of natural gas, which is furnished by the same company, will run low when cold weather comes. O. M. C.

Michigan.

Grand Rapids, September 15.—If the plan of a Grand Rapids alderman is adopted by the Common Council the Grand Rapids Street Railway Company will be forced to build extensions which have been asked for by the city or compete with a rival street-railway company. The plan is to prepare a franchise for a street railway to run on streets not occupied by the Grand Rapids Railway Company, but paralleling them so closely as to give a competing service in every part of the city. This franchise will be offered the Grand Rapids Railway Company, with the provision that it make extensions desired, but the paralleling tracks need never be built. Should the company refuse the franchise it is to be offered to the highest bidder, with every facility for putting the new system in operation.

The Detroit Edison Company may soon double its big Delray plant, and largely extend its service in Detroit and for miles out in the country. The company is quietly placing with its stockholders a special bond issue of $1,000,000. The Delray plant is one of the largest in the country and has a rated capacity of 20,000 horsepower and has cost to date about $1,350,000. A million dollars, however, would suffice to duplicate the buildings and install the generating sets first needed, and other sets could be added until the building is fully equipped. This will be a long step in the development of that extensive chain of generating stations comprehended in the Edison plans.

The first real step for electric lights has been taken by the village of Saline in granting a franchise to the Washtenaw Light and Power Company for street and commercial lighting. Power will be transmitted from Geddes, and the work of construction will be commenced at once.

Eau Claire will soon have light streets, a contract having been made with the Benton Harbor and St. Joseph Lighting Company, a franchise having been granted for commercial lighting. Eau Claire will be made a sub-station of the St. Joseph River interurban, which will run cars through the village when the line is completed.

Block Bros. of Paris, France, have brought suit to collect $3,000 of the Grand Rapids, Holland and Chicago Railway. An order for a quantity of steel bars was placed by the railway company with the Paris concern, a bar of steel such as the railway company ordered being 10 inches long, as listed by American concerns. When the steel arrived it was discovered to be 12 feet long, and the quantity greater than the company could use in 20 years. The company refused to accept the invoice and the suit resulted. L. W. B.

Indiana.

Indianapolis, September 15.—The 11 traction roads entering into Indianapolis carried unprecedented crowds to the State Fair during the last week. Every bit of equipment owned by the roads was placed in operation and all previous records were broken each day. Interurban men say they handled at least 60 per cent. of the visitors against 40 per cent. for the steam lines.

The Westinghouse Electric and Manufacturing Company has begun the work of equipping the 20 passenger cars of the Indianapolis and Cincinnati Traction Company with new and larger motors capable of a speed of 90 miles per hour. The re-equipment is being done in the shops in Rushville and will engage the attention of a score of skilled workers for several weeks. The change will be made at the expense of the Westinghouse company, which has made free use of the millions at its command to perfect the single-phase alternating-current system of electric traction. The company's most experienced electrical engineers have, since the opening of the Rushville line, been engaged in perfecting alternating-current motive power, and every new idea evolved has been given a practical test on the Indianapolis and Cincinnati road.

Engineers are running the line of the Cycle Traction Company which is to encircle Indianapolis, connecting all the county-seat towns of the adjacent counties. The promoters say this line will positively be built within a year. Franchises have been granted in all but one of the seven county seats.

At a meeting of the stockholders of the Evansville and Cannelton Electric Railway Company officers were elected, with F. W. Cook, president. The directors ordered an immediate survey of the proposed line.

The Southern Railway Company has made a reduction in fare 10 cents lower than the rates now charged between competing points by the Evansville, Suburban and Newburg Traction Company. The company will sell coupon books, commutation tickets and a monthly school ticket. General Manager Mulhausen of the electric line says that his road will meet the reduction, and thinks hourly service against three trains each way a day will give the electric line the advantage.

The officials of the Indianapolis, New Castle and Toledo Traction Company, now building a line from Indianapolis to New Castle, have declined to pay the $5,000 toward track elevation in Indianapolis as provided in the company's franchise. The refusal is based on the ground that there was to be a clearance of 16 feet from the rails to the top of the overhead structure instead of only 14½ feet.

The Cambridge City Town Board has closed a deal for the rights and title of the electric-light plant now owned by the Cambridge City Light and Power Company. The plant will be improved.

A division of opinion concerning the municipal electric-lighting plant has developed in Logansport. Opponents of municipal ownership insist Logansport stands to lose many factories because the municipal plant cannot or will not furnish electrical power as cheaply as it can be obtained elsewhere. They declare the city, although unable to provide adequate power, refuses to grant any competing company the privilege of providing it. The mayor and Board of Public Works declare the city can supply the needed power and as cheaply as any private concern has offered to furnish it. Notwithstanding these declarations a petition has been presented by a hundred business men asking that outside corporations offering to supply cheap power be permitted to use the city's poles without cost. The mayor and City Council declare such a proposition preposterous. As a result the alleged monopoly of the power supply by the municipal plant is a matter of vigorous discussion, and municipal ownership is being put to a test and may lose out in Logansport.

The destruction of the Covington Electric Light and Water Company's plant on September 13th leaves the city without light and water. The loss is estimated at $25,000. E. H. Nebeker, president of the company, says the plant will be rebuilt immediately and equipped with new machinery and the latest appliances.

Eugene Rush, president of the White River Hydraulic Company, which is building a dam in White River at Decker and installing a hydraulic electric plant to supply all the cities and towns within a radius of 50 miles with cheap light and power, is now taking contracts and securing franchises. The best city in the territory is Vincennes, and he proposes to furnish that city with arc lamps at $53 a year. The city is now paying $63. S. S.

Illinois.

Peoria, September 15.—The Westfield Electric Light and Power Company of Westfield has been incorporated with a capital stock of $20,000 to produce and sell electricity. Incorporators are Thomas M. Gardner, E. I. Wenger and J. C. Kirkpatrick.

Incorporation papers have been issued to the Moline, Rock Island and Eastern Traction Company of Rock Island, with a capital stock of $5,000. The road is to be built from Rock Island to Carbon Cliff, both in Rock Island County, and to Galesburg in Knox County. Incorporators and first board of directors are Joseph F. Porter and James F. Larder of Davenport, Iowa; Frank G. Young and Herbert E. Pasteel of Rock Island, and Burton F. Peek of Moline.

The Harrisburg Independent Telephone Company has been incorporated with a capital stock of $2,500 by John T. Wheatley and others.

The Central Union Telephone Company has moved into its new building in Springfield and now has a modern central-energy system. The new exchange is equipped with all the latest types of instruments. The company now has about 3,500 lines. The first floor is used for the city superintendents, the second for the division superintendents and the third for the operating room. This floor also has three rooms fitted up for the comfort of operators.

The Illinois Traction Company has now made arrangements with the Venice Terminal Company and the Madison County Ferry Company to cross their tracks at Venice. Work has been begun on the track laying at Venice and the road to the ferry will soon be completed. This will allow the company to enter St. Louis by the ferry. The plan of entering St. Louis by the proposed new municipal bridge has not been abandoned. The company is now operating to Venice from Springfield, and between Decatur and Bloomington, from Staunton to Litchfield and Hillsboro, also between Danville and Bloomington.

An ordinance has been introduced in the Springfield Common Council to collect a tax of four per cent. on the gross earnings of all the interurbans entering Springfield, this to apply only to tickets sold in the city.

There is some talk of laying a double track to be used by all the interurbans entering Springfield.

The Springfield and Western has asked for a franchise in Springfield. This company proposes to build between Quincy and Springfield.

The City Council of Bloomington asks the Illinois Traction Company to furnish the city 400 street lights free for the use of the streets. The company offers to furnish 150 free and asks $25

for each additional light. As yet they have been unable to reach an agreement.

The Illinois Traction Company is having built 33 motor cars, 12 express cars, three locomotives and 16 city cars. They are being built by the St. Louis and the American Car companies under the direction of Master Car Builder Bosenberry.

The village of Peoria Heights is considering the erection of a water and light plant. Several propositions are under consideration. The village is now lighted by the Peoria Gas and Electric Company, which proposes to furnish the power for operating the waterworks plant and has made the village a low rate for day service. Others have made a proposition to build a municipal plant.

V.

Northwestern States.

Minneapolis, September 15.—Shelton & Wixon of Rhinelander, Wis., are planning to build a large power plant at White River and transmit power to Ashland.

A street-railway system is to be constructed at Wausau, Wis.

The Leavitt Lumber Company has sold its electric-light system at Frederic, Wis., to Grimm Bros., who talk of building a power plant at Trade Lake.

The Chippewa Valley Electric Railway Company has applied for a franchise for traction, heating, power and lighting privileges at Menomonie, Wis.

The bonds for the proposed interurban line between Boone and Webster City, Iowa, have been floated at Chicago.

Langstadt & Meyer of Appleton, Wis., have secured the contract for the installation of a generator, switchboard and equipment and engine at the municipal electric-light plant at Oconto Falls, Wis.

A franchise ordinance is before the council at Mitchell, S. D., which will, if passed, grant an electric-light franchise to the Mitchell Gas Company.

The Fort Dodge (Iowa) Light and Power Company has decided to build a dam in the Des Moines River. About 4,500 horsepower will be developed.

Bids for the construction of a new power plant at Aberdeen, S. D., have been opened, but action was deferred until the next meeting of the City Council. The bids ranged from $30,000 to about $40,000.

The proposition to levy a three per cent. tax at Fairfield, Iowa, to aid in the construction of an interurban line to Memphis, Mo., was carried.

The promoters of the proposed interurban railway between Davenport and Muscatine, Iowa, are busy on the plans, and it is now estimated that only about $1,000,000 will be required. The earlier estimates were much in excess of that amount. The leaders in the project are leading stockholders in the Tri-City Railway and Light Company.

A franchise for an electric-light plant at Cambridge, Iowa, has been granted to W. A. Curtis, and work on the new plant has been started.

The Oconto (Wis.) Electric Company is contemplating building a new power house and installing new machinery.

The contract has been let at Two Harbors, Minn., for an 80-kilowatt generator and a 125-horsepower engine to the Crowley Electric Company at $4,050.

R.

Pacific Slope.

San Francisco, September 13.—The United Railroads of San Francisco has restored industrial peace by consenting to the arbitration of its differences with all of the seven allied unions whose members are numbered among its employes. It now appears that the question at issue with each of the unions will have to be arbitrated separately and the personnel of the arbitration board will have to be changed from time to time as the affairs of different unions are taken up. The larger portion of the Farley strike-breakers have been sent East again and the situation now looks very favorable for uninterrupted operation of cars. The company, while refusing to discharge any skilled employes who had actually gone to work, agreed to avoid any discrimination against former strikers and give employment to all.

Work has been actively resumed on the reconstruction of the west track on the Sutter Street line with a force of 300 men, and the company has planned to complete as soon as possible the reconstruction of all of those lines on which operations have been suspended by reason of the fire. It is announced that the erection of the necessary additional electric sub-stations and repair shops will be on a cheap scale of construction, as with the prevailing high and unsettled conditions as to labor and materials in the building line the company would not be warranted in erecting permanent structures. The idea of erecting a modern fireproof office building downtown to cost about $1,000,000 has been abandoned until such time as industrial conditions are considered more settled.

The Pacific Gas and Electric Company is trying to complete its 16,000-horsepower gas-engine reserve plant in San Mateo County, six miles south of San Francisco, within a short time, so as to fill its contract with the United Railroads, which requires the furnishing of all the power needed to operate the cars of its system. At present a moderate amount of power is being supplied to the car system from the company's transmission lines. There have been many vexatious delays in completing the three big 4,000-kilowatt gas-engine-driven generating units, including the earthquake, which cracked a bed plate of one engine and did other damage. It is the expectation that one of the direct-connected units can be started up this month.

There are persistent reports in circulation in San Francisco that there are to be changes in important details of the management of the Pacific States Telephone and Telegraph Company, with headquarters in San Francisco. It had been rumored and denied that Henry T. Scott, who was made president to succeed the late John I. Sabin, would soon retire from his position. E. C. Bradley, formerly of the Postal telegraph company, who is understood to represent the Eastern interests in the Pacific States company, has been in the city for some time. It is rumored that General Manager Louis Glass, who has served the company ably for a number of years, is to retire in order to devote himself largely in the future to the affairs of the new telephone company at Manila, of which he is president. He is now visiting the Philippines on an inspection tour.

The Central California Power Company, which has filed articles of incorporation with an authorized capital stock of $5,000,000, has among its purposes to acquire and construct electric power plants in the state of California within transmitting distance of San Francisco with a view to supplying a part of the demand for electric power existing all around San Francisco Bay for manufacturing and other purposes.

J. E. Marshall and F. E. Hatch report the arrival of boilers for the South Raymond Electric Light Company of South Bend, Wash. Mr. Hatch has invested and will take an active interest in the enterprise.

The Pend d'Oreille Electric Light Company is preparing to make improvements in its plant at Sand Point, Idaho, at a cost of about $50,000.

Attorney J. B. Ryan of Portland, Ore., has filed right-of-way deeds for the trolley line from Canemah to Salem, Ore. This is the line projected by L. B. French of Portland about two years ago.

The Pittsburg Reduction Company has filed on water rights on Horse Creek, Ore., for 20,000 miner's inches. It is the intention to develop the mineral resources and furnish electric power, light, heat, etc.

A.

PERSONAL.

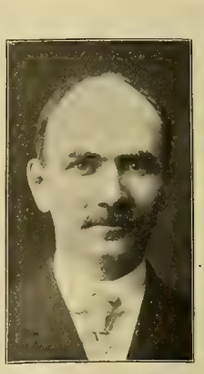
Samuel C. Shaffner, formerly engineer and general manager of the Illuminating Company of Mobile, Ala., has joined the engineering staff of H. M. Byllesby & Co., Chicago.

Mr. Edward J. Nally of Chicago, general superintendent for the Postal Telegraph-cable Company, has been promoted to the position of vice-president of the company and has become a member of the board of directors. He will remove to New York.

George F. Maddock, formerly general superintendent for A. L. Ide & Sons, Springfield, Ill., and for some time past practicing consulting engineer, with offices in the Marquette Building, Chicago, has joined the engineering staff of H. M. Byllesby & Co., Chicago.

Daniel T. Hunt, who succeeded the late Charles T. Yerkes as president of the North Chicago City Railway Company and West Chicago Street Railroad Company in 1899, during the formation of the Chicago Union Traction Company, died suddenly at the Hotel Del Prado, Chicago, on September 17th. Mr. Hunt came to Chicago from Rochester, N. Y., in 1893. In Rochester he was prominent in business circles and in politics. For 12 years—from 1876 to 1888—he was postmaster of that city, and his administration of the office was businesslike and efficient. In Chicago Mr. Hunt was manager for Illinois of the American Surety Company. He was about 70 years of age.

Dugald C. Jackson, professor of electrical engineering at the University of Wisconsin, Madison, Wis., has been elected professor of electrical engineering and head of the electrical engineering department of the Massachusetts Institute of Technology at Boston. He will go East in the middle of the college year. In the meantime Prof. H. E. Clifford will be acting head of the department at "Tech." Professor Jackson comes of Quaker stock and was born at Kennett Square, Pa., in 1865. He graduated from Pennsylvania State College and afterward spent two years at Cornell in graduate study of electrical engineering. In 1887, with J. G. White, he organized the Western Engineering Company at Lincoln, Neb.



DUGALD C. JACKSON.

This company built a number of electric-railway and electric-light plants and one of the first hydro-electric transmissions in the country. Later Mr. Jackson became associated with the Edison and Sprague interests, eventually becoming chief engineer for the Central District of the Edison General Electric Company, with headquarters in Chicago. This district covered 13 states, and Mr. Jackson had many important problems to solve, for those were still the "early days." One was to install compound-wound dynamos of large capacity so that they would give suitable railway service. In 1891 Mr. Jackson became professor of electrical engineering at the University of Wisconsin. The department of electrical engineering was established at this time, and as it stands today, with its high reputation, it is substantially Professor Jackson's work. Professor Jackson has also carried on an independent practice as a consulting engineer; has testified as an expert in important patent litigation; has written several electrical books; has served as a juror of award at international expositions; has an interest in several manufacturing companies, and is a member of various engineering and scientific societies (both at home and abroad) as well as several social clubs. In a word, he is a man of notable capacity, energy and enthusiasm who should add strength and vigor to the already excellent electrical engineering department of the Boston school.

George W. Jackson, chief engineer and general manager of the construction department of the Illinois Tunnel Company, has retired from that position. Mr. Jackson planned and constructed the 45 miles of freight tunnels under Chicago's streets, an exceptionally interesting undertaking which has from time to time been described in the Western Electrician. For this work Mr. Jackson is said to have received a salary of $75,000 a year. Mr. Jackson was born in Chicago 45 years ago.

ELECTRIC LIGHTING.

The Louisiana (Mo.) Gas and Electric Light Company has increased its capital stock to $200,000.

The Cannel Coal Company of Laredo, Texas, has let the contract for the installation of an electric-light plant in its coal mines, to cost $30,000.

The Auburn Electric Light Company of Auburn, Neb., will extend its wires from the Auburn plant to Johnson, Neb., and will supply that city with light.

On September 24th bids will be received for lighting the city streets of Toledo, Ohio, with electricity for a period of five or 10 years. Address the city clerk.

A charter has been issued at Harrisburg, Pa., to the Palo Alto Electric Light, Heat and Power Company, capital $5,000, to construct and operate a plant at Palo Alto, Schuylkill County.

Bids will be received by W. H. Gibson, secretary of the board of prison commissioners, until September 25th, for a heating, lighting and pumping plant at the Idaho state penitentiary, Boise, Idaho.

At the meeting of the West End Business Men's Association of St. Louis Secretary Wolff reported progress from the municipal lighting-plant committee. He says that a plant capable of supplying the entire city with street lights could be ready for business by 1910. The estimated cost is $2,500,000.

Two new electric companies have been chartered in Pennsylvania for Lancaster County. They are the Stoever Light, Heat and Power Company, Mt. Joy, and the Leland Light, Heat and Power Company, Manheim. The capital of each is $5,000. The incorporators are J. Hector McNeal, L. M. Edenbrock, H. C. Case, Philadelphia; E. L. Baker and George R. Heisey, Lancaster.

The City Council of Mattoon, Ill., has decided to make a complete change in the lighting system of the city. According to a resolution the light committee is empowered to purchase a dynamo and 125 new arc lamps at an approximate cost of $5,700. It is the intention of the council to keep about 80 of the present lamps for use on the outskirts of the city, the new lights to be placed in and near the business district.

The taking over of the properties of the Harrisburg Light, Heat and Power Company of Harrisburg, Pa., by a new corporation, to be known as the Harrisburg Securities Company, has been fixed for October 15th. The Harrisburg company is making extensions and improvements to its plant, having purchased two 50-kilowatt Curtis turbines. The Paxtang company in the same city is also making similar improvements, to be completed this fall.

Considerable interest is taken in the legal proceedings instituted against the Gas and Electric Company of Galesburg, Ill., in which the contention of a number of aldermen and attorneys is that the original charter of the company is invalid and that the company has rendered it inoperative by the mergers to which it has been subject in the last few years. The original company was the Galesburg Gas Light and Coke Company. Its charter forbade the increasing of the $300,000 capital

stock. In 1886 the Merchants' Electric Illuminating and Power Company was organized, and in 1893 the two companies were consolidated. After the McKinley people came into the possession of the franchises and the property there was organized the Galesburg Railway and Light Company. This merger also is attacked in the bill as illegal.

Articles of incorporation of the Salt Lake Public Service Company, which takes over the light, heat and power franchise granted by the City Council to J. S. Manley and L. H. Curtis, have been filed. The company is incorporated with a capital stock of $3,000,000. The officers named are: President, James J. Chambers; vice-president, John W. Dages; secretary, J. S. Manley; treasurer, E. M. Fullington. The new light, power and heat-supplying organization is to be on a large scale. The company is to also operate in Park City and Alta and several of the other mining towns. Outside of Salt Lake the company is to be known as the Summit Electric Company. In Park City during the last month work has been begun in the way of setting up the poles for wires. In Salt Lake all the wires in the paved district are to be placed in conduits, and the distribution will include every part of the city.

ELECTRIC RAILWAYS.

A franchise has been granted to Frank Toben of El Paso, Texas, to build an electric railway 15 miles long to extend to Yelesta.

Harry P. Clark of Salt Lake has petitioned for a franchise to build an interurban railway between Salt Lake and Murray, Sandy and other places.

At the special election in Seattle, Wash., on September 12th the proposition to issue bonds for the municipal ownership of street railways was defeated.

The work of surveying the route for the Murphysboro and Johnston City (Ill.) electric railway has been begun. The line will run from Murphysboro, through Carbondale, Carterville, Gifford and Herrin, to Johnston City, a distance of 30 miles. It is promoted by Neucomer & Co. of Philadelphia, represented by George Hecket of St. Louis.

The underwriting of the Baltimore (Md.) Terminal, it is said, is now oversubscribed. The subscribers of the Washington, Baltimore and Annapolis have all taken their proportion of the securities. Those who have become interested in these properties seem well satisfied with the prospects for the future. The Sherwin-Bishop syndicate of Cleveland is building the line.

A general movement among the great English railways to establish electric suburban lines is reported by Frank W. Mahin, consul at Nottingham. The successful working of those thus equipped has led to the discussion of the feasibility of establishing main lines also. The chief objection advanced is the vast amount of capital now invested by railways in steam equipments. The answer made thereto, Mr. Mahin says, is that an electric line costs less than a steam line to operate and maintain, and is capable of earning a greater percentage of interest on the capital invested, and, consequently, in time would repay any loss incurred by a change of motive power.

The large power house of the Kansas City-Western Electric Railway Company, located at Wolcott, Kan., was destroyed by fire recently. Four large engines, three generators, six transformers and a large storage battery were ruined. Two transformers and one generator were just added to the plant to increase the power for additions and changes in the road to decrease the time between Leavenworth and Kansas City. The company was about to double the size of the power plant, however, and most of the new machinery is now on the ground. This will be placed in a temporary power house at once. The Wolcott power house was built in 1899. It was a brick structure with two stories and a basement.

PUBLICATIONS.

"Sunbeams" is a pretty little illustrated booklet in two colors, just published by the Sunbeam Incandescent Lamp Company of Chicago and New York. It contains a number of original verses in "lighter vein" bearing on the lighting question. The Western Electric Company, general distributor of Sunbeam lamps, will be pleased to mail a copy of this booklet upon request.

A handy reference book, convenient for desk or pocket use, has been published by the Pringle Electrical Manufacturing Company, 1906-08 North Sixth Street, Philadelphia. The booklet contains illustrations of various lines of the company's manufacture, together with a brief description and a price-list. The Pringle company manufactures high-grade switches, panel boards, switchboards, accessories, receptacles and specialties.

The Atlas Engine Works of Indianapolis has just published an attractive and well-illustrated description of Atlas four-valve medium-speed engines which will be of interest to those confronted with the question as to what class of apparatus will produce a horsepower at the lowest ultimate cost per year. A copy will be sent to those who write to the company for one. The Atlas company makes other kinds of engines also, comprising a complete line of engines and boilers.

SOCIETIES AND SCHOOLS.

A meeting of municipal executives of Illinois was held at Rock Island, Ill., on September 13th and 14th, at which an organization was formed to promote the regulation of public utilities. The association will be known as the Mayors' Association of Illinois. George W. McCaskrin, mayor of Rock Island, was elected president.

Intending visitors to the reunion of the Old Time Telegraphers and Historical Association who desire hotel accommodations should notify R. G. Callum, in care of the Western Union Telegraph Company, Washington, D. C. The meeting will be held in Washington, October 9th to 11th, with headquarters at the Arlington Hotel.

The United Engineering Building in New York city, which will be the permanent home of the American Institute of Electrical Engineers and other engineering societies, is now enclosed and roofed, with partitions in place, all risers in position and some elevators running. Foundations were carried down in some cases 67 feet to secure a hard rock footing.

The semi-annual meeting of the National Association of Cotton Manufacturers was held at Lake Champlain, Clinton County, New York, September 12th and 13th. The programme contained papers on "The Curtis Vertical Turbine," by C. B. Burleigh of Boston, and "Practical Experiences in Electrical Drive," by John A. Fernley of New Bedford, Mass. James R. MacColl of Providence, R. I., delivered the address as president of the association.

Elaborate preparations are being made for the entertainment of the members of the League of American Municipalities, which will meet in Chicago next week—September 26th, 27th and 28th. Business sessions will be held each morning at 10 o'clock, and there will be good speakers. The afternoons and evenings will be spent in sightseeing, attending theaters and parks, etc. A dinner will be given at White City Wednesday evening. Joseph Beifeld is chairman of the entertainment committee and vice-chairman of the general committee.

The International Union of Steam Engineers held its tenth annual convention in Milwaukee last week. Various matters of interest to the union were considered. Among the exhibitors at the convention were the Foster Pump Works, Garlock Packing Company, Mayvill Specialty Manufacturing Company, Keystone Lubricating Company, Norwall Manufacturing Company, International Correspondence Schools, Peerless Rubber Manufacturing Company, Dearborn Drug and Chemical Works, Steam Appliance Company, Atlas Engine Works, H. W. Johns-Manville Company and Adam Cook's Sons.

John H. Merrill, secretary of the Central Electric Railway Association, is sending out invitations and programmes for the first fall meeting of the association to be held in Robison Park, Fort Wayne, Ind., on the line of the Fort Wayne and Wabash Valley Traction Company, September 27th. The meeting will be largely in the nature of an autumn outing, with vaudeville entertainment, boating, dancing, bowling and a ball game between the Hoosiers and Buckeyes. A special feature will be a chicken dinner served in first-class country style. A business meeting will be held at 10 a. m. and C. R. McKay will read a paper on lightning arresters, followed by a discussion and the question box.

The two-hundred-and-ninth meeting of the American Institute of Electrical Engineers will be held in the auditorium of the New York Edison Building, 44 West Twenty-seventh Street, on Friday, September 28th, at 8:15 p. m. Dr. Samuel Sheldon, recently elected president of the Institute, will be officially conducted into office at this meeting. Dr. Sheldon will read his inaugural address, entitled "The Work of the Institute." Papers will also be presented as follows: "The Effect of Iron in Distorting Alternating-current Wave Form," by Prof. Frederick Bedell and Albert B. Tuttle of Cornell University, Ithaca, N. Y.; "The Current Transformer," by Kenneth L. Curtis of Leland Stanford Jr. University, Palo Alto, Cal.

SPACE TELEGRAPHY.

Answering numerous inquiries concerning the introduction of space telegraphy on railway trains in Germany, intended to lessen the danger of accidents, Consul E. L. Harris of Chemnitz says that Saxon railway officials will give out no information except that contained in newspaper reports previously sent by him. He adds: "A recent issue of the Berlin Woche contains an illustrated article which shows that experiments are being carried on quite extensively on the Berlin-Zossen line, with results which are in favor of an early adoption of wireless systems on many of the state railways. I would advise those interested in securing detailed information concerning the progress of these experiments to address a letter of inquiry to Zimmerstrasse 37-41, Berlin, and it is not improbable that the writer may eventually be put in touch with the officials having charge of the matter."

MISCELLANEOUS.

A report from Rushville, Ind., says that three men were killed a few days ago from electric shock received from a barbed-wire fence. The point along the fence where the men were killed was near the power house of the Indianapolis and Cincinnati Traction Company. It is said that a bolt of lightning burned an insulator which in some way caused a guy wire leading to the fence to carry the current to the barbed wires.

The Irish Automobile Club has arranged to hold a show of motor cars on the grounds of the Royal Dublin Society at Ballsbridge, Dublin, from January 5 to 12, 1907. All applications for information and space should be made to Walter Cawood, Esq., St. James Hall, Manchester, England, who has charge of the undertaking. The show will be open to all manufacturers of motor cars and motor accessories. Vice-consul A. D. Piatt says that the few American cars to be seen on the roads in Ireland have a good reputation, and automobile manufacturers who wish to cultivate the Irish market may possibly find it to their advantage to exhibit their cars at the coming show.

It is asserted that the Kjelin electric furnace for the production of steel is about to be utilized on a large scale in Sweden. This is to be done in connection with the development of the immense waterpower of Tralhatta, near the extensive ore deposits in Noorland Province. The intention is to build a steel mill for producing at least 500,000 tons annually, with a similar size works at Gothenburg. The Swedish government has accepted the proposition of a mill company, and will jointly commence the work to develop the power, which it is expected will be ready by 1908 to the extent of 10,000 to 15,000 horsepower. The Krupp works are reported to have acquired the Kjelin patents for Germany.

A hydro-electric plant which is used for electrolytic processes for soda manufacture has been installed at Barcena, in the north of Spain. Current for the electrolytic works is obtained from three principal turbine sets of 500 horsepower each. Two smaller groups of 80 horsepower serve to supply the circuits for some of the motors used in the factory as well as the lighting of the buildings. The 500-horsepower groups are formed of a turbine working at 450 revolutions per minute coupled to two generators. Each of these machines has two commutators and delivers 1,400 amperes at 120 volts, or 1,200 amperes at 130 volts. On account of the heavy currents which are used for the electrolytic work the switchboards of the large units have been modified as to their apparatus. As the electrolytic tanks are operated continuously day and night, the ordinary switches are replaced by a pair of mercury cups connected by a copper bridge-piece. To simplify the connections the three main groups of 500 horsepower are divided into two series. One series comprises two groups, each of which is connected permanently with one set of the electrolytic tanks by means of the mercury cups. The second series includes the other set which acts as a standby, and when desired it can be connected upon the circuit by a set of mercury cups.

TRADE NEWS.

The Bryan Cotton Oil Company of Hearn, Texas, intends to install electric apparatus. P. S. Grogan is president.

The West-Stengall Grain and Commission Company of Montgomery, Ala., proposes to purchase electrical equipment.

The Fort Smith (Ark.) Furniture Manufacturing Company will purchase a dynamo and other electrical apparatus. E. Ballman is secretary.

Consul-general William Martin, of Hankow, China, advises that a concession has been granted for the erection of waterworks and an electric plant in Hankow to a wealthy Chinese merchant, who has decided to purchase equipment in England or America, and wants best net prices. Further particulars will be furnished by the Bureau of Manufactures (File No. 320), Washington, D. C.

The Isthmian Canal Commission is inviting sealed proposals until October 2d for furnishing a fire-alarm telegraph system and a motor-generator set. Specifications and blank forms can be obtained upon application to D. W. Ross, general purchasing agent, Washington; the assistant purchasing agent, 24 State Street, New York, or the chief quartermaster, Department of the Lakes, Chicago.

To enable users of galvanized-iron telephone and telegraph wire to test the wire they buy the Indiana Steel and Wire Company of Muncie, Ind., is sending out to the trade a leaflet giving, in condensed form, the Western Union Telegraph Company's specifications for this class of wire.

The Indiana company makes a specialty of high-grade wire and particularly invites these tests to be applied to its product.

A. G. Lewis, county auditor, will receive sealed proposals until October 2d for apparatus and equipment for a 100-light electric-lighting system for the county hospital at Fargo, N. D.

Sealed proposals will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until 3 p. m. October 1st, for the installation of an electric burglar-alarm system, and for service thereon to June 30, 1907, in connection with vaults or safes in the postoffice, courthouse, etc., building at San Francisco, Cal. The number of vaults and safes to be equipped can be ascertained upon application to James A. Wetmore, acting supervising architect.

The Navy Department, through the Bureau of Supplies and Accounts, is inviting sealed proposals until October 9th for furnishing a quantity of electrical supplies at various yards as follows: Incandescent lamps, bells, buzzers, testing sets and generators, keyboards, Gonda cells, fuse wire, fuses, dynamometers, switches, cable, wire and miscellaneous electrical supplies. The schedule number is 147, which can be obtained at the navy pay office in New York or upon application to the bureau at Washington.

BUSINESS.

The Chicago Pneumatic Tool Company reports its trade for the month of August to be the heaviest in the history of the organization, both in business booked and shipments made, the latter exceeding all previous monthly records by 15 per cent.

The Central Electric Company of Chicago is sending out to the trade a catalogue of condulets and is calling attention to the fact that it is carrying a complete stock of all styles and sizes up to and including the one-inch. Condulets have been on the market for only a comparatively short time, but have already made a place for themselves and are becoming extremely popular among contractors and wiremen. It is suggested that anyone who has not received a copy of this catalogue write the Central Electric Company, 264-270 Fifth Avenue, Chicago.

The borough of Kutztown, Pa., after operating a municipal lighting plant for some time, is increasing its capacity by the installation of a 125-horsepower Hornsby-Akroyd oil engine. The present plant consists of a 65-horsepower Hornsby-Akroyd oil engine belted to generator. Both engines were supplied by the De La Vergne Machine Company, New York city.

The Yukon Consolidated Goldfields Company has contracted with the Canadian Westinghouse Company for the following electrical apparatus to be used in gold dredging in the Yukon Territory: Twenty-one motors of various types ranging from 7½ to 100 horsepower; nine 75-kilowatt oil-insulated self-cooling transformers; two 625-kilowatt three-phase 60-cycle 2,200-volt alternating-current generators, and two 17-kilowatt type S exciters for same; one four-panel switchboard for controlling above; four 250-kilowatt oil-insulated oil-cooled transformers, and four 200-kilowatt transformers, same type.

The Blake Signal and Manufacturing Company of Boston, Mass., announces that its sales of staples and cleats to the smaller telephone companies, both Independent and Bell, are beginning to increase rapidly. These smaller companies are beginning to realize, as the larger companies did some time ago, that although the first cost of these staples is greater than that of bare staples, different kinds of tacks or other forms of metallic insulated wire support, they are a decided economy in the end. The use of the Blake insulated staple prevents numerous short-circuits, grounds on wiring and circuit interruptions. The company has established an agency in Canada with the Norton System Telephone Manufacturing Company of Toronto and Halifax.

The "Reliance" Reynolds-Corliss engine built by the Allis-Chalmers Company was designed primarily for driving electrical and other fast-running machinery, either by belting or direct connection, as the conditions of service in each particular case might render advisable. It has now been before the power-using public a little less than three years, during which time hundreds of engines of this pattern have been sold and put in operation, under widely varying operating conditions, in factories of all kinds, flour mills, saw mills, electric-light and power plants, ore-reduction works, etc., and without exception it has given unqualified satisfaction. Nearly one-half of all the Reliance engines thus far installed have been designed for direct connection to electric generators.

The National Brake and Electric Company of Milwaukee reports orders for National air-brake equipments from the following-named: Chicago City Railway Company; United Railways of San Francisco; Oakland Transit Company, Oakland, Cal.; Spokane Traction Company, Spokane, Wash.; Metropolitan Street Railway, Dallas, Tex.; Rapid Transit Railway Company, Dallas, Tex.; Dallas Consolidated Railway Company; San Diego Electric Railway Company, San Diego, Cal.; Worcester Consolidated Street Railway Company, Worcester, Mass.; Michigan United Railways, Kalamazoo, Mich.; Twin City Rapid Transit Company, Minneapolis, Minn.; Chattanooga Railways Company, Chattanooga, Tenn.; York Street Railway Company, York, Pa.; Memphis Street Railway Company, Memphis, Tenn.; Birmingham Railway Light and Power Company, Birmingham, Ala.; Knoxville Railway and Light Company, Knoxville, Tenn.; Pensacola Electric Terminal Railway Company. All orders for the above roads have been taken within the last 30 days, during which time this apparatus has been on the market, and approximate 400 equipments.

ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued (United States Patent Office) September 11, 1906.

830,497. Circuit-closing Device for Speed Indicators. Hans Dahl, Berlin, Germany. Application filed June 20, 1901.

A contact rotates with and moves outwardly from the axis of the rotating body by centrifugal force; spring means oppose the movement of the contact and electrical means are provided for automatically indicating various positions of the contact accordingly to the speed of rotation.

830,501. Protecting Bushing for Electric Circuit Wires. John H. Goehst, Chicago, Ill., assignor to the Federal Electric Company, Chicago, Ill. Application filed February 16, 1905.

A bushing for protecting electric-circuit wires is made wholly of insulating material, and comprises a hollow shank provided at one end with a hollow head, and at its other end with a screw thread.

830,533. Electric Brake. Frank L. Sessions, Columbus, Ohio, assignor to Joseph A. Jeffrey, Columbus, Ohio. Application filed January 17, 1905.

The brake is connected with the armature shaft of a motor and adapted normally to oppose its rotation. An electromagnet is provided for releasing the brake and an electro-magnetically operated circuit-breaker, the energizing coils of the brake-releasing magnet and the circuit-breaker being in series with each other and connected directly across the current-supply line in parallel with the armature of the motor.

830,537. Time-element Device. John G. Statter, Birmingham, England, assignor to William Maxwell Scott, Philadelphia, Pa. Application filed July 31, 1905.

The combination, with the tripping mechanism of a circuit-breaker, consists of means associated with the tripping member for delaying the start thereof during the continuance of a predetermined electrical condition and yielding instantly upon the occurrence of a different electrical condition.

830,568. Trolley-controlling Apparatus. Frank E. Case, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed March 10, 1905.

In current-collecting apparatus for electric railways, one claim covers a current-collecting device, controlling means therefor including a manually controlled member, and means controlled by the engagement of a device carried by the car and a device located adjacent the roadway for causing the manually controlled member to assume a definite position.

830,572. Clamp for Electrical Conductors. Scott C. Cutter, Oswego, Ill. Application filed July 3, 1905.

The patent covers a clamp for connecting together electrical conductors.

830,575. Telephone System. William W. Dean, Chicago, Ill., assignor to the Kellogg Switchboard and Supply Company, Chicago, Ill. Application filed December 6, 1901.

A polarized line signaling device and a batery at the central office are connected with the line, and there are means to render the device inoperative when a connection is established with the line and to maintain the same inoperative as long as the connection exists.

830,583. Combination Telephone Transmitter and Receiver. Charles C. Gilchrist, New York, N. Y., assignor to the Western Electric Company, Chicago, Ill. Application filed October 12, 1905.

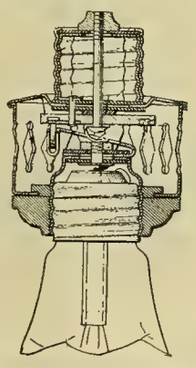
The receiver and transmitter of a hand telephone set are contained on the same casting.

830,585. Insulator for Telegraph and Telephone Wires. Salathiel V. Graves and Samuel H. McDaniel, McFall, Mo. Application filed November 14, 1905.

The device consists of a hollow metallic casing containing an insulating block. There are means for fastening the casing to a cross-arm or other object.

830,598. Incandescent Lamp. Gottlop Klumpp and Henry F. Herman, Brooklyn, N. Y.; said Herman assignor to said Klumpp. Application filed September 9, 1905.

One claim covers a disk of insulating material, a non-continuous contact-strip arranged upon the disk, a conductor post passing through the disk and engaging an end portion of the contact-strip, a rotatable lamp socket, a spring-metal trolley carried by the socket and a wheel carried by the trolley adapted to travel in a path including the contact-strip, when the lamp socket is rotated. (See cut.)



NO. 830,598.—INCANDESCENT LAMP.

830,628. Switch for Electric Circuits. Eddy R. Whitney, Lynn, Mass., assignor to the General Electric Company, Schenectady, N. Y. Application filed June 2, 1904.

In a reversing switch for electric circuits is a switch member movable in a single plane having an off position. There is a running position on each side of the off position, and a stationary member is adapted to be engaged thereby and to prevent a unidirectional movement of the switch member from one running position to the other.

830,629. Semaphore. Jean F. Webb, Jr., Denver, Colo., assignor to the Electric Signagraph and Semaphore Company, a corporation of Arizona Territory. Application filed November 11, 1905.

A rotatable driving shaft operates an oscillating signal shaft which bears the semaphore arm. Electrically operated means including a circuit controller are provided for unidirectionally rotating the driving shaft.

830,639. Process for the Electrolytic Production of Copper. Johannes A. W. Borchers, Aachen, Paul R. Frank, Eisleben, and Franz E. Günther, Aachen, Germany. Application filed September 21, 1905.

This process for the direct electrolytic production of pure copper from copper matte consists in first bringing the copper matte to a richness of between 72 and 80 per cent. of copper, and then using the matte as an anode in an electrolyte composed of an acid solution of copper sulphate.

830,653. Telephone Pay-station Device and System. Alfred H. Dyson, Chicago, Ill., assignor to Milo G. Kellogg, Chicago, Ill. Application filed December 30, 1904.

The device covered by the patent includes a central source of current for operating purposes, a pay-station device associated with the calling subscriber's line at the substation, and apparatus associated with the device adapted to be actuated by the response of the called subscriber to automatically collect a coin deposited in the device.

830,654. Telephony. Alfred H. Dyson, Chicago, Ill., assignor to Milo G. Kellogg, Chicago, Ill. Application filed April 3, 1905.

The patent covers an automatic telephone system equipped with a pay-station device adapted to collect a deposited coin upon response of the called subscriber.

830,674. Machine for Electrically Welding. Louis S. Rolland, Brussels, Belgium. Application filed September 28, 1905.

Included in the mechanism of the machine is a lever carrying the movable terminal of the primary current arranged opposite the fixed terminal.

830,675. Attachment for Telephone Test Sets. George L. Rosenberger, Manassas, Va. Application filed September 12, 1905.

One of two pivotally connected members is provided at its extreme outward end with a spur in its outermost recess whereby wires of different sizes may be accommodated in the registering recesses, and whereby also the spur may pierce the insulation of wires or a wire may be inserted at will in those recesses that are devoid of spurs.

830,686. Trolley-pole Controller. John J. Tartt, Los Angeles, Cal., assignor of one-half to David E. Spangler, Los Angeles, Cal. Application filed December 28, 1903.

A pivoted trolley pole has means for supporting the pole, a magnetic device for controlling the supporting means, a trolley carrier on the trolley pole, and means controlled by the trolley carrier for controlling the magnetic device.

830,696. Telephone Switch Hook. James A. Wotton, Atlanta, Ga., assignor to the Electric Manufacturing and Equipment Company, a corporation of Georgia. Application filed June 17, 1905.

A single sheet of material is split at one end and bent in shape to accommodate the receiver.

830,698. Electric Lamp. Albert Ackerman, Pittsburg, Pa., assignor to the Nernst Lamp Company, Pittsburg, Pa. Application filed October 4, 1899.

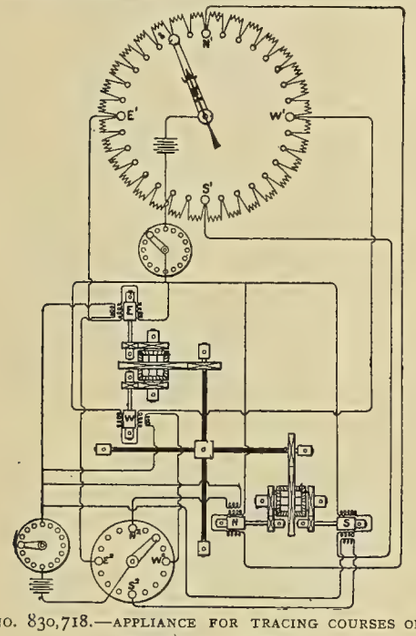
One claim covers one or more glowers containing rare oxides, a heater therefor consisting of a conducting filament which will deteriorate in the open air, the filament being separate from the glower or glowers, but in proximity thereto, an air-tight inclosing chamber therefor, a ballast conductor in circuit with the glower, means for sending current through the filament for heating the glower, and means for interrupting the circuit through the filament by the action of current transmitted through the glower.

830,708. Combined Candle Base and Socket for Miniature Electric Lamps. John H. Goehst, Chicago, Ill., assignor to the Federal Electric Company, Chicago, Ill. Application filed April 11, 1904.

An elongated one-piece candle-shaped body made of a single piece of insulating material is provided at one end with a base comprising an external-screw-threaded terminal ring fitted over the end of the body and adapted for screw-threaded engagement with a screw-threaded terminal ring of a standard electric-lamp socket. A central terminal is adapted for contact with the central terminal of the socket, the candle body being provided at its other end with a socket comprising an internal-screw-threaded terminal ring made smaller than the terminal of a standard socket to receive the base of a low-candlepower or miniature electric lamp.

830,718. Appliance for Tracing Courses on Charts. Harold E. S. Holt, Farnborough, England. Application filed November 26, 1904.

Apparatus for indicating the course of a vessel comprises an indicating device, independent mechanisms for driving the indicating device in two mutually perpendicular directions across a chart, electric motors for driving the mechanisms, and rheostats for controlling the motors according to the speed and direction of the vessel and of prevalent tides, currents and winds. (See cut.)



NO. 830,718.—APPLIANCE FOR TRACING COURSES OF VESSELS ON CHARTS.

830,730. Means for Surveying Bore-holes. Hugh F. Marriott, Parktown, Transvaal. Application filed August 30, 1904.

An instrument for surveying bore holes has an electric circuit and a resistance coil arranged so that the declination of the plumb bob from the vertical and the corresponding movement of the switch arm on the commutator first makes a free current, then a blank, then a resistance, then a blank, then a free current, then a blank, then a resistance, and so on.

830,767. Headlight. Frank Buchanan, Dayton, Ohio. Application filed October 26, 1903.

The patent covers an electric headlight.

830,770. Automatic Resetting Switch. Samuel H. Couch, Boston, Mass. Application filed October 2, 1905.

A telephone switching apparatus is described.

830,780. Circuit-closer for Locks. Anthony Glass, Cleveland, Ohio. Application filed January 31, 1906.

A circuit closer for locks comprises contact terminals, a movable connecting piece therefor, means actuated by the lock bolt to move the connecting piece into "set" position, and means actuated by the key to move the piece so set into closed position.

830,812. Protective Apparatus for Compensator Dynamos. Henry H. Wait, Chicago, Ill., assignor to the Western Electric Company, Chicago, Ill. Application filed January 18, 1904.

In a compensating system of electrical distribution, combined with the main generator and compensator dynamos provided with compound windings, is an electromagnetic switch responsive to excessive current through one side of the system, adapted in its response to render inoperative the series of field windings of the compensator dynamos. (See cut.)

830,849. Dynamo Electric Machine. Willard F. Richards, Buffalo, and William A. Turbayne, Lancaster, N. Y., assignors to the Gould Coupler Company, New York, N. Y. Application filed August 12, 1905.

The combination consists of a main field magnet frame, heads closing the ends of the main frame and provided with armature-shaft bearings, an armature shaft journaled in the bearings and projecting out through one of the heads, a main armature on the shaft and inclosed by the main frame and heads, an auxiliary armature secured to the projecting end of the shaft, an auxiliary field-magnet frame surrounding the auxiliary armature and secured to the adjacent head of the main frame, and a cover closing the outer end of the auxiliary frame. (See cut.)

830,862. Electrical Ceiling Switch. Joseph G. Swallow, New York, N. Y., assignor of one-half to Hubert Krantz, Brooklyn, N. Y. Application filed April 29, 1905.

A rotary snap switch is the basis of the patent.

830,879. Votometer. George E. Campbell, Pittsburg, Pa. Application filed July 19, 1905.

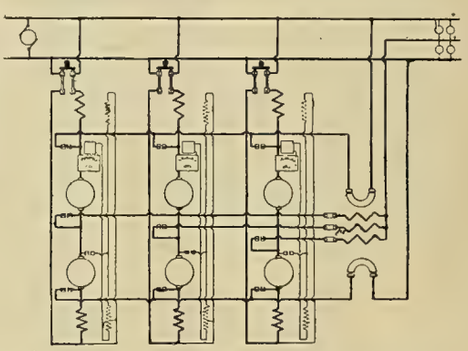
An electrically operated voting apparatus is covered by the patent.

830,898. Gas-engine Sparker. Stephen A. Hasbrouck, Yonkers, N. Y., assignor to Anna M. Hasbrouck, Yonkers, N. Y. Application filed August 26, 1903. Renewed February 10, 1906.

The invention consists of an improved sparker for gas engines.

830,918. Anode. John Nelson, Peru, Ill. Application filed June 28, 1906.

This anode comprises a plate equipped with vertical marginal cleats and a porous envelope forming therewith a pocket open at its upper end.



NO. 830,812.—PROTECTIVE APPARATUS FOR COMPENSATOR MOTORS.

830,919. Device for Igniting and Extinguishing Gas. Richard N. Oakman, New York, N. Y. Application filed June 2, 1905.

An electrode is arranged to make and break an electric circuit and cause a spark to light the gas at the burner when turned on.

830,921. Means for Transmitting Electrical Impulses. Francis L. Orr Thurman, Iowa. Application filed July 19, 1905.

A device for sending intermittent charges of electricity comprises an electromagnet, a rotating member turned by the electromagnet and a circuit-breaker having one of its terminals mounted on the rotating member and organized as a centrifugal governor to close the circuit only below a definite speed.

830,923. Presswork Recorder. Walter F. Palmer and John Winnacott, New York, N. Y. Application filed July 7, 1905.

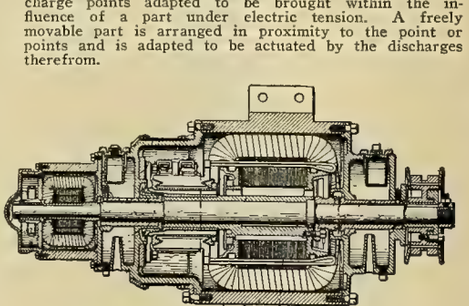
Electrical means are provided by the invention for indicating and recording the theoretical speed of a printing press.

830,924. Current Rectifier. Franz Pawlowski, Vienna, Austria-Hungary. Application filed November 14, 1904.

The rectifier involves two electrode plates, one of which is composed of aluminum, and a plate of hemi-sulphide of copper arranged between the two plates.

830,938. Potential Indicator. John B. Taylor, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed January 3, 1905.

A potential indicator comprises one or more discharge points adapted to be brought within the influence of a part under electric tension. A freely movable part is arranged in proximity to the point or points and is adapted to be actuated by the discharges therefrom.



NO. 830,849.—DYNAMO-ELECTRIC MACHINE.

830,947. Means for Starting Alternating-current Machines. Obed F. Whitehurst, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed January 28, 1905.

Combined are an alternating-current machine, a circuit to which the machine is to be connected, a voltage regulator, means for impressing the voltage of the circuit upon the whole or upon a portion of the regulator, and means for connecting the machine to the regulator or to the circuit independently of the regulator.

830,971. Electric Clock. Ulysses L. Collins, St. Louis, Mo. Application filed September 18, 1905.

A clock having suitable electrical connections from a lever through the coils of an electromagnet and to the ratchet wheel has a spring in which power is stored by the actuation of an armature.

830,981. Telephone System. Alfred H. Dyson, Chicago, Ill., assignor to Milo G. Kellogg, Chicago, Ill. Application filed April 17, 1905.

An automatic telephone exchange system is the basis of the invention.

830,982. System of Electrical Distribution. Justus B. Entz, Philadelphia, Pa. Application filed March 28, 1905.

The features include an alternating-current circuit and its generator, a battery, transforming provisions interposed between the battery and the alternating-current circuit, and a regulator and field connections operatively independent of changes and frequency in the alternating-current circuit and responsive to changes of energy in the alternating-current circuit and adapted to effect changes in the direct-current voltage to permit the battery to deliver and receive energy in respect to the alternating-current circuit. (See cut.)

831,001. Receiver Hook for Telephones. Denis Howard, Binghamton, N. Y. Application filed January 16, 1906.

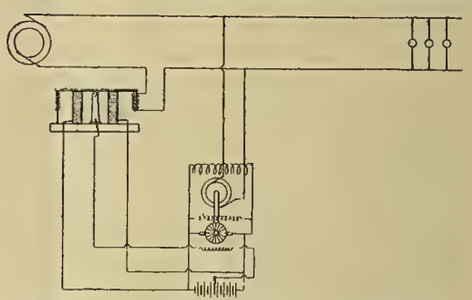
The hook has one end provided with a detachable contact plate carrying a number of make and break members for indicating the local station as the receiver is removed from or placed upon the hook.

831,013. Distant-acting Electrical Gas Igniter. Georg Lentschat, Hohen-Schönhausen, near Berlin, Germany, assignor of one-half to Wenzel I. Drahonowsky, Miröschau, Austria-Hungary. Application filed July 24, 1906.

In a distant-acting electrical gas igniter are two electromagnets and their armatures and a ratchet wheel operated by the armatures of the electromagnets.

831,016. Electric Door Strike. George N. Parker, Boston, Mass. Application filed July 9, 1904.

An electric door opening device has within its frame an electromagnet and its armature.



NO. 830,982.—SYSTEM OF ELECTRICAL DISTRIBUTION.

831,025. Locomotive Engineer's Alarm. Edward McClintock, Merriam Park, Minn., assignor to the McClintock Manufacturing Company, St. Paul, Minn. Application filed May 16, 1904.

The combination, with the main track rails, includes auxiliary rails divided into blocks or sections, a suitable resistance interposed between the main and auxiliary rails, "good-order" and red-light alarm circuits having suitable closers, one circuit having a greater resistance than the other and being normally open while the other is normally closed, signal devices provided in the circuits, a pole-changer circuit, and a source of electrical energy connected with the circuits.

REISSUE.

12,530. Electrical Circuit Controller. Harry W. Leonard, Bronxville, N. Y. Application filed July 2, 1906. Original No. 817,719 dated April 10, 1906.

Combined with a rheostat are a separate switch, a device for causing a force to be suddenly applied at its full strength and thereby actuate the switch to either close or open the circuit, the switch and its operating device being capable of independent movement, and an arm on the rheostat contact lever for operating the actuating device.

PATENTS THAT HAVE EXPIRED.

Following is a list of electrical patents (issued by the United States Patent Office) that expired on September 17, 1906:

411,016. Manufacture of Carbon Filaments. T. A. Edison, Menlo Park, N. J.
411,017. Carbonizing Flask. T. A. Edison, Menlo Park, N. J.
411,018. Manufacture of Incandescent Electric Lamps. T. A. Edison, Menlo Park, N. J.
411,019. Manufacture of Incandescent Electric Lamps. T. A. Edison, Llewellyn Park, N. J.
411,020. Manufacture of Carbon Filaments. T. A. Edison, Llewellyn Park, N. J.
411,030. Combined Electric Motor and Blower. C. J. Hirlimann, Fort Lee, N. J.
411,042. Electric Meter. H. W. Kolle, London, County of Surrey, England.
411,058. Mechanical Telephone. C. M. Radford, Concord, N. H.
411,088. Arc Lamp. F. R. Boardman, London, England.
411,093. Instrument for Connecting Line Wires. W. H. Coughlin, Worcester, Mass.
411,120. Signaling Apparatus. W. R. Cole, Detroit, Mich.
411,124. Receptacle for Secondary Batteries. F. W. Huestis, Newton, Mass.
411,133. Electric Polarized Annunciator. C. E. Scribner, Chicago, Ill.
411,138. Electric-clock System. C. H. Carter, Brooklyn, N. Y.
411,150. Electromotor. M. A. Kissell, Chicago, Ill.
411,153. Terminal-plug Attachment for Flexible Electric Cords. S. C. Lafferty, Chicago, Ill.
411,168. Gong-striking Mechanism for Synchronized Clocks. C. H. Pond, Chicago, Ill.
411,198. Telegraph Key. A. E. Johnson, Carson City, Nev.
411,204. Pole for Supporting Electric Conductors. S. H. Short, Columbus, Ohio.
411,230. Electric High and Low-water Alarm. D. H. Streeper, Norristown, Pa.
411,287. Electric Arc Lamp. F. E. Kinsman, New York N. Y.
411,301. System of Electric Generation and Distribution for Railway Cars. E. E. Ries, Baltimore, Md.
411,313, 411,314. Overhead Frog for Electric Railways. M. J. Wightman, Lynn, Mass.
411,370. Connector for Secondary Batteries. S. H. Barrett, Springfield, Mass.
411,380. Cut Out. F. G. A. Heller, Berlin, Germany.
411,396. Holder for Electric-light Shades. H. H. Sawyer, Ridley Park, Pa.
411,400. Galvanic Battery. W. C. Thompson, Minneapolis, Minn.

WESTERN ELECTRICIAN

EVERY SATURDAY

Vol. XXXIX. CHICAGO, SEPTEMBER 29, 1906 No. 13

Alternating-current Motors in a Large Laundry.

Probably no branch of the electrical industry is making more rapid strides than that which has to do with the development of industrial motor applications. In many and diverse industries operators are rapidly realizing the advantages of the electric motor, and in consequence other forms of factory transmission are daily being discarded for the more modern, economical and efficient electric drive.

In equipping a factory, mill or the like for electric drive, several types of motors are available, and each in its particular field is giving satisfaction. What system of motors to install is a question to be determined by the location and characteristics of the plant and the nature of and conditions surrounding the machines to be driven. Much can be said on this subject, and many model electrically operated industrial plants might be cited. It is, however, the purpose of the present article to tell briefly of the first application of polyphase induction motors, in this country at least, to the operation of laundry machinery.

The Schriver Laundry Company, a well-established and thriving concern, some time ago abandoned its old quarters and moved into its large new laundry building at 1482-1486 West Lake Street. It may be said truthfully that everything which went into the new building is modern and of a high grade of excellence. The plant as now in operation may fairly be termed a model one.

After much thought it was decided to install alternating-current motors to drive the machinery. The conditions affecting electric motors in a laundry are severe, owing to steam, water, excessive heat in many places, the use of gas for heating various machines and the prevalence of combustible material. To meet these conditions three-phase induction motors were installed. About 15 motors are required to operate all the machines. In most cases group drive is employed, from three to five or six machines operating at constant speed being driven by one motor.

All the motors were furnished by the Stanley-G. I. Electric Manufacturing Company and embody this company's latest improvements. They are of squirrel-cage construction, the armature consisting of a cast-iron body on the shaft and a core mounted on the body made up of slotted iron punchings containing armature conductors short-circuited at each end by rings. The motors have no electrical connections between their armatures or revolving part and any outside electrical circuits, and therefore have no need of moving contacts of any kind, such as commutators or collector rings. These features eliminate the elements which require the most care and attention and remove danger from electric spark, permitting the motors to operate with safety when surrounded by inflammable materials or gases.

Most of the motors are suspended from the ceiling, as seen in the accompanying pictures. In this position they have now been in successful operation for seven weeks without so much as a five-minute delay. Very little attention is given them, the effects of dust and steam showing no bad results.

In Fig. 4 are shown five wash machines along the east wall and near the middle of the building These are operated by one eight-horsepower motor from a line shaft. Another string of four wash machines and two extractors is located just west of these. This group is operated from a line shaft by a 10-horsepower motor shown at the ceiling in Fig. 4. A duplicate of the last-mentioned group is located along the west wall and is operated by a 15-horsepower motor. The line shaft for this group extends to the north where the mechanism of a freight elevator is belt connected. All the motors are operated at 220 volts, and those thus far mentioned at 1,200 revolutions per minute.

The largest single machine in the laundry is a direct-driven mangle used to smooth or iron flat goods, such as sheets, towels, etc. This machine, a rear view of which is given in Fig. 2, is connected by worm gear to a two-horsepower motor running at 1,800 revolutions per minute. The cylinder of this machine weighs 8,000 pounds and carries 80 pounds of steam. A smaller mangle, not shown, is operated by the same size motor as the first one, but is belt connected.

Fig. 3 is a view of four extractors mentioned

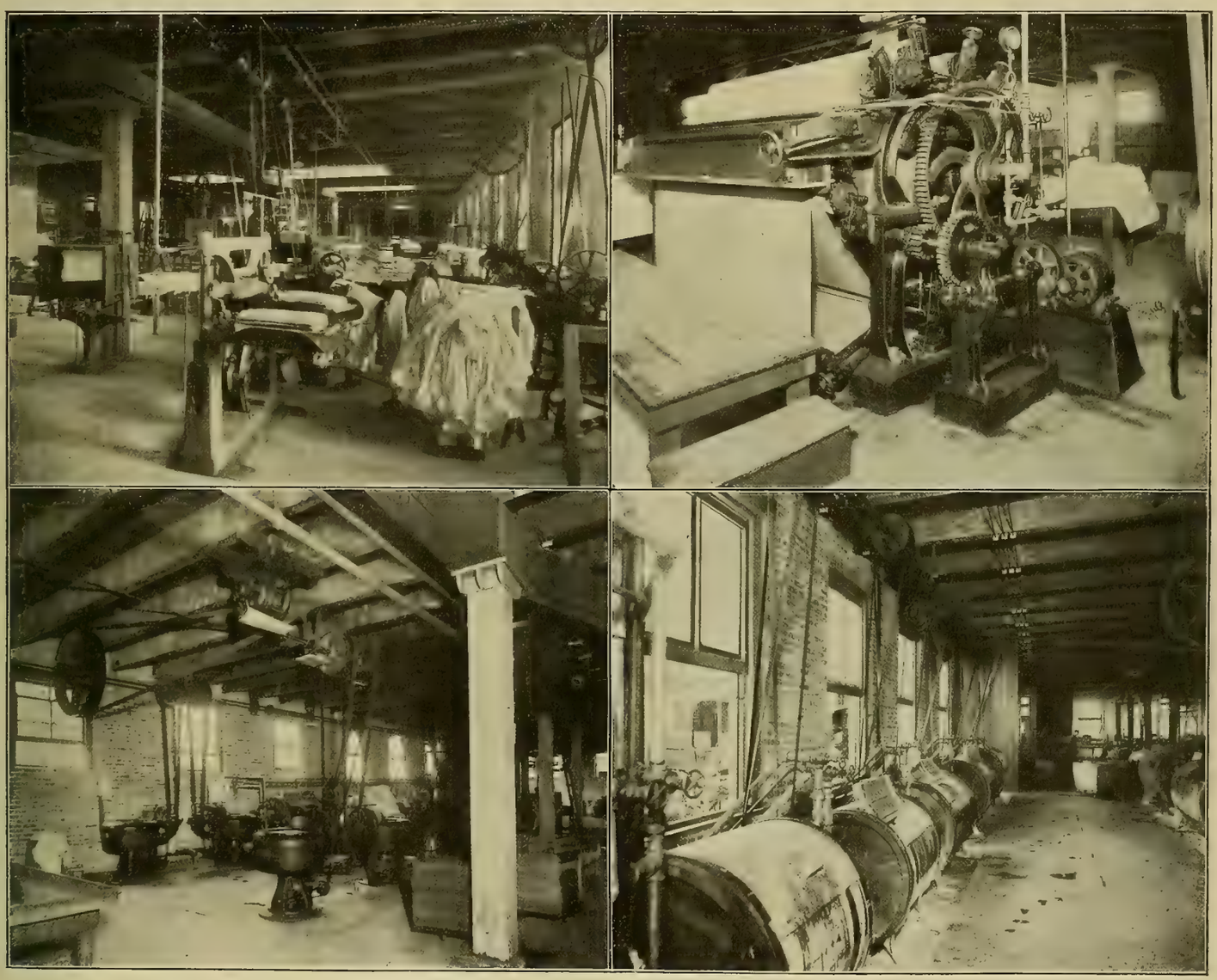


Fig. 1. Ironing Machines on the Second Floor.
Fig. 2. Two-horsepower Motor Driving a Large Mangle.
Fig. 3. Four of the Electrically Operated Extractors.
Fig. 4. A String of Wash Machines Operated by Overhead Motor.

ALTERNATING-CURRENT MOTORS IN A LARGE LAUNDRY.

above. The motor shown suspended from the ceiling is of 15 horsepower and drives a line shaft to which the two machines to the left in the picture are belted.

On the second floor of the building are found the drying apparatus, starch extractors, dampeners, a large variety of ironing machinery, etc. This floor is well lighted and the machinery is of the best. It is conveniently arranged, reducing hand work to the minimum. A view of a section of the ironing department is shown in Fig. 1.

Group drive is largely employed on the second floor also. Two Troy patent dryers and the starch machines are driven by a two-horsepower motor. One large dryer, a small wash machine and a starch extractor are run from a shaft driven by a three-horsepower motor. A similar motor operates four dampeners, a small mangle and a shirt-body ironer, and still another three-horsepower motor drives a No. 5 collar and cuff ironer and a shaping machine for collars and cuffs. The only direct-driven machine on the second floor is a reversible body ironer which is operated by a one-half-horsepower motor attached to the machine. The last group on this floor is made up of two body ironers, one band ironer, three plain-shirt ironers, a cuff ironer and one sleeve ironer. The shaft for this group is run by a three-horsepower motor.

In the background of Fig. 1 is located the department where the hand ironing is done. This department, like all others, has been equipped to employ electricity wherever possible. Electric flatirons are provided and suitable connections, but owing to some delay in getting the installation in order and owing to the extremely busy season, the electric irons have not yet received full attention. A thorough trial is to be made as soon as the busy season is over.

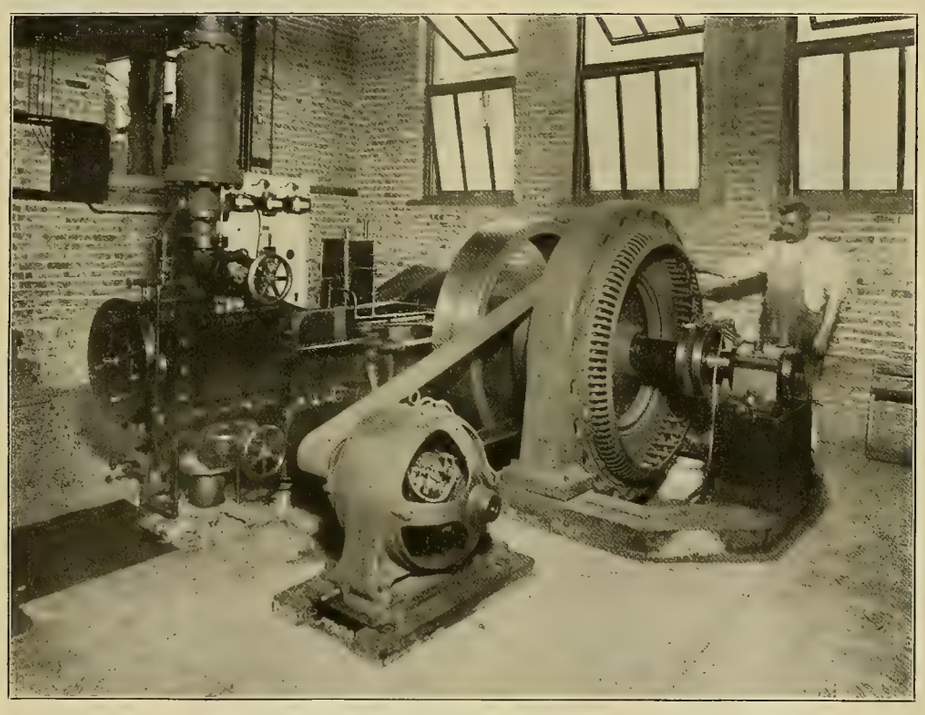


FIG. 5. THREE-PHASE GENERATING PLANT IN ELECTRICALLY OPERATED LAUNDRY.

As the armatures of the motors used in this installation are always short-circuited, the motors take several times their full-load current when starting with normal potential on their fields. It was found advisable to cut down this starting current on the larger motors and therefore all sizes larger than five horsepower are provided with a device called a starting compensator. This is merely a single-coil transformer with several taps brought out for the secondary voltage and with a switch so arranged that a reduced voltage may be applied to the motor terminals in starting. After the motor has attained full speed the compensator may be thrown out and the motor connected direct to the line. The circuits throughout the building are 220-volt.

Current for light and power is generated on the premises. The power house adjoins the northeast corner of the main building and is very complete and convenient. It is divided by brick walls into four rooms—the boiler room, coal storage, engine and generator room and machine shop. A good view of the engine, generator and switchboard is given in Fig. 5.

The generator, made by the National Brake and Electric Company, is of the engine type, direct-connected to a 125-horsepower Ball engine. It is a 75-kilowatt alternating-current, three-phase, 60-cycle, 220-volt revolving-field machine, operating at a speed of 277 revolutions per minute. The revolving field is separately excited and is supplied with an 80-volt exciting current from the direct-current genenerator shown in the picture, the current passing through the collector rings to the field terminals.

The switchboard, shown in Fig. 5, and the wiring were installed by Kohler Bros. of Chicago. It is of white marble and contains the usual instruments. The switch in the center is the exciter switch and those in the bottom row are in order the power, light and main generator switches. Besides the usual connections, a field rheostat furnished with the exciter is mounted on the rear of the board.

The boiler room at present has one 125-horsepower boiler, installed by the Ames Iron Works of Oswego, N. Y. Another of the same size is being installed. Water for the plant is taken from a well 475 feet deep, owned by the company. A deep-well pump throwing 40 gallons a minute from this well is located in the boiler room. There is also a water heater capable of heating 4,000 gallons of water an hour for washing purposes, and the boiler, feed-water heaters and pumps. The coal is stored only a few feet from the furnace doors. The smoke-stack is 110 feet high and made of brick.

In the machine shop adjoining the generator room can be found the various tools and machines necessary to keep things about the plant in repair. A three-horsepower motor mounted on the wall drives a shaft from which the various tool machines are operated. The motor also drives a gas machine with which gas is manufactured from gasoline for use throughout the plant for various heating purposes.

At present the plant is lighted by ordinary incandescent electric lamps. Preparations are now being made to install Nernst lamps.

Mr. J. A. Barkey, secretary and treasurer of the Schriver Laundry Company, manages the business. In planning the new plant the best authorities in the various lines of machines and appliances were consulted and no expense was spared to make it complete. The company does a fairly large business, requiring about 90 employes. The machinery and power plant are in charge of Mr. J. J. McCarty.

The Osram Lamp.

The Osram electric lamp is a new invention on the German market undergoing test. It replaces the carbon filament for incandescent lamps by fine wires of wolfram, which are said to employ only one-third of the energy heretofore required. A test at Charlottenburg showed that after use of 1,000 hours there was an average drop in candlepower of 6.3 per cent. in the case of 25-candlepower lamps and 3.6 per cent. in the 32-candlepower lamps. Of the 16 lamps under test 11 were not damaged, and capable of continued use. The new lamp shares with the osmium lamp the drawback that it can only be used hanging downward, but it is assumed that this disadvantage will be overcome.

Colorado Electric Light, Power and Railway Association.

The fourth annual convention of the Colorado Electric Light, Power and Railway Association was held in Denver, beginning Monday, September 18th, and continuing for three days. This association is not old in years, but it has been productive of much good for the purposes for which it was organized. A good part of the credit of the work

GEORGE B. TRIPP, PRESIDENT OF COLORADO ELECTRIC LIGHT, POWER AND RAILWAY ASSOCIATION.

of the association is due to the energy and ability of the retiring president, Frank W. Frueauff, the general manager of the Denver Gas and Electric Company, and George B. Tripp of Colorado Springs, who was honored by being elected to the office of president to succeed Mr. Frueauff. The new secretary, on whom a great part of the work will devolve during the coming year, is J. F. Dostal, chief engineer of the Denver Gas and Electric Company. Mr. Dostal was recently appointed to this position with the Denver company. W. G. Matthews of Denver was elected vice-president. F. W. Frueauff and J. A. Beeler were elected additional members of the executive committee. The new finance committee consists of John F. Vail, William Mayher and E. P. Dillon. The new members of the membership committee are J. W. Stearns, F. C. Webber and M. T. Merrill. W. J. Barker, Gen. Irving Hale, L. M. Cargo, D. V. Sickman and W. T. Wallace were elected to serve as members of the advisory committee.

During the convention the members were pleasantly entertained. Representatives of the different supply houses took the visitors to the theaters and other points of interest. In the earlier part of the week a visit was made to the power plant of the Denver City Tramway Company, which is one of the most complete and best equipped in the West. Later in the week the delegates inspected the high-tension sub-stations of the tramway company.

The papers read and the discussion that was given them brought out a number of interesting points and questions of considerable importance. In the opening session the members and visitors present heard an interesting address by W. D'A. Ryan of Lynn, Mass., who is connected with the General Electric Company. Mr. Ryan is widely known as an illuminating engineer and spoke on his line of work. His discussion covered his field very completely and developed a number of points that were thoroughly appreciated. One point of interest was as to the lighting needed to show off jewelry.

"In lighting a large store," he said, "we will consider the light that is wanted for a jewelry store. If they are displaying and selling lots of jewelry, the white lights should be introduced in order to bring out the effects. On the other hand, jewelry flattens very much under a white light. A diamond picks up light beautifully, however. In a large department store that is a little different proposition. Step into almost any department store and notice how it is lighted. You will find that the columns are anywhere from 17 to 22 feet apart, and the lights will be strung along almost anywhere they take a notion to place them, for the reason that one large light in the center is not sufficient properly to light the store."

The paper read by E. P. Dillon of Colorado Springs on "Transformer Testing and Line Records for Transformers" was exhaustive and covered this subject with remarkable clearness and ability. "Transformer testing from the standpoint of central-station men," Mr. Dillon said, "may mean very elaborate investigation, or it may mean rather elementary researches, according to the means at hand and the time and the expense allowable for expending on the subject. The large central station, with a considerable engineering staff, if systematic, will doubtless go into the subject with considerable thoroughness, while the small station has neither the time nor equipment for doing so in the majority of cases. It is always well to check the manufacturer and determine whether his apparatus sustains his claims. At the same time, due to

the advanced stage of design and clean competition, the average customer will be quite on the safe side if purchasing any reliable grade of apparatus."

Mr. Dillon went on to discuss in detail the more simple methods of testing transformers and keeping track of them after they are in use on the line.

J. R. Cravath of Chicago read a paper on the "Lighting of Small Stores." He explained that his paper was meant to be of assistance only to central-station men in the smaller towns. He said that the whole problem of store lighting is one of combining maximum useful illumination with the best advertising effect possible. Mr. Cravath showed how lighting with the current in use could be made much more effective than it is in the majority of instances.

The principles of operation, construction and results obtained from the steam turbine were elaborately and admirably set forth in a paper read by C. C. Chappelle of Denver. He said that it was quite impossible to go into the subject in a way to do it entire justice, but that he would devote his attention to the branch with which he was most intimately connected. "The many excellent features of the steam turbine," he said, "have frequently been taken advantage of in a manner which should not be tolerated in a power plant worthy to be equipped with such refined and modern apparatus. It is not in the makeshift plants that the turbine can do its best work. In many cases it has had to be designed to accommodate existing conditions in the plant. Today the reverse is true. The plant is now being designed for the turbine, and the more universal this practice becomes the more marked will be the influence of the turbine in general power-station practice. In many respects the turbine and reciprocating engine are now upon an equal footing. Even if first cost of turbine were a paramount issue, in view of the many additional advantages and sources of economy which the turbine presents, we could deliberately expend much larger amounts for equipments, with the assurance that the cost would soon be wiped out in actual service."

The paper of J. Robert Crouse of Cleveland on "Profitable Commercial Co-operations" was read by George B. Tripp, the secretary of the association, as Mr. Crouse was unable to be in attendance. The paper was long and amplified the views made public by Mr. Crouse at the Denver convention of the National Electric Light Association in 1905. The writer told of the increase in the work of co-operation by central-station managers, and predicted that it would continue at a remarkable rate the coming year.

A. M. Ballou of the Denver Tramway Company was accorded unstinted praise by the members of the convention for his excellent paper on "Water-type Lightning Arresters." Mr. Ballou explained how these arresters had diminished to a great extent the expense of operation, and after he had finished it was conceded that he had nearly solved this most momentous question in connection with the operation of street railways.

The paper read by Leonard Wilson of the General Electric Company on "Voltage Regulation" went into every phase of the question and brought forth a considerable amount of interesting discussion.

The discussion on new-business methods brought out the fact that central-station men in Colorado are finding the electric flatiron a source of increased revenue. Some of them sell the iron at cost; others give it on trial to consumers, while others charge the full amount and still make good revenue from the use of the iron.

In connection with the Question Box, the subjects of boilers and engines, meters, transformers and lines, lamps and wiring and management were widely discussed.

Mr. W. A. Carter of the engineering department of the Denver Gas and Electric Company read a good paper on "The Use of Three-phase Motors in Outlying Districts." He gave an outline of the work that has been done by the Denver Gas and Electric Company in changing over the power distribution system of its outlying districts from 440-220 volts direct current to 2,200 volts alternating current, three-phase. He said that the change involved considerable initial investment, as it was decided that it must be made without any cost to the present consumers. In most cases it was agreed to give the customer a new three-phase motor in place of his old direct-current motor, the company to make the necessary changes in wiring and to stand the expense of removing the old and installing the new motor. In a few cases, where the motor was in very bad condition or a very ancient type, the customer was required to pay a small difference on the exchange. There was very little difficulty, he continued to state, in getting the consent of the old consumers to make the change. In some cases the customer was a little suspicious of the offer of the company to give him a new motor in place of his old one, and thought there must be some underhanded scheme to make him pay more for his power than he had been paying, but a short explanation of the reason why the company found it necessary to change the system and was willing to stand all the expense of doing so, usually made the matter perfectly satisfactory to the customers. A few of them were afraid the new motor would not be as good as the old direct-current motors, but a short explanation of simplicity and superior advantages of the three-phase motor was sufficient to allay their fear. In many cases the consumer took advantage of the opportunity to increase the size of his motor, simply paying the difference between the prices of the two sizes. In other cases the location of the motor was changed, the advice of the company's engineers being given free as to the arrangement which would give the most satisfactory results to the customer. A great deal of careful work was involved in ascertaining the speeds and sizes of pulleys in the old installations, so that the correct size of pulleys might be ordered for the new motor. In many cases measurements were made of the power consumed, and quite frequently the new outfit was figured to give a more satisfactory speed on the line shaft.

The following is a list of the names of those registered:

William Mayher, Greeley; W. G. Matthews and John M. Connelly, Denver; George B. Tripp, Colorado Springs; Ray Stout, Central City; F. C. Lattimer, Florence; C. H. Paul, Trinidad; John J. Cooper, C. K. Durbin and F. J. Campbell, Boston Building, Denver; W. L. Iliff and J. F. Dostal, Denver; Charles Neely, Florence; A. M. Ballou, A. J. McMullan and W. A. Cowling, Denver; Albert A. Danson, Colorado Springs; H. P. Tewksbury, Denver; George M. Hoag, Colorado Springs; C. M. Wright, Pueblo; G. Strum, Idaho Springs; H. S. Sands, Denver; Frank P. Read and T. F. Grover, Trinidad; William T. Wallace, Canon City; C. W. Humphrey, Denver; John J. Sherwin, Idaho Springs; W. P. Eyre, Buena Vista; N. Read, Denver; Robert J. Clark, E. P. Dillon, R. L. Goodale, Ivan A. Hoy and A. R. Wager, Colorado Springs; M. T. Morrill, Golden; F. Luddeback, Pueblo; F. C. Webber, Leadville; Fred H. Dewey, Georgetown; J. E. Blackall, F. J. Kysela, Irving Hale, H. C. Glaze, R. D. Marthens, Leonard Wilson, B. K. Sweeney, E. C. Means, L. M. Cargo, C. C. Chappelle and D. Van Sickman, all of Denver; W. Robbins, St. Louis; H. L. Woolfenden, Denver; J. F. Boynton, Colorado Springs; A. R. Hall, Denver; J. R. Cravath, Chicago; W. D'A. Ryan, Lynn, Mass.; Louis H. Frick, Cheyenne; C. Kuhlman, Elkhart, Ind.

Side Lights on Municipal Operation in Great Britain.

[From the London correspondent of the Western Electrician.]

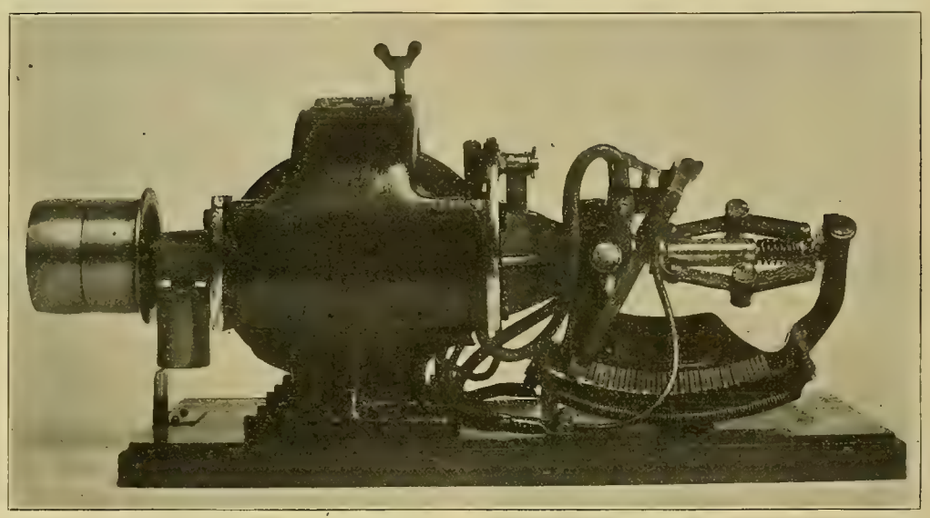
London, September 12.—An interesting sidelight upon the influence which the present socialistic tendencies of municipalities have had upon their employes is the action of the motormen and conductors on the Halifax tramway system in consequence of one of their number being discharged through allowing a car to run away and overturn. The whole of the operating staff struck for the reinstatement of their comrade, and for a day and a half no cars were running. The chairman of the tramway committee at Halifax, however, refused to be dictated to in this manner. With the aid of the tramways manager he set about engaging a new staff, and in spite of the efforts at intimidation the service is again running and many of the strikers cannot be employed again at Halifax owing to agreements having been made with the new men. It is pretty clear that the coming elections had something to do with the men's attitude, but this is now somewhat played out. Councillors do not live in that mortal dread of election time that many of the more ignorant imagine, and in consequence matters tend to be carried out on more business-like principles than was the case in the early days of the rise of socialism.

It is well known that the opinion of practically all our municipalities is that beyond paying the installment of the sinking fund for the year, no provision should be made by way of depreciation. The borough electrical engineer at Aberdeen in Scotland has been making some inquiries on this point and the result is interesting. Out of 171 undertakings, 125 follow the policy outlined above, although 114 put something to reserve in varying percentages; but 57 have made no provision either for reserve or depreciation. G.

Electric Lighting for Automobiles.

What is known as the Eyquem system for lighting gasoline automobiles by electricity has been developed in Paris. The principal feature is the installation on the car of the small dynamo illustrated herewith, especially designed for the purpose. This plan, although not particularly cheap, is considered to have advantages over a storage-battery equipment.

Power from the gasoline engine on the car, belt-transmitted, is used to drive the dynamo. The characteristic feature of the outfit, a centrifugal device, is seen at the right in the picture. This works against a spring and acts to move a lever arm across a series of contacts so as to operate a rheostat. The resistances which form the rheostat consist simply of a few turns of german-silver wire for each contact point, and the wire is wound upon a curved flat frame, as will be noticed, thus bringing the contact points into the arc of a circle. The regulator is so proportioned that the voltage at the terminals remains quite fixed, even though the speed of the dynamo is widely varied, as is to be expected. When the speed rises, the governor balls fly apart and bring the arm to the right so as to include a certain part of the resistance in the circuit, and vice versa. The dynamo is connected directly upon the lamp circuit. However, a small storage battery is also provided to supply current for spark ignition and to the lamps when the driving engine is at rest. The battery is always kept charged, unless the vehicle is stopped when it is desired to keep the lamps burning, when battery discharge begins. In relation to the ignition for the motor, the system has the added advantage that the battery never fails to give current, a point which will be appreciated. In this case the battery consists of five cells of 40 ampere-hours, two of which are sufficient for the ignition circuit. The use of a portable lamp and flexible cable for examining the motor is another good point about the system. The Paris correspondent of the Western Electrician had occasion to observe the performance of the dynamo when running upon lamps, and no change in the light could be observed when the speed of the motor was varied within the usual limits.



AXLE-DRIVEN DYNAMO DESIGNED FOR AUTOMOBILE LIGHTING.

Timber Testing at Purdue.

A long series of experiments has been completed at Purdue University affecting certain processes to increase the life, strength and physical qualities of timber. These processes are regarded necessary because of the steady diminution of the timber supply. The feeling is prevalent that everything possible should be done to increase the durability of the timber that is now being used for various purposes. The experiments at Purdue have been made chiefly in the interests of railroads by making mechanical tests of the ties treated by different processes. Over 400 ties were used, and upward of 600 tests were made. The timber-testing laboratory at Purdue is the one used by the government at the St. Louis Exposition.

Proposed "Inner Circle" System of Chicago Subway Terminals.[1]

By Arthur S. Robinson.

The particular feature of the problem that interests me most, and the one to which I desire to call attention in this paper, is the downtown terminal facilities.

The street surfaces have been so occupied by the tracks of the different and often antagonistic systems, endeavoring to get their terminals into the busiest possible portion of the downtown area consistent with economy of construction and operation, that it is a huge undertaking to try to bring a uniform system out of the diversified interests now occupying these streets. The result of this construction of individual lines without refereuce to the tracks or requirements of the other entering companies, and with no well-formed plan for a system as a whole, has been that there existed in the streets of Chicago a very large mileage of street railway that was operated at such cross purposes as to fall far short of its own possibilities, if rearranged, simplified and united in one harmoniously working whole.

It is evident that but little relief may be expected from the elevated railway systems, more because of the objection to the occupancy of any new territory in the streets of the downtown district than of any constitutional or structural failure. The opposition to any rearrangement, even, of the downtown terminal would be almost insurmountable. This has shown itself very unmistakably in the stop put on the extension of the station platforms, when it was hoped that this extension would have increased twofold the capacity of the loop to handle passengers.

Therefore, the space below the streets presents the only remaining and untouched opportunity, which if properly studied and treated will be the solution of

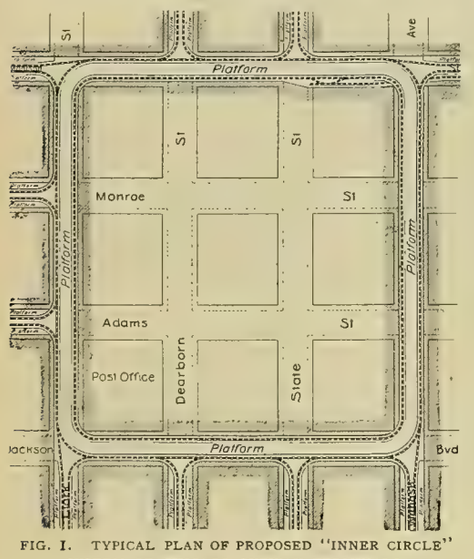


FIG. 1. TYPICAL PLAN OF PROPOSED "INNER CIRCLE" SYSTEM OF CHICAGO SUBWAY TERMINALS.

the traffic problem of the city. If imperfect or makeshift systems, or corporations, are allowed to occupy it, to the embarrassment of a full and complete operation of a comprehensive and harmonious solution of the problem, the passenger subway will be forever handicapped or crippled in its fullest development, just as it is now almost impossible to make any improvement in the surface lines.

No claim is made that what is here presented is the solution of the problem, but rather that it is a plan that has at least a number of features to recommend it, and which it is hoped may prove to be of so much value that they may be incorporated in the final plans.

Where the conditions will permit of its installation, it seems almost superfluous to insist upon the adoption of the loop as the essential feature of any system of terminals where a continuous movement of the traffic must be kept up. And yet there has been a very elaborate treatment of this problem for Chicago, in which it practically has no part.

The present trouble with the surface and elevated systems is not that the traffic cannot be brought into the terminal district, but once there, it cannot be handled rapidly enough with the present accommodations to prevent congestion. Therefore the problem of bringing the numerous street-car lines to their objective point, the business district, is not more vital to the success of the transportation question than the distribution of the terminals, when once the lines have reached that area, because the success or failure of the transportation problem depends upon the terminal system adopted.

Under normal conditions, the greatest congestion is not at "way stations," but at terminals, and an analysis of this condition reveals the fact that where the rolling stock can be kept most nearly in continuous motion, the nearest approach to the ideal terminal obtains. At all the great passenger-handling points, the loop terminal is adopted where possible, or approximated, where the conditions will not permit of its adoption.

The plans herewith submitted embody in the greatest measure the ideals of a perfect terminal. This plan contemplates a subway surrounding any given number of blocks in the downtown district—in this case, for illustration, the 12 blocks bounded by Jackson, Wabash, Madison and Clark. (See Fig. 1.)

In this subway there would be two belt tracks separated by a passenger platform. The inner track would be used simply as a transfer track. The cars used on this would be open on the platform side,

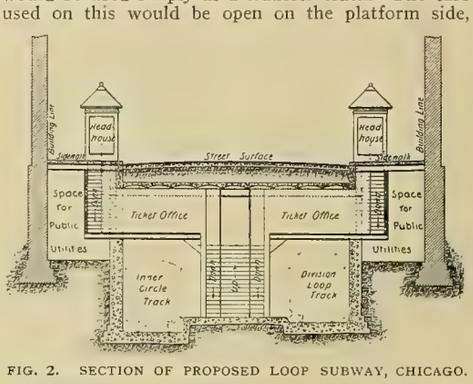


FIG. 2. SECTION OF PROPOSED LOOP SUBWAY, CHICAGO.

but closed on the other, and be run in the opposite direction to those on the division loops. There would be transverse partitions dividing these cars into small areas, to prevent the surging of the passengers when starting or stopping. There would probably be seats along the back wall of the car, for those who desire to use it for a trip of more than a couple of blocks. But for those passing to a nearby division loop station, it would be expected that they would stand. This car would be in effect a section of a moving platform that would stop and start instead of having a continuous motion. I have canvassed the question of using a moving sidewalk, and believe the best interests of the public would be served by a number of cars as I suggest, to be put on or taken off the inner track as the needs of the rush hours demanded, especially in view of the fact that the "better half" of the population would insist on getting on or off a moving platform backwards, as they will do with street cars.

The platform between the two tracks would be continuous, thus making it in this case twelve blocks long.

The end sections or tangents of the loops of each division line, those parts that are parallel to the inner circle and separated from it by the platform, are all connected up, and form the second or outer track of the subway. By means of this track, through car service can be maintained between the different divisions of the city, without in the least interfering with the perfect operation of the loop terminals of the independent divisions, because on this track all the cars of the division lines entering this loop subway run in the same direction.

Simplicity of arrangement is attained, because the main lines come into the business portion of the city and leave it in the most direct manner. This simplicity of arrangement makes simplicity in operation possible, because each division line terminates in its own loop.

The operation of this loop system must not be confounded with the method in use at present on the elevated loop. In this "inner-circle system,"

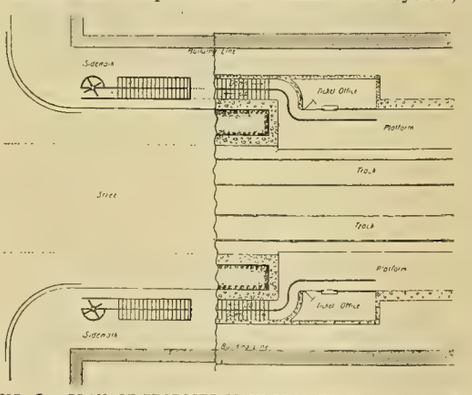


FIG. 3. PLAN OF PROPOSED MAIN-LINE SUBWAY, CHICAGO.

each division line terminates in its own loop, the operation of which does not in any way interfere with any other line, and neither do the cars of any other line interfere with this, while in the present elevated system the cars of all the divisions pass around the same loop, and each interferes with all the others by cross-overs and grade crossings. In other words, it is the difference between the use of individual loops for each line, and the use of a single loop for all the lines. Even in case of an accident blocking any division loop, or in the inner-circle subway. It does not interfere with the operation of any of the other division lines.

In this plan, curvature may be reduced to the minimum, in most cases to only the 360 degrees necessary to form a loop, and long tangents are the rule, reducing the wear on the car trucks.

Accessibility is accomplished by so covering the downtown district that the maximum distance to walk to enter a subway is one and a half blocks. The field being unoccupied, it is possible to design the subways so as to occupy the streets to the best advantage, and to accomplish this, the dominating idea should be to make every other utility subordinate to this. Chicago's passenger traffic must be the first consideration. This is a system of absolutely no grade crossings, as all cars on the connected tracks run in the same direction, and each division is independent of the others.

Through-car service is easily accomplished by means of the outer track in the loop subway, which is composed of the division loops connected up to form it, thus taking all through traffic off the surface of the streets downtown.

The passenger entrances to the subways may be all at the edge of the sidewalks anywhere along the subway, hence may be as numerous as the traffic demands, and not necessarily limited to street intersections. Entrances may also be had from railroad stations, office buildings, theaters, stores, etc., thus eliminating another element of surface traffic.

As none of the subways would come to the surface of the streets in the downtown district, there would be no tunnel approaches in that area. The existing approaches would all be closed and the streets restored to their normal condition. To save

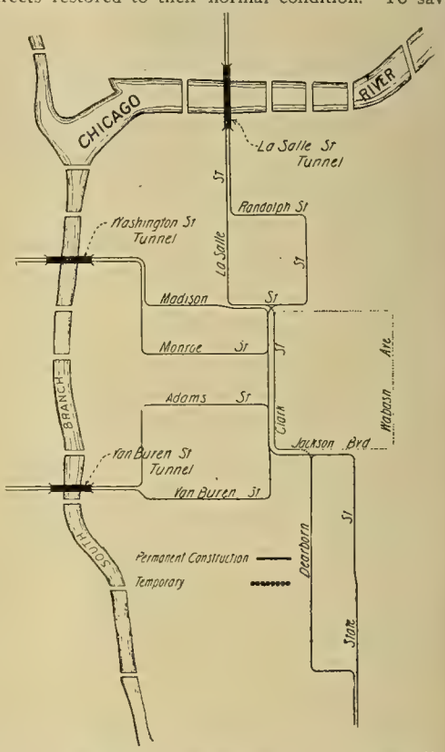


FIG. 4. SKETCH MAP OF PROPOSED "INNER CIRCLE" SYSTEM, CHICAGO, AS AFFECTED BY THE RIVER TUNNELS.

the street area at the points where the subways would come to the surface, the plan to purchase private property for the tunnel approaches is recommended.

There is but one level in this system and that will be as near the surface as the conditions of street surface, drainage and the underground utilities will permit, with a minimum depth of about 18 feet. Thus it will be seen that there will be a less number of steps to reach the platforms than are now required at the elevated stations.

In providing for express train service, after leaving the loop, these tracks can be carried to a lower level until the local tracks come to the surface, at which point the express tracks would come up to the upper level and continue on this, to the limit of the express service zone, at the minimum depth below the surface if desired. While the necessity for this service is not apparent at present, perhaps, it will only be a few years until the demand for it will be made in no uncertain voice.

At the corner of Wabash and Madison (Fig. 1) is shown the connection between the inner loop and the outer systems. This is indicated here as being accomplished by turning out of the Indiana Avenue loop (and also by a cross-over), passing under the outer and inner circles, coming up and connecting with the inner belt line by means of a turnout and a cross-over, enabling cars to be placed on or taken off without stopping, changing direction or running against the direction of the movement of the cars on either track.

In view of rapid increase in area and growing density, it becomes necessary to look a long way into the future and to provide, if possible, a means whereby any system, even if it does not meet all the requirements, will at least not be a handicap to this growth, nor to the introduction of another system that may be developed for the traffic de-

1. Condensation of a paper read before the Western Society of Engineers in Chicago on September 19, 1906.

mands. To meet these requirements, I have introduced additional cross-overs or loop ends, passing from one side of the loops to the other, on the cross streets. These tracks may be single at first, perhaps, and doubled when the traffic demands it, provision being made for doing this when the work is first done. These tracks would also serve the purpose of preventing a blockade, in case of an accident on or near the inner loop. But their principal object would be to sufficiently divide the traffic with the head of the loop, and thereby prevent congestion, thus enabling the lines to increase their loop capacity, which means, of course, an increase in the capacity of the whole system. For the capacity and efficiency of any line to handle its traffic depend upon the rapidity with which it can receive and discharge passengers at its most con-

METROPOLITAN ELECTRIC-RAILWAY BRIDGE OVER THE SEINE, PARIS.

gested point. The object of these additional heads is to enable the cars to be handled so rapidly in the downtown district that there will be no reduction of speed on the main line, outside of this district. The underlying principle of the whole scheme is the idea of an inner-loop transfer track, surrounded by an outer loop, composed of the connected loop ends of the diverging lines, and separated from it by a continuous platform between them.

The method of construction should be that of the "cut and cover," the "core" remaining to be excavated later, and hauled to the Grant Park filling by tracks laid in the tunnels of this system as fast as the material is removed. In Fig. 2 is shown a typical section of the proposed loop subway. Fig. 3 shows the plan of the main-line subway.

The act of lowering the tunnels will make the approach grades steeper, if connections are to be maintained with the surface tracks, as they now exist. As these grades are now about the maximum, the logical thing to do would be to either extend the approaches to maintain the old grade, or better yet, to plan to close the openings in the street surfaces as soon as practicable and arrange to terminate the tunnel approaches in subways. By this means the grades would ultimately be reduced, and a beginning be made on a system of subways. But before these subways can be extended, or even their depth below the street surfaces, which determines the approach grade of the tunnels, can be established, it is imperative that a comprehensive general plan of subway terminals shall be adopted for the accommodation of the traffic in the downtown business district.

In addition to the requirements of this system, whatever it may be, that it not only accommodate the traffic upon its completion, and that it may be flexible enough to be extended to accommodate the growing needs of the city, it shall be possible to build the least amount of subway at present necessary to accommodate the river tunnel traffic and yet to have that which is built a part of the completed system without the construction of unnecessary tunnels or the abandonment of any works that may be built for this tentative use.

Since the three existing tunnels would naturally, from motives of economy, be incorporated in any plan of subways, the reconstruction of them forces a decision in favor of the commencement of the construction of a system of subways, and that portion of the subways which would be immediately affected by the three tunnels would logically be the portion first built.

By reference to Fig. 4, it will be seen that in the "inner-circle system" the lines using these tunnels terminate in three loops entering the transfer subway in Clark and Madison streets. And to inaugurate this tentative arrangement it would only be necessary to build these loops and join them by that portion of the transfer subway which connects them; using the inner track of the transfer subway as a

[*Continued on page 249.*]

Electric Lighting of Metropolitan Railway Bridge over the Seine.

On the new bridge which has been built across the Seine for the Paris Metropolitan Railway, which is partly in subway and partly overhead on the new section, the lighting is carried out in a somewhat original way, especially in relation to the use of an automatic cut-out device for controlling the lamp circuits.

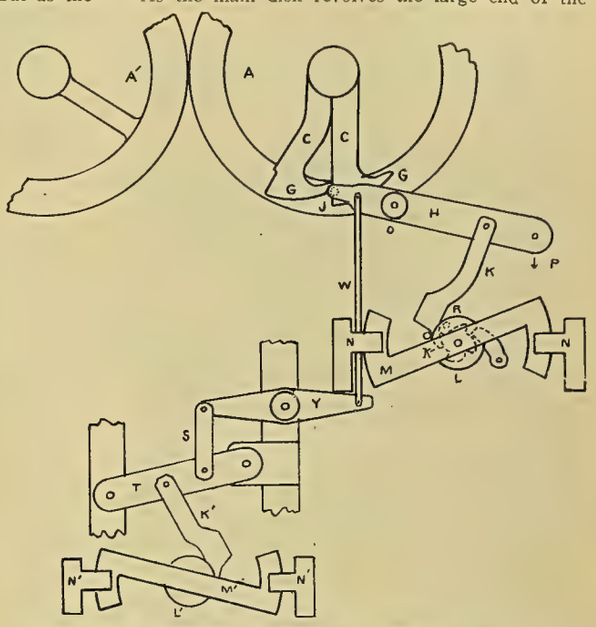
At first it was desired to use the system of incandescent gas lighting on the bridge, but as the passage of the cars causes a considerable amount of vibration, this being of very frequent occurrence owing to the large number of trains which are run on the line, the incandescent mantles would soon give out, especially as the lamps are mounted on the ends of long rods which hang down from the superstructure. The tests which were made of the incandescent gas system showed that it could hardly be used on the bridge, and again it was found undesirable to lay gas pipes across the bridge owing to the leakage of current which was to be feared between the current rail and the gas piping.

Accordingly, the present system of incandescent electric lighting was decided upon, using 550 volts from the main line. There are 85 lamps in all, and these are placed in the hanging lanterns which will be noticed here. A cabin contains the main switchboard and the automatic device. The lamps are run in series of five. Some of the lamps, 35 in number, are cut off at 12:15 a. m., and the 50 permanent lamps run till daybreak.

Two separate cables are run, one being the normal line and the other the specially protected circuit for extra precaution. Thirty of the permanent or all-night lamps are placed on the protected circuit and 20 on the other, and the 35 variable or early lamps are connected on the normal circuit. This arrangement is used so as to provide for accident in one of the circuits and always have the bridge lighted. It is now desired that the lighting and extinguishing of lamps be done without having to look after them, and for this purpose an ingenious device is used.

The automatic lighting and cut-out apparatus was designed by the Chateau firm of Paris, and as it was found that an electromagnetic device would be more difficult to regulate and keep in order, the present mechanical system was used. It has been constructed so as to operate the three different circuits upon which are placed all the lamps of the bridge. In the diagram will be seen the main details of the cut-out device. It is contained in a wooden case, and a clockwork movement drives the mechanism. The clock can run for 15 days at a time. The two-toothed disks (A) (A′) are rotated by the clockwork once every 24 hours, and the disks are geared one with the other. Running over the disk (A) are two arms (C) (the second disk (A′) carries an identical device), which turn upon the rim and can be fixed by a set-screw at any point on the circumference. At the end of the arm is a rounded part which forms a cam (G) and acts with the lever (H) at its extremity (J). Two hours before the moment of lighting the lamps, the cam begins to act upon the lever and raises it gradually, making it turn at the point (O). The lever carries at the other end an arm (K), which terminates in a pawl (K′), and this pawl works with the ratchetwheel (L), carrying four ratchet teeth on the circumference. As the pawl is raised up along the ratchet it falls at a certain moment into the depression above one of the teeth of the ratchet. The movement of the pawl is limited by the stop-pin (R).

As the main disk revolves the large end of the



AUTOMATIC DEVICE FOR LIGHTING AND EXTINGUISHING INCANDESCENT LAMPS ON METROPOLITAN BRIDGE.

cam (G) passes beyond the pin (J) so as to allow the arm to fall under the action of the weight (P) attached to the outer end. By the sudden movement of the arm, the pawl (K′) causes the ratchetwheel to rotate. On the shaft of the pawl is carried a switch arm (M), which serves to connect the jaws (N) (N). When the arm drops, the switch is thrown on, in the position here shown. This allows the current to pass in one of the three lighting circuits mentioned above, these being the permanent lamps. In the same way, at a time two hours before the lamps are to be turned off, the mechanism begins to work again, for now the cam of the second arm begins to lift up the lever. When the lever falls the second time it operates the ratchetwheel by another tooth and opens the switch.

The lamps of the permanent circuit are operated by the right-hand device. These lamps are placed 30 on the protected circuit (upper switch) and 20 on the normal circuit (lower switch). Both circuits are made or broken at once by the upper switch and by the lower switch, which are connected by a central rod (W), the rocking arm (Y) and the system (S_1) (T_1) (K′) and (M′). The lower switch is identical in construction with the other. The left-hand device, which is operated by the second disk (A′), is identical with the first, but without using the lower or second switch. It is used to operate the variable circuit, as above stated.

As the disks carry 288 teeth, the position of the movable arms can be set to five minutes. Divisions are engraved on the disks so as to show the hours and minutes from one up to 24. The desks can be set at the proper hour by a device which releases them from their shaft, after which they are fixed in place.

A. DE C.

Feather River Power Transmission.

The Western Power Company, which has been doing preliminary work in the Big Bend and Big Meadows districts in Plumas County, California, for several years, has completed its financial engineering and is expected to get down to practical construction work before long. It is considered by engineers one of the greatest projects in its ultimate possibilities outside of Niagara Falls. An office has been established in San Francisco and another will be located at the power site at the Big Bend of the Feather River. The New York engineering firm of Viele, Cooper & Blackwell is in charge of the construction work. The 165-mile transmission line to San Francisco is to start from the Big Bend, where a postoffice is to be established and a small town is springing up. The main power house, which is to be constructed near the Big Bend Tunnel, is to have sufficient room, ultimately, to accommodate generating units with a combined capacity of 120,000 horsepower. The first section will be built to house units of a total capacity of 40,000 horsepower.

WESTERN ELECTRICIAN

EVERY SATURDAY.

PUBLICATION OFFICES:

507 Marquette Building, - CHICAGO.

TELEPHONE, MAIN 1746.

Eastern Office, 150 Nassau Street, New York.

Telephone, 5220 Beekman.

Trade Supplied by Western News Co.

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SUBSCRIPTION, in advance, postage prepaid, $3.00 for a full year of 52 numbers; in clubs of four or more, $2.50, with free extra copy for eight subscriptions; foreign countries, $5.00 a year; single copies, 10 cents. When change of address is requested, the **old address** as well as the new should be given.

CORRESPONDENCE relating to electricity or any of its practical applications is cordially invited, and the co-operation of all electrical thinkers and workers earnestly desired. Clear, concise, well written articles are especially welcome; and communications, views, news items, local newspaper clippings, or any information likely to interest electricians, will be thankfully received and cheerfully acknowledged.

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REMITTANCES.—All checks, drafts and other remittances should be made payable to the order of the publishers, the **Electrician Publishing Company,** and addressed to the offices of publication, Suite 507, Marquette Building (204 Dearborn Street), Chicago, Illinois, U. S. A.

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DATES AHEAD.

Old Time Telegraphers and Historical Association, and United States Military Telegraphers (annual meeting), Arlington Hotel, Washington, D. C., October 9th, 10th and 11th.

American Street and Interurban Railway Association (annual convention), Columbus, O., October 15th to 19th.

Railway Signal Association (annual meeting), New Willard Hotel, Washington, D. C., October 16th, 17th and 18th.

Western Association of Electrical Inspectors (annual meeting), Denison Hotel, Indianapolis, October 17th, 18th and 19th.

PENSION SYSTEMS are being adopted in increasing number by the large industrial corporations of the United States. In these days of social unrest a system of old-age or disability pensions appeals alike to the employer as a powerful incentive to faithful, continuous service, and to the employed as a guaranty that if he cannot win in the mad race for riches, he can at least assure himself against the extreme calamities of actual want in the days when he can no longer do a strong man's work. Several electrical companies, both manufacturing and operating, have adopted the pension system. In this issue we describe the judicious and carefully planned arrangement of this sort now in force by one of the largest of these companies. Private pension systems seem to work to the benefit of all concerned, and so far as present experience shows are worthy of encouragement.

RUBBER is in large and constant demand in the electrical industry. Even more than copper, its cost seems to be continually on the increase, and the crude product of good quality now brings $1.10 a pound or more. The world's net consumption of rubber in 1904 was 57,300 tons, of which 26,470 went to the United States, 12,800 to Germany, 10,030 to England, 4,130 to France, 1,320 to Austria-Hungary, and the remainder to other countries. According to the Mouvement Géographique of Brussels, the world's production will reach 75,000 tons this year. In any case, its value is estimated at $115,000,000. There is some reason to hope that the cultivation of rubber or the synthetic production of artificial rubber may in the future reduce the price. The Annales de Géographie points out the successful results arrived at by the Kew Colonial Gardens, to which is due the planting of 35,000 acres of hevea in the Malacca Peninsula and 40,000 acres in Ceylon. The Mouvement Géographique, in a recent number, also mentions the successful efforts of the Belgian government in its Congo possessions. Thanks to an energetic influence on the officials and the companies who have concessions, as well as to a very severe system of imposing fines, they have succeeded in a few years in planting more than 12,000,000 rubber trees. In addition the chemists declare that the production of caoutchouc by chemical means has virtually been accomplished.

REPORTS of the proceedings of two state electrical associations—those of Illinois and Colorado—in annual convention, are given in this issue. Both were good conventions, fairly well attended, and devoted to the discussion of timely topics of electrical interest. At the Springfield convention in Illinois a feature was a further report from the useful insurance committee, which has brought about a substantial reduction in power-house insurance rates in this state. The committee was continued for another year. A beginning was also made by this association in the matter of collecting information about methods of charging and the like throughout the state. This may, in the end, lead to the establishment of a system of uniform accounting throughout the central stations of Illinois—a consummation devoutly to be wished not only for Illinois, but for the whole country.

At the Colorado convention, among other good features, considerable interest was manifested in a description of the way in which the Denver Gas and Electric Company changed over its power-distribution system in the outlying districts of the city from direct current to three-phase current.

George B. Tripp of Colorado Springs and J. N. C. Shumway of Taylorville, Ill., were elected presidents of their respective associations, and although the traits and training of the two men are unlike, yet each has qualities that make for a good executive. To each association and to each new administration the Western Electrician extends its felicitations, with good wishes for another successful year.

FROM the correspondent of a London financial paper, writing from Johannesburg, some further and interesting details of the financial side of the far-famed proposed 700-mile electrical power transmission from Victoria Falls, on the Zambesi, to the Rand, are obtained. This writer learns that a well-informed Transvaal engineer indicates the amount of power which the African Concession Syndicate would be able to draw from the falls as 275,000 horsepower, and it appears clear to him that this enormous amount of power would be more than sufficient to cover all the requirements of the whole of the Transvaal and Rhodesia. It is stated in one case that the capital of the company to be formed will be $15,000,000, but in another statement it would seem that in addition to this, debentures will also have to be issued to the extent of probably $11,000,000. The engineer interviewed says that it is hard to see, even for an optimist, where the requirements for electrical energy could be found which would justify such a huge undertaking. It would appear that the chartered company undertakes to find the capital for shares, and the Allgemeine Electricitaets Gesellshaft of Berlin the capital for debentures. It is denied that the scheme is to be controlled by German financiers, but it would appear that the order for the electric installation for the principal plant has already practically been placed with a German firm, states the engineer. The high cost of development, it is thought by another engineer, can hardly compete with the steam plants on the Rand, and the correspondent adds that the scheme would not be feasible unless current could be supplied at guaranteed regularity at under one cent per kilowatt-hour. From all accounts it appears likely that the scheme is a more ambitious one than can be justified by the market for power, when considered in connection with the onerous conditions to be met.

TROUBLE, TROUBLE, nothing but trouble, for the members of the Ohio Fire Prevention Association, and almost all created by bad electrical men. That is what caused the loud wail which characterized the recent quarterly meeting at Columbus of the association mentioned. A report which reaches us sets forth the complaints of the virtuously indignant insurance men in these pathetic words:

"The members have encountered such serious conditions in the installation of electric wires and motors in many places that they have almost come to the conclusion that this is the most serious menace to life and property in the state as well as the most serious cause of losses to the insurance companies. The problem discussed at this meeting was how to secure improvements in this line and establish some rule by which future installations would be up to the standard. Many of the small cities and most of the towns of the state are without electrical inspectors, and where they have such officers the system is in many cases far from what it should be. Electricity is becoming so generally used for lighting and power that something must be done to reduce the fire waste from this cause.

"Almost every member present had something to say regarding this subject, as all had come in contact with serious conditions. Several plans were suggested of combatting it, the most hopeful, perhaps, being that of securing license laws similar to those under which the plumbers work. This is not only hopeful because the same plan is used with other trades, but because the members of the National Electrical Contractors' Association heard the matter discussed at the annual meeting in Cleveland recently, by their treasurer, John H. Galloway of Washington. Of course Mr. Galloway did not have the fire-prevention matter so much in mind as he did the cheap contractors, who are continually menacing their business by bidding contracts down and then furnishing inferior material and doing poor work. But at the same time it all amounts to the same thing—poor installation and the increase of the fire hazard from electricity.

And this comes at a time when, taking the whole country over, electrical men know that the standard of wiring and construction was never so high. Of course, there is a kernel of truth in the loud-voiced complaint from Ohio; but how absurd to say that electric installations are almost, or anything near, "the most serious menace to life and property in the state"! The underwriters have been "seein' things at night," and should put themselves on a restricted dietary. The condition of electric wiring in Ohio is far indeed from being as bad as the Fire Prevention Association represents, and nothing will be gained by this ridiculous exaggeration, which offends electrical men of all classes.

ILLINOIS STATE ELECTRIC ASSOCIATION.

The seventh annual convention of the Illinois State Electric Association was held at the Leland Hotel, Springfield, on September 19th and 20th. The convention, both as to number of members attending and the excellence of the papers presented, was the best that the association has held. The interest displayed by the members and the visitors was most encouraging. There is a membership of 110 companies, and six new applications were received at the convention. The membership consists of only private-plant companies, municipal plants not being admitted to membership.

The convention was opened by President D. Davis of Litchfield, who introduced Mayor Devereaux of Springfield, who extended a welcome to the members of the association. The mayor said that a plant to be successful must give good service at reasonable rates. The best way to keep out municipal ownership is by the giving of good service. Two states now have commissions to control the lighting plants. Private ownership might make the rates less if the public utilities, as street railway, gas and electric service, were combined, using the same office. What the public is the more concerned in is cheaper rates.

President Davis, in thanking the mayor for the welcome extended, said that his ideas were the same. Good service and reasonable rates were the primary objects.

A paper on "System of Accounting for a Moderate-size Plant," by Mr. W. J. Achelpohl of Galesburg, was read. The paper dealt with the various forms in use by the author's company and was supplemented by a full exhibit of the forms used, including the gas production, station sheets showing supplies used and the ledger accounts, and the gas and electric bills. In the discussion Mr. Achelpohl was asked if he would advise any change in the voucher check, to have a single sheet instead of a folded one, as some of the banks objected to a folded voucher on account of other papers catching in it. He answered that he had found no objection to the use of it, and the advantage of a voucher check was that it must come back. Further discussion was had on how to take account of the partial payments on a bill and on freight allowances.

At the afternoon session Mr. Emil G. Schmidt of Springfield moved that the president appoint a committee of three to nominate officers, which was carried.

Oil Engines.

W. G. Austin of Effingham then read his paper on oil engines. He has at his plant two 120-horsepower Diesel oil engines. The plant was originally a steam plant and was a losing venture until, in 1905, the company secured a 15-year franchise and contract for lighting.

The engines are direct-connected to two 60-cycle 2,200-volt 85-kilowatt alternators. The guaranteed fuel consumption was 12½ gallons per 100 kilowatt-hours on 50 per cent. to full load.

The plant is equipped with integrating meters on the switchboard, and, according to tests, the fuel consumption was 15½ gallons on a 24-hour run, with a load varying from 12 to 85 per cent., average 23 per cent. of full load. This made the cost 54.2 cents, with oil at 3.4 cents a gallon, which is the average cost of the oil. On a 24-hour run, with a 30 per cent. load, the oil consumption was 14 2-7 gallons, making a cost of 48½ cents per 100 kilowatt-hours.

Another test of six hours with a 70 per cent. load showed a fuel consumption of 11.3 gallons, making a cost of 38.4 cents per 100 kilowatt-hours. The machines are run in parallel, and the author has had no trouble with them. He described the operation of the engines starting from the inspiration of air which the return stroke compresses to a pressure of 500 pounds to the square inch at a temperature of 1,000° F. The fuel is then sprayed in and ignited, giving the impulse, followed by the exhaust at the return, making a regular two-cycle engine.

There are three cylinders with the cranks set 120° apart, making the engine very steady running. The engine is also equipped with two air compressors and the necessary air storage tank at a pressure of 800 pounds to the square inch. The engines can be started in two minutes by one man. Being vertical, they do not take up much room. The author's power house is 32 by 48 feet by 16 feet high, and has room for two more. The cylinders are 14 by 18-inch stroke. The clearance being only one-eighth inch, the compression of the air drawn in by the first stroke is from 14 inches to one-eighth inch, producing the high pressure and temperature. Cylinders are water cooled, fed from an elevated tank, and are self-circulating. The temperature is 180 degrees at ordinary conditions. The circulating water from the cylinder jacket is piped around the plant and keeps the room warm except in the very coldest weather. As to the cost of repairs, Mr. Austin could not tell, as his company had not had any to make.

The discussion was opened by Mr. Emil G. Schmidt of Springfield, who asked if the cost of 54 cents per 100 kilowatt-hours was the oil cost, and Mr. Austin informed him that it was. Mr. Austin, on being further questioned as to initial cost, replied that, according to the figures he obtained, the total cost of engines and generators was approximately the same as a steam plant.

The question was raised as to how the city authorities considered the oil storage; that a large park (White City) in Chicago had considered putting them in, but had decided to take power from the station. Mr. Austin said that the insurance rate had been reduced, thanks to Mr. Frey, from $1.48 to 75 cents on building and machinery, so he had had no trouble from that score. He said that the reason the engines had not made more rapid progress was on account of the cost. They had not been much developed until the St.

J. N. C. SHUMWAY, PRESIDENT ILLINOIS STATE ELECTRIC ASSOCIATION.

Louis Exposition. The American Diesel engine is entirely different from the German engine of the same name. The engine has to be made very heavy throughout to stand the enormous strains. The most trouble had been caused by the rupture of air pipes that had to carry a pressure of 1,800 pounds.

Asked as to causes of the breakdown, Mr. Austin answered that he had no trouble, but that the engines required close attention. The gain in fuel economy is equal to the cost of repairs. As near as they could ascertain, the cost of operation of the two 75-horsepower engines at Peoria was eight cents per kilowatt, including cost of maintenance and depreciation. They run 10 hours per day with an average load of 25 horsepower. Asked as to the engineers required, Mr. Austin answered that he was running with the same help as before, and had had no trouble running 24 hours with a shutdown of four or five hours on Sunday. Mr. Shumway asked as to the price of oil, and was informed that it cost 3.4 cents delivered. He was now using Kansas crude oil. The plant is 23 miles from the nearest oil well, and Mr. Austin said that he could buy the Illinois oil, that the Standard Oil Company would not discriminate.

Electrical Co-operation.

The next paper was to have been read by Mr. J. Robert Crouse on "Profitable Commercial Co-operation." Mr. Crouse had been suddenly called to New York, and F. C. Maxheimer of Cleveland read the paper. The paper had been printed and distributed, so Mr. Maxheimer only read portions of it. The paper was the same as that prepared for the National Electric Light Association. Mr. Maxheimer asked the convention, at the request of Mr. Crouse, to appoint two members as a co-operating committee to work with his association. Mr. Crouse desired one member to be from a combination gas and electric plant and the other from a strictly electric central station.

Meters.

R. C. Lanphier of the Sangamo Electric Company then read his paper on meters. This was given close attention. The author thoroughly discussed the subject of meters from all points of view, commencing from the central-station end. All plant managers needed integrating wattmeters to get proper returns from their stations. That flat rates were not fair to all concerned. There had been some complaints when the change had been made from flat rates to a metered service, but in nearly all cases the metered service gave the best satisfaction. Following this, the speaker went directly into a description of the various types of meters in present use. Broadly speaking, they can be divided into two classes, as follows: First, those with a motor mechanism; second, those with electrolytic action, where the current decomposes the electrolyte and deposits it on a plate, the weight of which determines the amount of current that has been consumed; third, the fluid expansion type, such as the Wright demand meter.

Then followed a description of the Thomson-Houston, Westinghouse, Schaefer and Sangamo meters. Finally it was stated that internal losses must be as small as possible and that frequent checking of meters is desirable. Central-station owners should co-operate with the manufacturers as to any trouble that arises in the use of their meters, and thus eliminate the troubles as they appear.

Concluding Business of Wednesday.

President Davis appointed J. N. C. Shumway of Taylorville and W. E. McCollough of Beardstown as the committee on resolutions, and upon suggestion of Senator Shumway, President Davis added E. B. Hillman as a moderator.

R. S. Wallace of Peoria, George H. Lukes of Evanston and R. H. Abbott of Petersburg were appointed the nominating committee. This concluded the afternoon session.

Trolley Party.

General Manager Schmidt of the Springfield Light, Heat and Power Company had three cars placed at the disposal of the members and visitors, who then proceeded to visit the factory of the Sangamo Electric Company and the watch factory. After this inspection the cars carried the party to the station of the Springfield Light, Heat and Power Company, which not only furnishes electricity for illumination but also for the railway system. After a ride about the city, lunch was served on the veranda of the Casino at Washington Park. About 125 members, manufacturers, supply men and representatives of the press were present, and they were also the guests of the Springfield Light, Heat and Power Company at the theater in the evening.

Central-station Insurance.

Mr. Frey of Hillsboro, chairman of the insurance committee, made his report the first thing on Thursday morning. The report consisted of various tables showing new rates and the reductions the committee had secured by the appointing of the insurance inspectors, and the accompanying correspondence. The reductions secured in some cases amounted to over 40 per cent. This was obtained by following the suggestions of the inspectors. The old rate on $728,700 insurance was $10,451.93; the new rate is $9,333.86.

The speaker cited the case of the station at Hillsboro. The building is of brick, and the former rate was $1.25 and the rate on machinery $1.50. The plant was inspected and the recommendations were to lay a cement floor to replace old wooden floor; erect standpipe equipped with 50 feet of hose and furnish six pails of sand. The new rate was then made at 81 cents and $1.05. The saving paid for the improvements. Mr. Frey also cited the station at Arcola, the old rates being $3.47 and $3.72, while the new rates were $2.38 and $2.63. The reduction in rate to be secured by laying cement floor and re-wiring according to National Electrical Code is 25 cents; by furnishing slate switchboard, 10 cents; by furnishing approved waste cans, five cents; by equipping with a chemical extinguisher and sand pails, 10 cents.

The discussion following showed that the members are very much alive to the benefits that can be secured by the following of the recommendations of the inspectors. Mr. Clarke asked as to the reduction to be secured by the use of fire doors. Mr. Frey, in answer, said the old rate on building was $2.08, new rate $1.59; machinery, $2.33, new rate $1.84. To equip the stacks with ventilators where they pass through the roof will cause a reduction in rate of 50 cents. Laying a concrete floor makes a reduction of 30 cents.

Further, the discussion brought out the fact that after an inspection is made, and the improvements made, credit is at once given, either by a refund or by canceling the policy and securing a new one at the lower rate.

Senator Shumway said that great credit should be given the committee. Its members were only appointed three years ago. While the efforts of the first year accomplished little, the last two years had been productive of great gains. This had been secured through the serving of notice to the companies that unless something was done the central stations would form a mutual company. Last year the companies appointed two inspectors, and with the inspections they had made and by following their recommendations the rates had been greatly reduced. In one plant in particular, where the former rate was $2, the present rate is $1.68. Mr. McCollough of Beardstown cited an instance where the installing of three lines of hose, 12 pails of dry sand and six "Babcocks" made a great difference. By an investment of $20 the rate was reduced one-third.

Mr. Davis asked for some information from Mr. Frey as to liability insurance. Mr. Frey said that he had asked the companies if they would take employes' insurance at not to exceed 2½ per cent., with public liability at not to exceed four per cent. To this he received 10 replies that they would take the employes' insurance. Four would take public insurance, and seven would not.

Mr. McCollough said that since the Legislature had raised the value of a human life from $5,000 to $10,000, companies ought to carry employes' and public liability insurance. By concerted action the central stations ought to be able to get a

more favorable rate. President Davis said that the liability insurance should be carried, as the courts will tend more to protect the public. The cost of carrying the insurance is a legitimate expense, and the public should help pay for it.

Mr. Frey, upon being asked as to losses in Illinois, said he did not know what they were. He suggested that plants should be classified into three divisions—where the lines and all properties are kept in good condition; where they are not so good, and where they are careless and have bad cross-arms. He further said that if the stations would get together and take the liability insurance, he knew two companies that would take the insurance, agreeing to refund if they made over five per cent. profit.

The discussion further brought out the fact that the small companies need the public liability insurance more than the larger companies; also that there is a better feeling among the employes by not carrying insurance. F. J. Baker of Chicago thought the same, and that different classification should be made of the plants according to service, for 24-hour service makes six to eight times the number of accidents that a midnight service does. An attorney regularly retained is a great help.

The insurance committee was continued for another year.

Incandescent Lamps.

A. C. Osborn of the General Electric Company lamp department read a paper on "The Present Status of the Incandescent Lamp," written by Francis W. Willcox, who was unable to be present.

This paper was well received and began by citing the fact that 52 per cent. of the income of central stations was derived from incandescent lighting, which represented an actual income of over $45,000,000. Then followed a detailed description of the new Gem lamps, together with tables giving the comparisons of watts, candlepower, efficiency and useful life at the three voltages as now given on the label. This was followed by a description of the street series lamp, tables and diagram showing life curves of the old carbon filament and the Gem filament. A detailed description of the tantalum lamp followed.

The effect of high-efficiency lamps was taken up, and it was declared that the new lamp will tend to increase the business of central stations rather than diminish it. The old question of free lamp renewals was also treated, together with tables and charts showing values of the new lamps and the old or present lamps.

"In regard to free renewals, present prices hardly permit central stations to furnish the tantalum lamp," said the author. "Control of renewals, however, should be maintained, and the tantalum lamp should be supplied on as liberal a basis as possible, allowing customers the value of the present lamp cost where free renewals are made."

Testing of Illinois Coals.

A. V. Schroeder gave a tentative outline of work to be done at the University of Illinois as to the testing of Illinois coal values. Last year at Peoria Professor Parr gave a paper on "The Composition and Heating Values of Illinois Coal," and this will be a continuation of his tests. Professor Breckenridge, who also spoke, could not give more than a tentative outline at present. Something depends on the Legislature, which makes a yearly appropriation to cover the costs of the experiments. The tests will necessarily be confined to Illinois coals, and most of the samples will be donated. All tests are to be made according to Am. Soc. M. E. Code. Tests to be of 10 hours duration, both as to commercial and scientific uses. They will recognize the gas producer and gas engine and investigate the development of both. The various thicknesses of fire, with the various sizes of coal best adapted to various furnaces, with varying drafts, are also to be determined. Professor Breckenridge will begin this fall on the various tests. This is the brief outline, and if carried through will undoubtedly produce a greater knowledge of the values of Illinois coals.

Single-phase Motors.

C. S. Sharpe of Moline next read a good, practical paper on "Central-station Operation." It is given elsewhere in this issue.

President Davis asked for the largest size single-phase motors that are operating on lighting circuits. R. S. Wallace of Peoria said that it depended on the service required; that he considered five horsepower the limit. A three-horsepower machine would make a two or three per cent. variation in the voltage. The custom in Peoria is to connect them on the outsides of a three-wire secondary distribution, making them 200-volt motors. Mr. Lukes also thought five horsepower a good limit, but would make exceptions, having some as large as 10 horsepower, but not on lighting secondaries.

Concluding Business.

Senator Shumway, reporting for the committee on resolutions, extended a vote of thanks to all those who had read papers, and to Emil G. Schmidt, as general manager of the Springfield Heat, Light and Power Company, and the other officers and employes for the entertainments provided and courtesies extended; also thanks to the press and the Illinois Traction Company. The insurance committee, which has done so much for the station owners, was not forgotten.

On Thursday afternoon, in executive session, these officers were elected:

President—J. N. C. Shumway, Taylorville.
First vice-president—E. L. Brown, Elmwood.
Second vice-president—E. MacDonald, Lincoln.
Third vice-president—E. H. Grey, El Paso.
Fourth vice-president—O. L. Hyatt, Chicago Heights.
Secretary—H. E. Chubbuck, LaSalle.
Treasurer—J. J. Frey, Hillsboro.
Executive committee—Emil G. Schmidt, Springfield; Charles Sharpe, Moline; W. B. McKinley, Champaign; Frank J. Baker, Chicago; David Davis, Litchfield.

Mr. Shumway, the new president, is one of the most popular members of the association. He has been secretary and manager of the Taylorville Electric Company since 1889. He is a lawyer by profession, but abandoned his profession to secure an outdoor occupation. He has been a state senator, and held other public offices. A man of marked ability and public spirit, President Shumway should have a successful administration.

The following-named new members were elected: Whitehall Electric Company, Geneseo Electric Light Company, Carlinville Gas and Electric Company, St. Hume Electric Plant, Spring Valley Electric Light Company.

An Interurban Ride.

After the close of the convention proper on Thursday afternoon the Illinois Traction Company's car Illinois was placed at the disposal of the members, and a trip was taken to Riverton, where the traction company's power house was inspected. This station generates the power for the Springfield-Decatur line, and from Springfield to Granite City. The equipment consists of one reciprocating unit and two turbine units, one of 1,000 kilowatts and one of 2,000 kilowatts. This current is stepped up to 33,000 volts and transmitted by bare wires, using sub-stations and rotaries for the conversion to 600 volts direct current. Upon the return to the city the visitors were taken south over the company's lines, some going as far as Carlinville.

Convention Notes.

"Wesco" had F. A. Brooks to attend to its interests.

The Allis-Chalmers Company was represented by D. K. Chadburne.

C. E. Delafield of the Wagner Company, St. Louis, was in attendance.

R. J. Russell of the Century Electric Company, St. Louis, was in attendance.

C. R. Wood of the Moline Incandescent Lamp Company was doing some lamp talking.

Louis Privat of the Central Electric Company appeared in the interest of his company.

The W. J. Baer Company was represented by George R. Craven, who dilated on the electric iron business.

J. S. Codman told of Stanley-G. I. goods, with F. Johnson of St. Louis and E. B. Wharty of Davenport.

J. S. Corby, assisted by J. G. Peters, pushed the sale of new high-efficiency lamps as made by the Bryan-Marsh Company.

The Springfield Lighting Company has a talking sign, and it spelled out a welcome to the electric men, and also some taking jingles.

F. N. Jewett of Chicago was in attendance, looking after the interests of the Wagner Electric Manufacturing Company of St. Louis.

The programmes were neatly gotten up and contained the full programme, including the entertainments. They were covered with a darker paper and bound by a silk cord.

The heat the first day was terrific, and, while the electric fans helped some, relief was not felt till the shower, which came while on the trolley ride around the city.

Mr. Schmidt, general manager of the Springfield company, extended to the association the courtesies of the street-car company during the convention. All members wearing the official badge were allowed to ride free on the city cars.

The Fort Wayne Electric Works showed in operation a street series alternating system of 25-light capacity. W. C. Knight, manager of the St. Louis office, J. C. Raymond of the Chicago office, together with T. T. King, A. L. Pond and O. Starzinger, were busily engaged in explaining the exhibit.

The Westinghouse Electric and Manufacturing Company had an exhibit on the ground floor, consisting of Nernst lamps in operation, arc lamps, prepayment meters, ceiling and desk fans. W. R. Pinckard, Mr. Schilling, A. C. Keene and J. W. Busch were in attendance. The line of portable instruments created much interest, especially the wattmeter for testing incandescent lamps, where the wattage is given at one reading, by screwing the lamp into the socket provided on the face of the instrument.

The members and visitors were furnished with neat badges, consisting of a bar giving the name and date of the convention. Suspended from the bar by two chains was a card bearing the name of the individual and the company he represented.

J. A. Erwin of Erwin & Co., Chicago, exhibited a house pump, operated by a Century motor, for which the Gregory Electric Company is the agent. A. O. Kuehmsted and J. D. Claghorn had charge of the electric end and also showed a vertical motor for direct connection to a centrifugal pump for pumping sewage and seepage from basements.

The Electric Service Supplies Company (Porter & Berg department) had an exhibit on the main floor, consisting of Victor porcelain insulators for high-tension lines, armature coils, protected rail bonds, Keystone street-railway line material, Gorton-Daniels lightning arresters, Miller guy anchors and the automotoneer or slow-feed controller handle. E. R. Mason had charge of the exhibit.

The General Electric Company had a varied exhibit. E. L. Callahan was in charge of the cooking and heating exhibit, including a complete kitchen outfit. J. Scribner, S. F. Dibble, C. R. Croniger and John A. Nicholson also were there. The new type Gem and tantalum lamps were displayed. In the lobby the company had a full line of these lamps burning, with A. C. Osborn in charge.

The Electric Appliance Company had H. N. Remington and W. H. Blakemore in charge of its exhibit. It made an extensive exhibit of the Sangamo meters in operation on a lamp load. R. C. Lanphier was very busy explaining the various types of meters as made by the Sangamo, for which the Appliance company is general sales agent. The Appliance company also showed Packard lamps and transformers and other material.

American Electrotherapeutic Association.

The sixteenth annual meeting of the American Electrotherapeutic Association was held in Philadelphia, Pa., on September 18th and 19th. About 100 specialists in the use of electricity as a means of curing disease were present from the United States and Canada. The sessions were held in the College of Physicians and Surgeons, Mayor Weaver delivering the address of welcome at the opening. Dr. William Benham Snow presided over the meetings of the association.

All the papers read at the three sessions of Tuesday were technical. Dr. Francis B. Bishop of Washington discussed the treatment of locomotor ataxia by electricity. The speaker took a hopeful view of the possibilities of relief from this malady, holding that in the earlier stages a cure was possible, that in the second stage such relief was possible that the patient might be enabled to resume his daily vocation if it were not too arduous, while in the third stage much relief from the severity of the suffering might be afforded.

Other papers read were: "The Present Status of Electrotherapy," by Dr. H. H. Roberts of Lexington, Ky.; "When Are Electrotherapeutics Indicated?" by Dr. A. C. Geyser of New York; "A Plea for Conservatism in Electrotherapeutics," by Dr. A. D. Rockwell of New York; "Why Use Electricity Therapeutically?" by Dr. W. S. Watson of New York, and "Tubercular Antitoxin," by Dr. J. D. Gibson of Denver, Colo.

A clinical demonstration of the cataphoric treatment of cancer was given by Dr. H. R. Swayne at the Oncologic Hospital at Forty-fifth and Chestnut streets. This is the first institution of its kind in America for the treatment of cancer, and it was brought especially to the attention of the electrotherapeutic experts in the city. As consulting ophthalmic surgeon to the hospital, Dr. G. Oram King presented a paper on "Electrochemical Sterilization as a Curative Agent in Malignant Disease of the Ophthalmic and Nasal Regions."

On Wednesday a part of the programme consisted of cataphoric operation for cancer of the face, with which a number of the delegates declared they were entirely unacquainted. A number of patients who have volunteered to show the results of treatment they had received both at the hospital and through private practice were present to aid in the demonstrations given by those who had prepared papers. The conference was held on the lawn of the American Oncologic Hospital, where luncheon was also served. George H. Stuart, Jr., president of the hospital, and Dr. Massie addressed the delegates.

A cured patient was exhibited by Dr. G. Oram King of Phiiadelphia in the course of his paper on "Electrochemical Sterilization as Applied to Malignant Disease of the Orbit and Nasal Regions." The patient's lower eyelid of the right orbit had been affected and a portion about half an inch in size had been removed. In its place

had been grafted a piece of tissue from the right arm.

Dr. Samuel McClary, third assistant surgeon at the hospital, read a paper on "Cataphoric Treatment of Cancer of the Face," and exhibited a number of cured patients. Dr. William S. Newcomet of Philadelphia also exhibited cured patients while giving demonstrations of radiotherapeutic results in cancer.

That obesity, inebriety, rheumatism, pulmonary troubles, neurasthenia, hysteria and whooping cough can be arrested and in many instances cured by means of high-frequency currents was asserted by Dr. Henry de Kraft of New York in a paper on the methods to be used in the application of such currents.

Interesting papers were read by Dr. E. Gard Edwards of La Junta, Colo.; Dr. Sinclair Tousey of New York; Dr. M. K. Kassabian of Philadelphia; Dr. G. H. Stover of Denver; Dr. Robert Wilson of Montreal, and Prof. Carlo Glombo of Rome, Italy.

The following officers were elected: President, Dr. Morris W. Brinkmann of New York; vice-presidents, Dr. J. D. Gibson of Denver and Dr. M. K. Kassabian of Philadelphia; treasurer, Dr. Richard J. Nuring of Savannah, Ga.; secretary, Dr. Albert C. Geyser of New York; executive council, Dr. Francis B. Bishop of Washington, D. C.; Dr. F. H. Morse of Boston, and Dr. W. B. Snow of New York. Jamestown, Va., will probably be the next place of meeting. The council will determine this at a later date.

Proposed "Inner Circle" System of Chicago Subway Terminals.

[*Continued from page 245.*]

return connection between the loops for routing through-cars only.

This would be, of course, only a comparatively temporary arrangement as far as the use of the inner transfer track is concerned, and would only be used in this manner until such time as the remainder of the loop became an accomplished fact. Upon the completion of the transfer loop, then, this track would be devoted to its original purpose, that of a passenger transfer.

In order to place this plan upon an equal basis for comparison with Mr. Arnold's recommendations in his recent report, it is only necessary to add a fourth loop on the South Side, say of the State Street lines, and connect it with the other three by that portion of the transfer subway that intervenes, as shown by Fig. 4.

While this fourth or State Street loop is not necessary for the solution of the inauguration of the subways affected by the tunnels, and possibly not yet required by the demands of traffic it would establish an underground interchange of traffic between the North and South sides and remove all the street-car traffic using the three tunnels and State Street from the street surfaces and form the beginning of a universal transfer system, which would be effective up to the capacity of the division lines.

This temporary plan, of course, would not make the track arrangement as simple as the completed system, but all the work done to accomplish it would be a part of the ultimately completed plan, and would not require the abandonment of any portion thus used, except the two temporary connections between the transfer tracks in the completed tunnels.

In addition to this, the remaining loops of this system could be built from time to time as conditions demanded, each loop being added to those in operation, all in the line of the original plan, by simply constructing the division loop and such portion of the inner-circle transfer tunnel as necessary to accommodate it.

In the initiative plan herewith submitted there is about 70 per cent. as much tunnel required to be built as by Mr. Arnold's plan, to accomplish the same results. This plan also saves the long trip over to Michigan Avenue and return for the West Side cars, which is objectionable in any plan both from the passenger's point of view and that of the street-car manager, hence from these two factors, and the added advantage of the high-level tunnel, economy suggests the plan herewith submitted.

DISCUSSION.

The paper was discussed at some length, most of the speakers taking issue with the author on the loop idea. Bion J. Arnold, C. V. Weston, M. B. Starring, Walter L. Fisher and others discussed the paper.

B. J. Arnold was not present, but in a written discussion he said that any transportation system for the city should embody through routing, thus tending to lengthen and widen the business district, as distinguished from the loop system, which tends to contract. Mr. Arnold called attention to his report on the subject issued in 1902. At that time he laid out a very elaborate loop system somewhat similar to that of Mr. Robinson, except that instead of operating cars upon the "inner loop" he proposed to operate a movable sidewalk along which the trains would run at the same rate of speed as the platform of the movable walk, thus enabling passengers to alight from the trains without stopping the trains. This idea Mr. Arnold abandoned after spending considerable time on it, believing it would tend to congest the business district rather than extend it. He eliminated the system from his report before it was published.

The criticism which Mr. Arnold applied to his own loop scheme, so far as the elimination of danger to passengers is concerned, would not apply so forcibly to Mr. Robinson's plan, because Mr. Robinson proposes to operate cars on the "inner loop" instead of a movable sidewalk, and stop all cars where passengers are transferred. This very restriction, however, Mr. Arnold said, greatly reduces the capacity of the Robinson loop over the Arnold plan, and Mr. Arnold was of the opinion that it would so restrict the capacity that it would be found impracticable to handle the number of cars necessary to take care of the passengers during rush hours.

Both subway systems, known as No. 1 and No. 2, outlined in the Arnold report, utilize, to the extent thought necessary, the loop system, but only for returning surplus cars from any particular district of the city, the majority of the cars running through.

The fundamental difference between Mr. Arnold's recommendations and those advocated by Mr. Robinson is that Mr. Robinson makes the loop principle the fundamental feature, with the through-routing scheme as supplementary, while in Mr. Arnold's plans the through-routing scheme is fundamental and the loop feature supplemental.

Mr. Arnold was glad that the society was discussing this important subject, which would best be solved by comparative analysis of systems and ideas outlined by various authorities.

Standard Symbols for Wiring Plans.

At the fifth annual convention of the National Electrical Contractors' Association, held in Boston, July, 1905, a committee was appointed to develop a set of symbols for wiring plans suitable for adoption by the association and for recommendation to all persons interested, with the object of rendering them standard throughout the country.

The committee says that the answers to letters of inquiry addressed to the leading engineers, architects, universities and various departments of the government and the technical press were unanimously in favor of the establishment of standard symbols. Many valuable suggestions were received and systems of symbols in use in various offices throughout the country were submitted. The committee, consisting of Mr. G. M. Sanborn, chairman, and Messrs. E. S. Keefer and J. K. How, examined carefully the different existing systems, and in formulating the scheme finally submitted it selected those symbols which appeared to be the simplest in form and easiest of execution, special care being taken to conform as closely as possible to the symbols now in use. To the material selected from that previously existing, and that suggested, the committee added such features as seemed necessary to make the system complete, comprehensive and serviceable.

The system submitted by the committee, together with its suggestions for the practical use of the system, was adopted by the association at the annual meeting held at Cleveland in July, 1906. The symbols and the accompanying suggestions are given herewith. Copies of the system and suggestions have been prepared at the expense of the National Contractors' Association and may be had upon application to Mr. W. H. Morton, secretary, 94 Genesee Street, Utica, N. Y.

STANDARD SYMBOLS FOR WIRING PLANS

AS ADOPTED AND RECOMMENDED BY

THE NATIONAL ELECTRICAL CONTRACTORS' ASSOCIATION OF THE UNITED STATES.

COPIES MAY BE HAD ON APPLICATION TO THE SECRETARY, UTICA, N. Y.

- Ceiling Outlet; Electric only. Numeral in center indicates number of standard 16 C. P. Incandescent Lamps.
- Ceiling Outlet; Combination. 4/2 indicates 4-16 C. P. Standard Incandescent Lamps and 2 Gas Burners.
- Bracket Outlet; Electric only. Numeral in center indicates number of Standard 16 C. P. Incandescent Lamps.
- Bracket Outlet; Combination. 4/2 indicates 4-16 C. P. Standard Incandescent Lamps and 2 Gas Burners.
- Wall or Baseboard Receptacle Outlet. Numeral in center indicates number of Standard 16 C. P. Incandescent Lamps
- Floor Outlet. Numeral in center indicates number of Standard 16 C. P. Incandescent Lamps.
- Outlet for Outdoor Standard or Pedestal; Electric only. Numeral indicates number of Stand. 16 C. P. Incan. Lamps.
- Outlet for Outdoor Standard or Pedestal; Combination. 6/6 indicates 6-16 C. P Stand. Incan. Lamps; 6 Gas Burners.
- Drop Cord Outlet.
- One Light Outlet, for Lamp Receptacle.
- Arc Lamp Outlet.
- Special Outlet, for Lighting, Heating and Power Current, as described in Specifications.
- Ceiling Fan Outlet.
- S. S. P. Switch Outlet.
- S² D. P. Switch Outlet.
- S³ 3-Way Switch Outlet.
- S⁴ 4-Way Switch Outlet.
- S° Automatic Door Switch Outlet.
- Sᴱ Electrolier Switch Outlet.

Show as many Symbols as there are Switches. Or in case of a very large group of Switches, indicate number of Switches by a Roman numeral, thus; S XII; meaning 12 Single Pole Switches. Describe Type of Switch in Specifications, that is, Flush or Surface Push Button or Snap.

- Meter Outlet.
- Distribution Panel.
- Junction or Pull Box.
- Motor Outlet; Numeral in center indicates Horse Power.
- Motor Control Outlet.
- Transformer.
- Main or Feeder run concealed under Floor.
- Main or Feeder run concealed under Floor above.
- Main or Feeder run exposed.
- Branch Circuit run concealed under Floor.
- Branch Circuit run concealed under Floor above.
- Branch Circuit run exposed.
- Pole Line
- Riser.
- Telephone Outlet; Private Service.
- Telephone Outlet; Public Service.
- Bell Outlet.
- Buzzer Outlet.
- Push Button Outlet; Numeral indicates number of Pushes.
- Annunciator; Numeral indicates number of Points.
- Speaking Tube.
- Watchman Clock Outlet.
- Watchman Station Outlet.
- Master Time Clock Outlet.
- Secondary Time Clock Outlet.
- Door Opener.
- Special Outlet; for Signal Systems, as described in Specifications.
- Battery Outlet.

- Circuit for Clock, Telephone, Bell or other Service, run under Floor, concealed. Kind of Service wanted ascertained by Symbol to which line connects.
- Circuit for Clock, Telephone, Bell or other Service, run under Floor above concealed. Kind of Service wanted ascertained by Symbol to which line connects.

NOTE—If other than Standard 16 C. P. Incandescent Lamps are desired, Specifications should describe Capacity of Lamp to be used.

Suggestions in connection with Standard Symbols for Wiring Plans.

Indicate on plan, or describe in specifications, the height of all outlets located on side walls.

It is important that ample space be allowed for the installation of mains, feeders, branches and distribution panels.

It is desirable that a key to the symbols used accompany all plans.

If mains, feeders, branches and distribution panels are shown on the plans, it is desirable that they be designated by letters or numbers.

For the convenience of those making wiring plans the National Electrical Contractors' Association have provided and will furnish sets of marking stamps of these standard symbols. These will be found of great assistance to those preparing wiring plans and will be furnished for $ per set (cost of making) on application to the Secretary, Utica, N. Y

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THE SMALL CENTRAL STATION.

Practical Hints on Its Construction and Operation.

CHAPTER XII.

TRANSFORMERS.

Upon the efficiency, close regulation and durability of transformers depend very largely the profits of a lighting plant. The two main sources of waste in a transformer are lack of regulation and leakage in the insulation. In purchasing transformers, therefore, it will pay to investigate these points thoroughly and allow first cost to be of secondary consideration. The life of a well-constructed transformer is of such a length as to warrant a fairly high first cost. Poorly constructed transformers, while low in purchase price, are correspondingly high in maintenance cost, and are short-lived and troublesome. As with every other piece of apparatus used in connection with central-station service, the maintenance cost of the transformer is the prime factor to be considered in making the purchase.

Unfortunately for the purchaser, there are transformers on the market which may be purchased for a low figure and which show on tests of short duration economical operation. For this reason it is well before deciding upon any one make to consult some person who is an authority on the subject, and who, through experience, is in a position to know where to draw the line between good and bad.

The use of oil in transformers has to a great degree lessened the troubles formerly met with on account of poor insulation in the air-cooled type. It is not to be understood, however, that it is absolutely necessary or even considered best practice to employ only oil-cooled transformers. There are manufacturers who do build perfectly insulated air-cooled apparatus, and also engineers who recommend their use. Conditions govern the decision in every case, there being no fixed rule to go by. As has been the practice all the way through this series of articles, expert opinion is recommended, and then a continuance by the management along the lines recommended.

The importance of close regulation in a transformer is readily shown by the accompanying table:

EFFECT OF VOLTAGE VARIATION ON LIFE OF INCANDESCENT LAMPS.

Percentage of Required Voltage.	Percentage of Rated Candlepower.	Percentage of Normal Life.
90	54	941
92	62	555
95	75	275
98	90	146
99	95	121
100	100	100
101	106	82
102	112	68
103	118	56
104	124	46

The test is made on lamps taking 3.1 watts per candlepower.

Note the effect of the slightest increase in pressure on the life of the lamp. This table was made up from results of a test made to determine what effect upon incandescent lamps would result from a fluctuating line pressure. Some manufacturers sacrifice regulation to attain efficiency, with the result that the user of the transformer is indebted to him for numerous lamp renewals which would not have been required had the transformers been properly designed.

Perfect insulation and good mechanical construction should be imperative. The efficiency of a transformer should be limited to its ability to keep lamps burning at their rated voltage, even though 95 per cent. of the total number be switched on or off at the same instant.

Power absorbed on account of insulation leakage is a direct waste, for which the station receives no pay. A saving of one ampere of primary current in a system operating 10 hours a day at a transformation rate of one to 10 means in a year's time a saving of 72,000 lamp-hours. This appeals to one as worthy of consideration.

Concerning the proper method to be used in the connecting up of transformers for three-phase work, conditions of service must govern. In small installations, however, the cheaper cost of transformers for Y connection with a grounded neutral will be the determining factor. The Y-connected transformer requires insulating only for 0.58 of the line voltage, while Δ-connected transformers require an insulation which will stand the full-line voltage; therefore the reason for the less cost of the first-named type is apparent. Where four-wire secondary service is employed, primaries should be connected in Δ.

The advantage of Y-connected primaries with a grounded neutral is the increased safety to life. The disadvantage is the possibility of operative troubles due to a tree "short" in a windstorm or similar cause.

Where both primaries and secondaries are Y-connected, both neutrals should be grounded. With both neutrals grounded, proper care must be exercised to see that adequate means of automatic cut-out are provided on the high-tension side. A "short" between the line and the ground or the low-potential secondary will then be properly taken care of without danger to the consumer or unnecessary cost to the station.

The hanging of transformers is to be discussed under "line construction" in a succeeding chapter. The average cost of transformers is given below. It will be noticed that the lamp cost decreases as the capacity of the transformer increases. It may be cited here that the percentage of loss is greatest in small transformers and remains practically constant under all conditions of load; consequently it follows that large transformers are the most economical to use, due regard being paid to the amount of secondary winding.

STANDARD HIGH-GRADE TRANSFORMERS, 50 TO 140 CYCLES.

Watts Capacity.	Shipping Weight, Pounds.	Number of 50-Watt Lamps.	Price.
600	100	12	$ 22.00
1,000	150	20	27.50
1,500	200	30	35.00
2,000	240	40	40.00
2,500	250	50	45.00
3,000	300	60	50.00
4,000	360	80	60.00
5,000	450	100	70.00
7,500	560	150	92.50
10,000	650	200	117.50
15,000	850	300	162.50
20,000	1,000	400	205.50
25,000	1,250	500	240.00
30,000	1,550	600	280.00
40,000	1,850	800	355.00
50,000	1,950	1,000	425.00

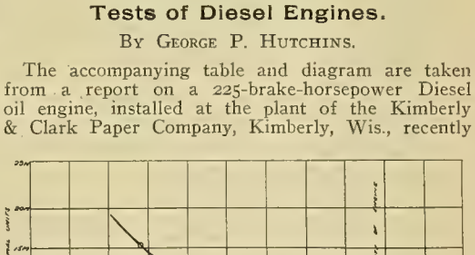
Secondaries wound for series or parallel operation.
Prices include hangers and oil.
For three-phase transformers, add 20 per cent. to above prices.

[*To be continued.*]

Tests of Diesel Engines.

By GEORGE P. HUTCHINS.

The accompanying table and diagram are taken from a report on a 225-brake-horsepower Diesel oil engine, installed at the plant of the Kimberly & Clark Paper Company, Kimberly, Wis., recently



EFFICIENCY CURVE OF DIESEL ENGINE.

tested by the Sargent Engineering Company, Chicago.

The plant consists of four Diesel engine units, one of a 450-brake-horsepower engine (found by coupling the drafts of two 225-brake-horsepower engines), coupled to a 300-kilowatt alternating-current generator, two units of 225 brake-horsepower, each connected to 150-kilowatt alternating-current generators, and one unit of 120 brake-horsepower to drive the high-pressure compressors used for starting and injecting the fuel oil.

All engines run in parallel with one another and with waterwheels. The plant was installed as an auxiliary to waterpower and is used when there is not sufficient water to operate the mills.

It will be noted from both table and diagram that the tests include five conditions of load—one-quarter load, one-half, three-quarters, full load and 16-per cent. overload.

The curve, in which the ordinates express the horsepower developed on the load factor, exemplifies two features of the Diesel engine—first, its low heat consumption per brake-horsepower, and, second, the remarkable manner in which the fuel consumption follows the load from 25-per cent. load factor, and especially from 50 per cent. to full load.

It is well known that a similar curve plotted for a steam engine would be a very rapidly ascending curve as the load falls off, due to a large heat loss in boilers, piping and cylinder condensation which are practically constant, no matter what the load, and which therefore result in poor economy under light load.

Referring to the table, the final data show the fuel cost of this plant, with crude oil at 3.64 cents per gallon, to be at full load 23 cents per 100 brake-horsepower-hours and 34 cents per 100 kilowatt-hours.

The Diesel engine is sold under a guaranty to deliver 100 brake-horsepower-hours on eight gallons of crude or fuel oil and 100 kilowatt-hours on 12½ gallons, which would cost, with oil at 3.64 cents per gallon, 29.12 cents for 100 brake-horsepower and 45½ cents for 100 kilowatts (on switchboard), respectively. Therefore, it appears that the guarantee has been exceeded over 26 per cent.

It is only fair to the reader to state that 3.64 cents per gallon is considerably above the price paid for crude or fuel oil in many parts of the country. Many Diesel engine plants receive their fuel delivered for 2¼ to 2¾ cents a gallon.

TABULATED RESULTS OF TESTS OF DIESEL ENGINES.

	¼ Load.	½ Load.	¾ Load.	Full Load.	Overload.
Date of run	1-5-06	1-5-06	1-5-06	1-13-06	1-13-06
Length of run in hours	1	2	2	4	.75
Revolutions per minute	170.1	177.1	174.5	169.1	161.2
Brake horsepower	68.15	133.7	194.9	249.7	263.8
Electric horsepower	54.5	113.6	170.6	224.8	237.5
Kilowatts	40.7	84.8	127.3	167.7	177.2
Pounds of fuel oil used in main engine per hour	42.75	57.1	82.5	106.37	126.66
Pounds of fuel oil used in compressor unit per hour	40.5	35.6	35.87	38.93	38.33
One-quarter oil used in compressor unit per hour	10.12	8.9	8.97	9.73	9.58
Total pounds of fuel oil used per hour	52.87	66	91.47	116.1	136.24
Pounds of fuel oil used per B. H. P.	.776	.493	.469	.464	.516
Pounds of fuel oil used per E. H. P.	.97	.580	.53	.516	.573
Pounds of fuel oil used per kilowatt-hour	1.29	.778	.718	.69	.77
Pounds of jacket water per hour	2,033.5	2,528.3	3,324	3,804.5	5,306
Pounds of jacket water per B. H. P.-hour	29.5	18.9	17.1	15.6	20.1
Average temperature inlet water	34	34	34	38.8	40
Average temperature outlet water	126.6	135.5	137.9	180	170
B. T. U. per B. H. P.-hour	15,103	9,594	9,127	9,029	10,041
B. T. U. per E. H. P.-hour	18,877	11,287	10,314	10,041	11,151
Thermal efficiency of engine and dynamo $\frac{2545}{\text{B. T. U. per E. H. P.}}$	13.4	22.5	24.6	25.3	22.8
Thermal efficiency of engine $\frac{2545}{\text{B. T. U. per B. H. P.}}$	16.8	26.4	27.8	28.1	25.3
Percentage B. T. U. in water jacket	18.2	20	19.5	24.3	26
Percentage B. T. U. in exhaust radiation and engine friction	65	53.4	52.7	47.6	48.7
Percentage B. T. U. in B. H. P.	16.8	26.4	27.8	28.1	25.3
Pounds of oil per 100 B. H. P.-hours	77.6	49.3	46.9	46.4	51.6
Gallons oil per 100 B. H. P.-hours	10.6	6.7	6.4	6.3	7.
Gallons oil per 100 kilowatt-hours	17.6	10.6	9.8	9.4	10.5
Fuel cost of 100 B. H. P.-hours in cents with oil at 3.64 cents per gallon	38.6	24.5	23.3	23	25.6
Fuel cost of 100 kilowatt-hours in cents	63	38.5	35.6	34.2	38.2

Electrical Equipment for the Hudson Company's Tunnel.

The twin tunnels of the Hudson Company, connecting Jersey City with New York under the North River, represent the most recent development in electrical projects centering about New York city. Construction work on these tunnels was finished about a year ago and work on the electrification will be begun at once. Fifty electric cars will be operated, taking their power from the third rail.

Each tunnel will have a single track, the north tube carrying the westbound traffic and the south tube carrying the eastbound or New York traffic. The cars will be operated in trains by the Sprague-General Electric system of multiple-unit control in a manner similar to that employed on the New York subway trains. Each car will be equipped with two GE-76 160-horsepower railway motors. Power for this new development will be supplied from a large station on the New Jersey side, located between Jersey City and Newark. Curtis steam turbines will be employed, the initial equipments including two 3,000-kilowatt 11,000-volt machines and two 6,000-kilowatt 11,000-volt machines. The total power so generated will be distributed at high voltage to three sub-stations, where the alternating current will be stepped down to 650 volts direct current through transformers and rotary converters. Sub-station No. 1 is located at

Greenwich and Christopher streets, New York, and contains five 1,500-kilowatt rotary converters and 15 step-down transformers; sub-station No. 2 is at Washington and First streets, Jersey City, containing four 1,500-kilowatt rotary converters and 12 step-down transformers, and sub-station No. 3 at Cortlandt and Church streets, New York city, contains two 1,500-kilowatt rotary converters and six step-down transformers. Each sub-station will, in addition, contain one spare 1,500-kilowatt transformer.

It is expected that when the new line is in operation the running time between the various suburban cities of New Jersey and New York city will be reduced one-half. The General Electric Company will furnish the complete electrical equipment.

QUESTIONS AND ANSWERS.

Copper Loss.

QUESTION.

P. H. C., Valparaiso, Ind.: We recently asked this question: "What number of amperes of current at two per cent. loss, 220 volts direct current at the generator, can be carried 1¼ miles over a 300,000-circular-mil copper cable?" In the Western Electrician of September 1st your answer was: "The answer to this question is 9.84 amperes, provided the return of this circuit also has a cross-section of 300,000 circular mils." We are somewhat puzzled at this, as there seems to be quite a difference of opinion in regard to the carrying capacity of a cable of the size in question. One erecting engineer represents to us that a cable should carry with a two per cent. loss about 90 amperes. Naturally this raises the question with us as to whether the mistake was made in printing the reply. Did you intend to say 98 amperes, or did you mean 9.84 amperes?

ANSWER.

The answer previously given—9.84 amperes—is correct, assuming that the total permissible loss in the circuit (outgoing and return) is two per cent., that the length of the circuit one way is 1¼ miles, and that the outgoing and return wire each consists of a 300,000-circular-mil cable. The calculation is as follows:

Total length of 300,000-circular-mil cable 2½ miles, or 13,200 feet, the resistance of which is approximately 0.447 ohm. The permissible drop in the circuit is two per cent. of 220 volts, or 4.4 volts. The current in the circuit would therefore be 4.4 volts, divided by 0.447 ohm, or approximately 9.84 amperes.

Wattless Current.

QUESTION.

B. W. J., Waukegan: What is the meaning of the term "wattless" as applied to an alternating current? And what is the effect of such a current in a circuit?

ANSWER.

The obvious meaning of "wattless," of course, is without watts or powerless. The condition for the so-called "wattless current" is that the current and electromotive force in a circuit shall be not in phase with each other; i. e., the current arrives at its greatest value at a different instant from that at which the electromotive force attains its greatest value.

The idea of wattless current arises from the fact that the measured power in an alternating circuit is not the product of electromotive force and current, as in a direct-current circuit, but is less than that product by an amount depending upon the difference in phase. This means that the current in the circuit, as measured by an ammeter, is not all available for running a motor under such conditions. Hence the conception that a part of it is "wattless."

As a matter of fact, there is no such thing as a "wattless" current; it is merely a convenient assumption.

There is only one current in an alternating-current circuit, and that is the current measured by an ammeter.

This current is part of the time flowing with the electromotive force and producing power. Part of the time, however (under the condition of phase difference, of course), it is opposing the electromotive force and consuming power. Therefore the power available or measurable with a wattmeter is the difference.

The conception of the phenomena occurring in an alternating-current circuit is often simplified by the assumption of a working current and an idle current, one-half cycle behind it in phase, both existing simultaneously in a circuit.

Pension System of the Western Electric Company.

Modern industrial conditions are now so strenuous that large employers are paying more attention than ever before to the establishment of pension systems, which serve as an inducement to continuous, faithful service. Recently the Western Electric Company, which employs, perhaps, 15,000 hands, has established a pension system which is now in complete working order, a number of employes who are eligible having already taken advantage of it.

President E. M. Barton announced on March

WESTERN ELECTRIC COMPANY
PENSION SYSTEM
RETIREMENT FOR AGE

INFORMATION.

Full Name .....
Present residence address .....
Present work ..... Department .....
Present wages .... per .... On pay roll of .... House
Date of birth .... Present age .. years. .. months

Record of Active Service.				Leaves of Absence exceeding 6 mos. ea.			
House	From	To	Period in years	From	To	Period in Years	With or without pay

Wages for ten years to .... 190 .....

Year ending	Year's wages	Year ending	Year's wages	
				Total for 10 years $.....
				Average per year $ .....
				The foregoing record of service and wages is correct according to the Company's record.
				..... Pay Roll Clerk.
				..... Chief Clerk

REMARKS.

APPLICATION.
I believe the foregoing record of my service and wages to be correct and I hereby make application for retirement from active service with a pension allowance.

RECOMMENDATION.
I recommend that ..... be retired from active service and granted a pension allowance.

I concur in the foregoing recommendation

ACTION.
Presented to Pension Board.....190.....
Remarks.....
Pension of $.. ..per month authorized beginning .. .. 190..
Signed..... Chairman of Pension Board.
..... Secretary of Pension Board.

BLANK FORM USED IN APPLYING FOR PENSION FOR AGE.

28, 1906, that the company had established the system "to make provision for its faithful employes, who, through age or infirmity, may become unable to continue in active service." The sum of $400,000 was set aside from the company's profits as a pension fund, the unused portion to draw interest from the company at the rate of four per cent. The president was authorized to set aside a sum not exceeding $150,000 annually from the profits to be added to the fund. Should the aggregate pension allowances exceed the amount available from the pension fund at any time, in the absence of action by the board of directors increasing the fund, a new rate shall be established proportionately reducing all allowances.

Administration of the pension fund, under the president of the company, is entrusted to a pension board consisting of five officers or employes of the company, appointed annually by the board of directors or executive committee. At present this Pension Board consists of H. F. Albright, New York; F. V. Bennis, Chicago; C. G. DuBois, Chicago; J. W. Johnston, Chicago, and F. H. Wilkins, New York. Any action by the Pension Board requires the affirmative votes of at least three of its members.

All employes engaged in any capacity in the operations of the company who shall have reached the age of 60 and have been 20 or more years continuously in the service may, at their own request, or at the discretion of the Pension Board, be retired from active service and become eligible to pensions.

Any employe who has been 10 years or more continuously in the service and has, by reason of injury or sickness, become totally incapacitated from further work for the company may or may not receive aid from the pension fund at the discretion of the Pension Board. If aid is granted, it shall be for such amount and for such period as the Pension Board may determine. The word "employes" means all persons who have received a stated and regular compensation from the Western Electric Company or its predecessor, the Western Electric Manufacturing Company. Leave of absence or temporary lay-off on account of reduction of force is not to be considered as a break in the continuity of service, but when such absence exceeds six consecutive months it shall be deducted in computing length of active service.

The following are the rules governing pension allowances and conditions:

"The annual pension allowance for each employe retired for age shall be as follows: For each year of active service, one per cent. of the average annual pay during the 10 years next preceding retirement.

"Pension allowances shall be paid monthly from the date of retirement until death, and, at the discretion of the Pension Board, allowances may, in exceptional cases, continue to widows or orphans for a further period not exceeding one year.

"The acceptance of a pension shall not debar any retired employe from engaging in any other business, which, in the judgment of the Pension Board, is not prejudicial to the interests of the company.

"Assignment of pension allowances will not be permitted or recognized.

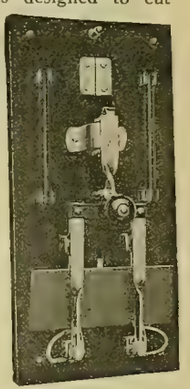
"Pension allowances may be suspended or terminated by the Pension Board in all cases of gross misconduct.

"Neither the action of the board of directors, in establishing a system of pensions, nor any action hereafter taken by the Pension Board, shall be construed as giving to any officer, agent or employe of the company a right to be retained in its service, or any right or claim to any pension allowance, and the company expressly reserves its right and privilege to discharge at any time any officer, agent or employe when the interests of the company in its judgment may so require, without liability for any claim for a pension or other allowance other than salary or wages due and unpaid."

In applying for a pension for retirement for age the applicant makes use of the form shown in reduced facsimile herewith. If the applicant's average yearly pay for the last 10 years had been $900, for illustration, and if his continuous years of service had been 24, then the pension would be 24 per cent. of $900, or $216, or $18 a month. Pensions for disability are entirely at the discretion of the Pension Board.

The H. & M. Safety Switch.

If wires become crossed with any high-tension circuit, the switch illustrated is designed to cut out the current and prevent damage. The switch can be set to operate at a point only a little higher than the regular voltage, so that crosses from other circuits, even if not fatal, are instantly detected and must be removed before the switch will stay closed.

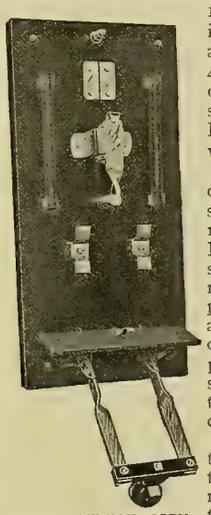


SAFETY SWITCH CLOSED.

It opens whether the wires are in service or not, day or night, and no injury to persons, fixtures, lamps or machinery can occur by starting while a cross is on and not known. It will open, it is said, 0.05 of an ampere of foreign current, and is instantaneous.

This switch is recommended by the F. Bissell Company, Toledo, Ohio, sole agent, for all installations whether high or low tension, because, with the increasing use of high-tension circuits and the congestion of conductors in streets, alleys and conduits, which brings them in close proximity and frequent confusion, there is danger that the high voltage will make trouble. If desired, it can be made to operate on the appearance of a ground without the presence of a high voltage. However, this feature has some disadvantages and is practical only where a single insulation is fed from one set of mains and where there is no natural ground connection.

As the switch is short-circuited across the mains there is an infinitesimal leak of current. The resistance of the carbon rods is 5,000 ohms each, or 10,000 ohms total. Theoretically, this will pass 0.022 of an ampere on 220 volts or 4.84 watts. 24 hours × 365 days × 10 cents per kilowatt should give $4.24 per year. In practice there is no cost whatever.



SAFETY SWITCH OPEN.

On 110 volts the resistance of carbon rods is just the same, so the price for current figures $2.12 per year. But the first installation consumes less than one-tenth as much current as a 16-candle-power lamp of the best grade, and the second consumes only one-twentieth as much. In practice the H. & M. safety switch costs the customer and the central station nothing for current.

The lightning arrester feature is valuable to the central station which owns the meter, and the switch should therefore be installed ahead of the meter.

The switch is designed to protect wires when crossed with any high-tension circuit, or when struck by lightning, but is not a circuit-breaker for an overload.

Multiple-voltage System of Motor Control in Cloth-printing Establishments.

Cloth printing constitutes an extensive industry. In most cases the work is done under contract, the mill supplying the cloth as it comes from the looms to the finishing company, which does the printing, and puts it in proper condition for the market. The printing is done on one side of the cloth, and may be in black or some other single color, or maybe in a variety of colors. Various kinds of cloth are printed, such as calico, dimity, lawn, silk, etc.

The cloth-printing machine consists of a large revolving cylinder around which the cloth passes; and bearing against the cylinder, with the cloth between, are one or more, sometimes as many as 10, copper rolls, called printing rolls, upon which the design has been engraved, the number of rolls being dependent upon the number of colors used, a separate roll being used for each color. The roll, in revolving, takes up the color from a trough into which it dips, and impresses the design upon the cloth. From the printing machine the cloth passes on through a drying room heated by steam to a high temperature, whence it emerges with the ink entirely dried, provided the speed of its passage through the drying room has been properly timed.

Previous to the adoption of electric motor drive, the printing machines were driven by a twin-cylinder engine, direct-coupled to the main driving shaft of the machine, the variation in speed being obtained by hand throttling of the engine. The printing room was invariably a dirty, oily damp place. The inefficiency of these engines, together with the large amount of condensation in the long steam pipes between boiler room and printing room, created a condition of power extravagance against which the electric motor drive has produced most favorable results in economy. The exhaust steam from the engines has in some cases been used for the heating of water, through indirect contact, for use in the dye houses, but the economy of the electric drive is so great that the live steam used in place of the exhaust from the engine is not a matter of much consideration.

The advantage of the multiple-voltage system of electric drive of this class of work comes in its cleanliness, economy of power, saving in floor space, and the ability to obtain a line of speeds necessary for the varieties of work which may at any time be put upon any printing machine. When using but one color, different speeds may be required, according to the character and thickness of the cloth, and the design being printed upon the cloth, these conditions determining the maximum speed permissible with proper setting of the color. With a number of colors, which usually means an intricate pattern, different speeds may be required to obtain the proper register as well as the setting of the colors. The printer finds the multiple-voltage system of particular advantage in "making ready," which usually consumes much time in getting the proper register and determining the proper pressure of the rolls to insure good setting of the ink. For this work very slow speeds and quick starting and stopping are a necessity. Once he has all adjustments made and has determined the proper speed for the work in hand, he lets it proceed, adjusting on the controller the notch at which he desires to run, so that if it is necessary to stop the machine, it can be instantly set to work again at the same speed and without loss of time in finding the proper speed.

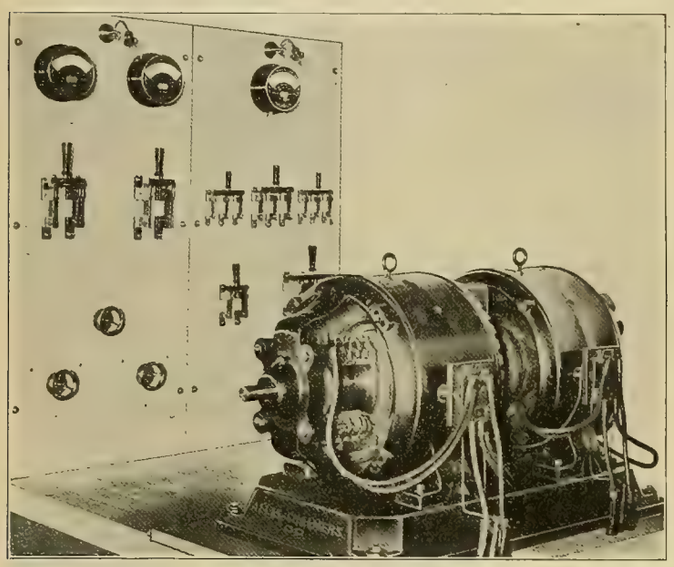
The usual method of equipping a printing machine is to install the motor on the floor below the printing room and belt up to a driving pulley on the main shaft of the machine. In one installation the motors are all located on a balcony above and to the rear of the row of printing machines. To save room, the most convenient method of locating the controller is to mount it on the ceiling of the floor below the printing room, the shaft of the controller being extended above, with the hand-wheel at a convenient height in front of and to the right of the printing machine.

On account of the very slow speeds required at different times, the four-wire multiple-voltage system is said to be better for this work than the three-wire system. To obtain the slowest speeds, a few steps of armature resistance are used, and this has necessitated the development of a special type of controller. This controller will give 18 speeds, the lowest of which are obtained through the use of armature resistance. Aside from the necessity for the slower speeds, the throwing of 60 volts on the motor armature for the first speed would cause a too sudden jump and result in tearing the cloth. This controller, with its 18 speeds, meets the conditions of all ordinary work, but in connection with a recent installation made for the Glenlyon Dye Works, by the Allis-Chalmers Company, a new controller giving 41 speeds was developed and is now in satisfactory operation.

Power necessary to drive a cloth-printing machine depends upon the number of colors for which it is built and in addition the pressure necessary to force the ink into the cloth being printed. Experience has demonstrated that for a machine built for three colors or less an Allis-Chalmers type H 17½-horsepower 240-volt 750-revolution motor is well adapted, and for any greater number of colors, a 30-horsepower 1,000-revolution motor is recommended.

The NI-136 balancer, having a capacity of 17½ kilowatts in each machine, has been found large enough to take care of the six 30-horsepower printing equipments already installed for the Glenlyon Dye Works, together with four other 12-horsepower equipments in the same plant, but driving another class of machinery. The multiple-voltage system lends itself well to the equipment of other machinery in textile finishing works, such as soapers and tender frames, the latter being used to stretch and straighten the cloth. Soapers require a motor of approximately 18 horsepower at 900 revolutions per minute, and 12 horsepower at 900 revolution per minute is ample for tender frames, the motor in both cases being direct-coupled to the machine. The X-1 controller gives very satisfactory results with the 12-horsepower motor driving the tender frames, and the X-2 controller is used with the 18-horsepower motor on the soapers.

The multiple-voltage system has met with exceptional favor from the companies in which it has been installed. It is stated that the use of the Allis-Chalmers system (using the H. Ward Leonard patents) has, in some cases, been known to effect a saving of over 50 per cent. in power. In addition to the Glenlyon Dye Works at Philippsdale, R. I., already mentioned, this system has been furnished to the United States Finishing Company of Norwich, Conn., Algonquin Printing Company of Fall River, Mass., and Arnold Print Works of North Adams, Mass. The illustration shows a three-wire balancer for the multiple-voltage system.

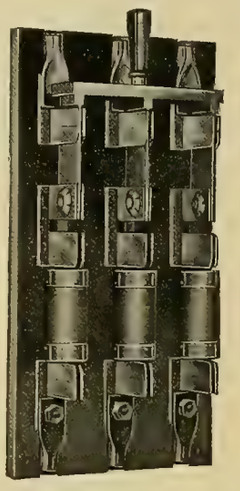


THREE WIRE BALANCER FOR MULTIPLE-VOLTAGE SYSTEM OF MOTOR CONTROL.

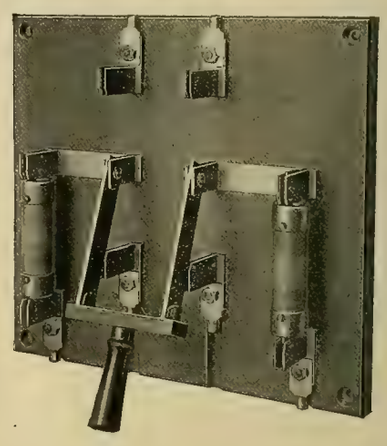
An Improved Type of Lever Switch.

The General Electric Company has recently developed a line of knife-blade switches to be known as D-12 lever switches, which meet the requirements of this class of electrical apparatus. Sweated joints have been eliminated as far as practicable, and such joints as are sweated are reinforced by other means of fastening. The crossbars are made of selected black fiber secured firmly to the blade. In order to provide for very low rise in temperature, the contact clips are generously proportioned from hard-drawn spring copper securely pinned and soldered into the clip blocks, and the hinge-clips are provided with large and substantial spring washers which serve to maintain good contact by compensating the slight sweat incident to long-continued use.

Switches of this type can be furnished with connections either for enclosed fuses of the National Electrical Code standard or link fuses. Single and double-pole double-throw switches have offset fuse connections, necessitating but one set of fuses. The standard switch for enclosed fuses is so arranged that when the switch is open the fuses are on the load side. This arrangement can be varied, however, and switches can be furnished so arranged that when open the fuses will be between the switch and the service. D-12 switches are made in single, double, triple and four-pole types.



TRIPLE-POLE, SINGLE THROW ENCLOSED-FUSE SWITCH.



DOUBLE-POLE, DOUBLE-THROW ENCLOSED-FUSE SWITCH.

BOOK TABLE.

ELECTRICAL INDUSTRIES, 1902. Special Reports of the Census Office. Prepared under the supervision of William M. Steuart, chief statistician for manufactures, Department of Commerce and Labor. Washington, D. C.: Government Printing Office. 1905. Pp. (9 by 11½ inches), 786, with 96 illustrations.

This book constitutes a compilation of data concerning the central-station electric-light and power stations, street and electric railways, telephones and telegraphs of the United States. While the information given is largely for the year ended June 30, 1902, some interesting facts of the electric-lighting industry from the pioneer days up to 1902 are presented.

In the part covering central electric-light and power stations the text was prepared by Thomas Commerford Martin, expert special agent. The schedule of inquiry was formulated after consultation with experts and persons identified with the industry all over the country, but the absence of uniform systems of accounting for central stations made it impossible to prepare a schedule that would be easily applied to conditions prevailing in different plants. Nevertheless, the canvass was satisfactory, and, with a few exceptions, complete returns were secured from all central stations in operation during any portion of the year. A few of the subjects covered in this part are: Recent origin of the industry; effect of recent discoveries; comparison of private and municipal plants; comparison of gas and electric lighting; financial operations; employes, salaries and wages; physical equipment; output of stations; franchises; history and development of electric lighting, etc.

The part on street and electric railways is equally complete. In this Mr. Edward Dana Durand collaborated with Mr. Martin in the preparation of the text. Statistics cover all electric railways, irrespective of their length, and all street railways of whatever motive power. Among the subjects treated are traffic and financial operations; franchises, public regulation and public ownership; roadbed, track and electric construction; cars and miscellaneous equipment; interurban-railway construction and equipment, and economic, financial and social features; street railways in Europe, etc. etc.

Telephones and telegraphs are taken up in the third report, which also includes municipal electric fire-alarm and police patrol systems. Messrs. A.

V. Abbott and W. Maver, Jr., co-operated with Mr. Martin in preparing the text, the former as to telephones and the latter as to telegraphs. The report, being for the calender year 1902, presents statistics concerning the physical equipment, service and financial operations of the commercial and mutual telephone and telegraph systems of the country and the physical equipment of Independent and rural telephone lines. It also gives data relative to the systems controlled in whole or in part by railway companies, and the ocean cable systems that were in operation all or part of the year. With the publication of this report the Bureau of the Census closes the first complete census of the generation and utilization of electric current for the transmission of power, messages and conversation.

Improved Inlet and Outlet Service Connections.

The National Board of Fire Underwriters requires that service conduit shall be continuous, and in order to meet these requirements the arrangement shown in Fig. 1 has been developed and placed on the market by the H. W. Johns-Manville Company, 100 William Street, New York. The service-box clamps are made in four sizes to fit over two-inch, 2½-inch and three-inch iron pipe and three-inch fiber conduit, and are split and bolted together in order to make a tight fit to the pipe. The box is made in one piece with two openings, one in the back and the other in front, and it may be twisted so as to allow the conduit to come out from top, bottom, either side or the front. This service box may also be used on a dead-end box, using the blank plates and coiling up the cables inside. A dummy plate is placed over the opening that is not used. On the other opening is placed the tube plate with three openings. If the cable is large and three single conductors, as for direct current are used, the three openings are used. If three small conductors are used, then two of the holes are filled with blank bushings.

Sprague flexible conduit is used for a conduit between service box and Noark service switch, as shown. Bushings to take three-eighth, five-eighth, three-quarter and one-inch Sprague conduits are used when cable or wire is small. The openings in the plates will take 1¼-inch Sprague conduit without bushing. For alternating-current work and

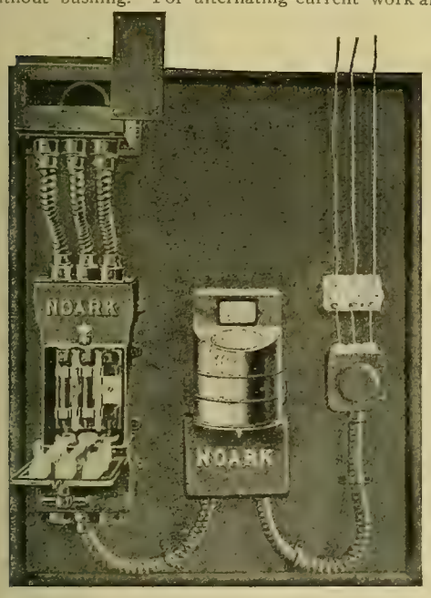


FIG. 1. INLET AND OUTLET SERVICE.

when cables are over 80,000 circular mils, an alternating-current plate (Fig. 2) which will take 2½-inch iron pipe is used. If it is necessary to go up or down from the service box the alternating-current split elbow (Fig. 3) is used, and iron pipe is continued to the Noark service switch. The conduit is continued to a guard which fits over the switch box, these guards being made right and left in order to go on either side of the service switch box. The end of the guards takes the same plate as the service box and any combination can be effected.

Fig. 2. Plate. Fig. 3. Split Elbow.
INLET AND OUTLET SERVICE.

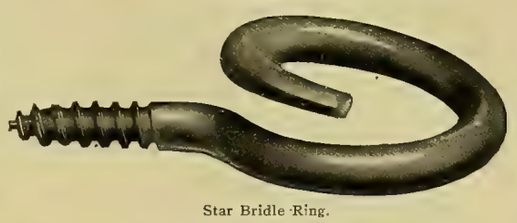
From the service switch box double-braided wire in Sprague conduit is used to the meter box. The meter box is made of galvanized iron with holes punched in, same to take conduit. These boxes vary in type, depending on style of meter used, and are made up to suit the conditions of the central station. From the meter box the conduit continues to the cut-out for the house wiring.

A number of different combinations may be made with these parts. Overhead service may be brought in direct to the service switch box. Alternating wires may be run by bringing cables or wires through one conduit, while large-sized cables may be used on direct-current service by employing the three openings. If a customer is disconnected and material is removed, there is no waste, as all parts, even Sprague conduit, may be used again. This is not so in moulding work, as the greater part of the material is wasted. The time consumed by the wiremen is less in installing than that with a moulding job. This system practically prevents the tampering with the wires between the meters and the service, as no tapping can be made without the evidence of wiring being tampered with. Any number of customers may be taken off service by use of cut-outs and bus-lines. The system is in use by the Brooklyn Edison Company, which has installed over 1,000 services of this type.

Line Construction Specialties.

A simple expansion bolt, made by the Star Expansion Bolt Company of 147 Cedar Street, New York city, is illustrated by one of the accompanying cuts. It requires a hole just large enough for the insertion of the expansion parts or shield. The lag screw being turned into the expansion

Star Expansion Bolt.



Star Bridle Ring.
LINE CONSTRCTION SPECIALTIES.

part causes a direct expansion irrespective of the nature of the article or material being fastened.

The screw anchor is especially adapted for small fastenings both in connection with wiring, the fastening of fixtures and the fastening of various parts to slate and marble switchboards. For this expansions are usually necessary. The star anchors are made of a soft composition which can be used almost anywhere without marking or defacing the surface of the material into which they are placed. They permit the screw to cut its own thread, enabling the use of either wood or machine screws. The hold is declared to be absolute and vibrations do not materially affect it.

The Star cable dog is designed for fastening cables to substances other than wood. The method of expansion requires a smaller hole than heretofore, and eliminates the necessity of using wooden plugs. These plugs often rot or dry out, while the Star cable dog cannot be affected in any way by the weather or natural conditions.

Enameled bridle rings are used generally by telephone companies. The enamel insures entire insulation, absolute smoothness, eliminates chafing of the wires and is rust and weather proof. Its form enables the wires to be readily removed and inserted at any time, but they cannot work out or be displaced by action of the wind or by strain.

Electrical Conditions in Philadelphia.

For the National Board of Fire Underwriters, a committee has made a report on the city of Philadelphia, and in connection with the fire-alarm system, comments as follows: "Manual central-office type. Headquarters good, except for a few details. Operating apparatus satisfactory. Methods of handling alarms unnecessarily slow. Boxes not of the most reliable type, but fair, mostly without keys attached. Distribution fair. Good proportion of circuits underground. As a whole, good."

In relation to wiring for electric light and power, the committee says: "Municipal control exercised over outside wiring only; laws well enforced, though practically limited to low-tension pole lines. Underwriters' Association maintains fairly rigid supervision over all inside wiring coming under its jurisdiction, but is too shorthanded properly to control the situation. New wiring in good condition; old, only fair. Electrolysis is under control. In the congested-value district the potential hazard is moderate in the west section, high in the east and very high in the central section, the most hazardous center, potentially, being the group of large-area department stores. Outside the congested-value district, the potential hazard is high in a few instances where large areas of lumber piles are grouped, but is mainly very moderate on account of the almost total absence of frame construction and the scattering of the manufacturing plants."

Standardization of Conduit.

The latest report of the Engineering Standards Committee of England on subjects of interest to electricians is on "Steel Conduits for Electrical Wiring" (No. 31). This concerns the adoption of standard lengths, diameters, internal and external, and threads for the steel conduits used for encasing internal electrical wiring, as well as for underground work.

The British committee's report was made after a careful consideration of the subject, testimony having been taken and measurements carried out at the Natural Physical Laboratory. The question of threads and gauges to be adopted was submitted to the sectional committee on screw threads and limit gauges. It is laid down in the report

Star Screw Anchor.

Star Cable Dog.
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that plain and screwed steel conduit for electric wiring are recognized as standards, and tables are given of standard dimensions of both classes before enameling or galvanizing. The standard lengths are given as 10 feet, 12 feet or 14 feet, and the necessary tests, prior to the rejection or acceptance of any batch of conduits, sockets, couplings, etc., are explained.

Equipment for Soulanges Canal Power Station.

The Montreal Light, Heat and Power Company recently contracted with the Canadian Westinghouse Company for a large addition to its power equipment for the new Soulanges Canal power station on the St. Lawrence River. The equipment consists of three 3,750-kilowatt revolving-field alternating-current two-bearing generators connected to water turbines. These generators are of 7,200 alternations, 4,000 volts, three-phase, operating at 225 revolutions a minute. There are also two 150-kilowatt direct-current 125-volt exciter units. Westinghouse 2,500-kilowatt oil-insulated water-cooled transformers to the number of 13 are an important part of the equipment. Seven of these transformers will be used for raising the voltage at the generating station from 4,000 to 44,000 volts, and six of them will be used at the lowering end of the transmission line, stepping down the voltage from 44,000 to 12,000.

The generators and exciters will be controlled by motor-operated rheostats, and the complete switchboard apparatus, which the Canadian Westinghouse Company is furnishing for both the main and substations, will involve the latest type of electrical control, representing the highest development of switchboard apparatus. This contract is among the largest recently placed in the Canadian field.

New Telegraph Service to Cuba.

A certificate of incorporation of the Commercial Cable Company of Cuba was filed at Albany, N. Y., on September 12th. The company is organized with a capital of $100,000, to operate telegraphic communication between New York and Havana, by way of Florida and Key West. The principal office is located in New York. The directors are William W. Cooke, Samuel S. Dickenson, George Clapperton and Albert Beck of New York city, Clarence H. Mackay of Roslyn, L. I., Albert B. Chandler of Brooklyn and Dumont Clarke of Dumont, N. J. Simultaneously with the announcement of the incorporation of this company came a report that on December 7th the Mackay Companies will open for business a cable system between the United States and the sister republic in competition with the Western Union Telegraph Company.

Practical Central-station Operation.[1]

By Charles Sharpe.

To begin with, I assume that the manager has been supplied with a modern station, efficient boilers, engines, generators, etc. It now devolves upon him to secure the best results from the equipment at his disposal. He will, in the first place, have the feed-water examined. It may contain some substances that should be eliminated or neutralized, some microbe that should be rendered innocuous. Then the coal should be analyzed and experiments made to determine what variety and grate will give the most economical results. I have sometimes found that it is not always the coal that is the cheapest in price that is the most economical, and I do not think it wise to purchase coal simply on analysis, but rather make a test of the coal in your own boilers and under different conditions.

The flue gases should have attention to ascertain if an undue number of heat units are escaping up the chimney. The manager may do this himself or he may delegate these duties to a subordinate; if he has forgotten his chemistry it would be better for the other fellow to do it. The boiler-room cannot be watched too closely, for otherwise many a dollar goes up the flue.

Recording chart instruments, including steam gauges, voltmeters, etc., should be put in every available place.

The engines should be so arranged and operated that each will carry its most economical load for as many hours a day as is possible. A careful study of the load curves will accomplish much to this end.

It is sometimes practical to have mutually satisfactory agreements with power consumers whereby the hours of their demand are so shortened that the power load does not overlap the lighting load. When this is done, there will be a marked saving in plant equipment.

Direct-driven generators are of great advantage and afford a saving over belt-driven machines. Long line shafts are an abomination and should be discarded if possible.

The output of the station should be accurately measured at the switchboard and a daily record kept. It is needless to say that a daily record of coal, water (if purchased), oil and waste and other material should be kept. By adding the station wages to the cost of these and dividing by kilowatt-hours as measured at the switchboard, it is an easy matter to obtain the actual cost at the switchboard.

Comparison of results obtained should be made from day to day, fluctuations noted and causes ascertained. Comparison should also be made with results obtained at other stations, and if comparisons are unfavorable, ascertain the fault, and correct.

Test the station meter regularly and keep it accurate. Direct-current meters are particularly apt to give trouble. Consumers' meters should be frequently tested. Compare the total reading on consumers' meters with the station meter and see what the loss is between the station and consumer; if too high, investigate and remove the cause.

Have your employes divided into a convenient number of departments. The number of departments is dependent upon the size of the plant. Have the head of each department make a daily report, particularly full in case of accidents and unusual occurrences. Let each employe understand what he is expected to do, and hold him responsible for the faithful performance of his duties. Confusion will be avoided if orders and directions go through a regular channel, and the man who does the work is instructed by his immediate superior.

I think that it is a great advantage to the company to furnish its consumers with free lamp renewals. A good lamp should be supplied, and all the elements entering into the quality of excellence should be considered before selecting a lamp. The cheapest is not apt to prove the best in the long run. When the company furnishes a first-class lamp, one of reasonably long life with low wattage, there is apt to be less complaint upon the part of the customer. When a customer furnishes his own lamp, he is apt to be controlled only by the first cost of the lamp, purchasing lamps of varying wattage which require a large amount of current and give poor results. Such conditions produce large bills and dissatisfaction and cause the customer to blame the company.

The average company often fails to appreciate the benefits of persistent advertising. Snappy advertising will attract the attention of many who will become interested in the advantages of electricity and ultimately become customers. I do not mean newspaper advertising necessarily, although that form of advertising, all considered, is the most profitable. Vary the methods. A demonstration of the manifold domestic uses of electricity for ironing, cooking, etc., is useful.

If the business is large, a soliciting department will be found useful. It is surprising how much business a courteous, well-qualified solicitor can obtain in a brief time. A great many people living in houses that have not been wired freely admit the advantages of electricity and admit a desire to use it, but fear the expense of wiring. This business can easily be secured by showing the customer the comparatively small cost of wiring, and, if, necessary, guarantee the estimate. It might not be a bad plan to do such wiring yourself, taking no profit, but looking to the profit in supplying the current.

It is usually advisable to confine the solicitors' efforts to territory already covered by the company's lines. While it is easier, perhaps, to secure customers in outlying districts, such business is commonly unproductive, as meters are scattered and long runs of wire are required to reach them. Transformer losses in such districts are very heavy. Do not understand me as advocating an unenterprising policy, but experience has shown that it is best to be conservative.

A solicitor can secure a great deal of small motor business. This business usually pays good rates and is extremely desirable. It is preferable that the company furnish the motors at cost, in all cases keeping the initial cost to the consumer to the lowest amount.

I would like to know what is the largest size single-phase motor that should be put on the lighting circuits and whose make is giving the best results. [See discussion on this paper, page 248.—Ed.] In talking with different managers I find that some are using as high as 15 horsepower.

I believe that the location of the company's office should be given much thought by the manager. A great many of the old-time managers seem to think that all that is necessary is to have a two-by-four space for the office at the plant. I think that the office should be in the central part of the business section of the city, and one can well afford to pay the rent in such a location. You want to be close to the people, and in position so that the people can easily reach you.

In conclusion I want to say a few words about the preparation and adoption of some system of uniform accounting by members of this association. Without some such system, it is absolutely impossible for us to make comparisons of our business. In the absence of such system a great deal of our talk about costs, profits and losses is meaningless, and much that should be of the greatest value becomes unavailable for our guidance.

[The association took steps to collect data of operation on which to base, perhaps, a system of uniform accounting.—Ed.]

1. A paper read before the Illinois State Electric Association at Springfield Ill., September 20, 1906. Mr. Sharpe is connected with the People's Power Company of Moline, Ill.

Industrial Activity in Egypt.

Charles M. Pepper, special agent of the United States, has furnished an interesting and comprehensive report on trade conditions in Egypt, which shows that the land of the Pharaohs has turned to modern methods for the development of its resources and is prepared to take its place among the most progressive of commercial countries. Mr. Pepper points out that the wonderful development that will follow the completion of irrigation projects will require a large amount of modern machinery of every description, including farm and industrial machinery. His report is sent from Alexandria, and he has this to say of electrical machinery:

"The prospect for electric installations is a fair one, though Arab villages do not take to electric lighting with such avidity as do many other primitive communities. Besides Alexandria and Cairo, some of the largest towns are the main dependence, as are also the big plantations. Electric railways (trolleys) are being extended, and recently the main suburban line of Alexandria has changed from steam to electric power, in harmony with the tramway system of the city. Telephone and telegraph lines under the state are likely to be materially increased. One of the chief American electrical companies seeks business in Egypt through its European office. The importation of electrical apparatus is valued at $750,000 yearly."

Copper Market.

Copper Gossip of New York, September 20th, says that "copper prices keep climbing, and the objective point of the market appears to be 20 cents. The metal is in remarkable request, and persistent buying for future delivery has infused an exceedingly strong tone into the whole situation. There has been a great increase in the volume of trading in the copper market, and prices have advanced sharply under the influence of an enormous demand. Buying of electrolytic wire bars on a large scale started in August at 18½, and has continued right along to 19 cents at each stage of the advance. The copper situation is strong, and the fact that consumption has broadened out, notwithstanding the advancing prices of the last two years, is the best proof of the urgent character of demand. Large sales have been made for deliveries during the balance of the year, and more recent transactions include deliveries for the first three months of 1907. There has been great eagerness to secure supplies, and more inquiries have come to producers than can possibly be entertained."

Relation of the Alternating-current Motor to Central-station Power Business.[1]

By E. W. Lloyd.

The bearing that the development of the alternating-current motor has on the securing of power business is greater than generally supposed.

It is not the intention to treat this subject in any but a general way, the object of this paper being merely to call to your attention the necessity of the co-operation of central-station men with the manufacturers, encouraging them in the design of apparatus that will meet the requirements of customers applying for central-station service.

We all run across cases where business was lost because we could not secure motors that would do the work as satisfactorily as the direct-current motor, the margin between the cost of the operation of a private plant and central-station service being so small that in order to secure the best results from machinery the manufacturer often decides to install his own plant and direct-current motors with a resulting loss to the central-station company.

If we can secure motors that will do the work asked for by the customer we will help our own cause materially.

With the increase in the capacity of central stations and the tendency toward the generation of alternating current at high potential in large units, it has become possible to furnish power in large quantities at a low price to the consumer several miles from these central stations.

If this power can be furnished directly from our overhead or underground lines with the use of transformers instead of installing sub-stations, even for large quantities of power, the saving to the central-station companies will be material. Some companies are today installing sub-stations on customers' premises, furnishing them power and standing the loss in transformation as well as the investment involved.

The last few years have seen a large increase in the use of alternating-current motors in connection with factory work. This has been largely due to the decreased cost of these motors, the prices now approximating closely prices of direct-current motors of the same sizes and speeds.

Excepting on tools and machinery requiring variable speeds, the alternating-current motor is generally admitted to be a better prime mover than the direct-current motor, owing to its overload characteristics.

This motor having been developed to a point where it can be guaranteed as a perfectly reliable prime mover as far as ordinary work is concerned, we are only waiting for the development for variable-speed work for factory use.

There have been numerous developments on single-phase and multiphase motors for variable-speed work by different manufacturers, one company having on the market single-phase motors up to three horsepower that will do variable-speed work with very fair results.

While, as with the three-phase motor, the operation of this type of motor is not as successful as the direct-current motor, still it is a great step in advance and of the utmost importance to central-station companies.

Already the possibility of equipping cranes and hoists with alternating-current motors has been realized. In Chicago we have several manufacturers using current from the three-phase 220-volt 60-cycle system who have their factory equipped with traveling cranes using three-phase motors. These equipments, while not perfect, are reliable enough so that the men using them are very well satisfied. In fact, one large customer, having approximately 700 horsepower in motors, is changing over a number of traveling cranes from direct-current to alternating-current motors. This is being done in order to save the loss in the changing of the current from alternating to direct current through rotary converters. One large alternating-current crane is already in operation and is proving entirely satisfactory.

We have also equipped several jib cranes with alternating-current motors with satisfaction, being able to handle molten metal in five-ton ladles with perfect safety.

One large foundry has several ladles running on tracks equipped with variable-speed alternating-current motors, enabling the operator to tip the same at will, and as easily as if equipped with direct-current motors.

For small printing-press work we have arranged to install three-phase variable-speed motors on cylinder presses, and while we know it is not possible to get the wide range of speed or efficiency possible with the direct-current motor, still the installation is a great improvement over the old installation of belt drive and cone pulley.

The possibility of equipping alternating-current motors with automatic starting devices is bound to be realized. With this device it is possible to start and stop a motor driving an air compressor from the varying pressure in the storage tank.

1. A paper read before the Association of Edison Illuminating Companies at Frontenac, Thousand Islands, N. Y., September 5, 1906. Mr. Lloyd is the contract agent of the Chicago Edison Company.

One company has a starter ready for the market which it will guarantee.

With alternating-current motors doing the work described above, the troubles of obtaining power business in larger quantities are to some extent overcome, as one of the most difficult obstacles in the way of obtaining this business was the fact that the alternating-current motor was not capable of giving anywhere near the duty to be obtained of the direct-current motor.

The alternating-current motor has many advantages: Its ability to operate under overloads, which would destroy a direct-current motor; it can operate in dirty places without extraordinary attention; its freedom from sparking; and last, but not least, the low cost of maintenance.

The direct-current motor has been specialized in many ways and designs, and in small sizes is made to accomplish results economically by the removal of many of the friction losses present in shops where shaft driving was used.

The manufacturers of alternating-current apparatus have not as yet made these motors to meet conditions required in individual driving, such as that used in connection with stereotype machinery, printing machinery, bookbinding machinery, or any of the small tools now generally equipped with individual motors, but there is no reason why this cannot be done.

Alternating-current motors equipped with back-gears would find a ready market today, as the demand for individual drive on all classes of machinery in factories is more pronounced every day.

As near as I can ascertain, there has not been the demand on the manufacturers for variable speeds in these motors that there might have been; the manufacturers being left to do the experimenting, if not leisurely, still not as fast possibly as if the demand had been greater and more urgent.

Certain manufacturers of apparatus have refused, not later than a year ago, to manufacture traveling cranes equipped with alternating-current motors, and if it had not been pointed out to them in a forcible manner that their competitors would get the business, they would still be in the same frame of mind.

If our central-station power business is to increase in outlying districts and we are to take care of this business with the same advantages to the customer as in the districts where we furnish direct current, we must have a prime mover that will fit all cases.

In our efforts to obtain power business in the alternating-current districts, we find that it is essential that we be able to recommend to our customers elevators that will operate satisfactorily on the alternating-current system without undue disturbance to the pressure on these lines.

There has been a large amount of money and a great deal of thought put into the development of a direct-connected alternating-current electric elevator, but I believe it safe to say that the progress made in the last two years has been greater than in the previous 10, and that the next two years will see even greater advances along these lines.

We can now see alternating-current multiphase motors in connection with elevator service giving excellent results, as the manufacturers are ready to place on the market machines of this type that have been perfected to such a point that their operation is quite satisfactory, the manufacturers stating that the machine takes about double full-load current in starting.

While, as true of other alternating-current motors for regular duty, they are not as good as are direct-current motors, as yet, still these elevators are very excellent indeed, considering the many difficulties that were necessary to be overcome in connection with their design and manufacture.

We all know that when the direct-connected direct-current elevator was connected to our lines years ago, many of the companies had serious trouble with their pressure on these lines.

The demand for the alternating-current elevator is growing rapidly, and in direct proportion to this demand the design is becoming better.

It is possible today to obtain an alternating-current direct-connected multiphase elevator that is practically noiseless in its operation, so far as the motors, brakes and controller are concerned, and as these three sources of noise have been the objectionable features in alternating-current elevators in the past, we can safely say that an elevator of this type can be secured that is practically noiseless.

I had the pleasure of examining a machine of this type in operation, and it was as free of noise as is necessary, running practically the same as a direct-current drum-type machine. This machine is equipped with magnet control, the main magnets operating directly from the alternating-current circuits. Driven from the worm shaft by a Reynolds silent chain is a small direct-current dynamo, which is used to furnish current to the acceleration magnets on the controller.

Machines of the larger sizes are equipped with this direct-current dynamo, while machines of smaller sizes, for apartment-house work, can be operated with alternating-current magnet controller without the use of direct current, and the elevator companies are prepared to take orders for this class of machine at this writing.

The manufacturers have had in operation for nine months an alternating-current motor with alternating magnet control in their shops. They assert that the machine has not had any further adjustment than that which would be required by an ordinary direct-current controller. This machine was also automatically operated by push-buttons.

While I did not have the pleasure of seeing this controller in operation, I will say that the alternating-current magnets operated in conjunction with the elevator, which was equipped with a small dynamo operating the acceleration magnets, did not make a particle of noise. The elevator in question had a speed of 210 feet a minute. The elevator company promised speeds up to 300 feet a minute for 1,500-pound lifts.

These elevators are equipped with alternating-current magnet brakes in the same general way as the direct-current elevators. The brake on the worm shaft seemed to work perfectly.

In addition to the electric brake, this car was equipped with a device preventing accident to the elevator, should there be any phase changes on the line. This device would prevent the operation of the car until the trouble was rectified.

The push-button type of elevator has not, I believe, received the support from central-station companies that it should. This type of elevator is in an excellent state of development, and there is no doubt a wide field for its use in apartment buildings in outlying districts.

This push-button elevator has been perfected in connection with an alternating-current multiphase motor to such an extent that it can be operated very satisfactorily, at least good enough for all ordinary purposes.

The hoisting part of the apparatus runs very smoothly, and the controlling part of the mechanism is very fine indeed, it being practically impossible to have an accident on this type of machine through any thoughtlessness on the part of the person operating it.

Outside of New York, I am not aware that tnere are any automatic elevators to speak of, even in the largest cities in this country, while in Europe, I am told, they are quite common.

Taking it altogether, the situation as regards the electric elevator is very flattering indeed. The progress being made is very good and promises to continue.

The experiments being conducted in connection with all types of electric elevators cover a large field, and a great deal of money is being spent and many able men are constantly designing new devices for the perfection of this class of elevator.

The progress in the design of single-phase motors in connection with direct-connected elevators has not been as satisfactory as with the multiphase motor.

We have one single-phase direct-connected elevator on our lines in Chicago which was installed to replace an old 500-volt machine. The old apparatus was used, the motor and controller only being changed. The operation of this elevator, while giving fairly good results to the apartment building, is hardly satisfactory to us, as the starting current is about five times the full-load current. When the line is well loaded the effect is not appreciable, but during times when the line is lightly loaded the effect on the lighting system is very noticeable.

The motor in getting up to speed makes considerable noise, and even when running at normal speed is more noisy than desirable. The company making it declares that it will in a short time be able to place on the market a machine that will act more satisfactorily, but there is room for a considerable improvement before this outfit will approach the smoothness of operation of the multiphase machine above mentioned.

We hope to see many improvements in the design of alternating-current apparatus, and, as stated in the first part of this paper, we should co-operate in encouraging the manufacturers in making apparatus that will suit all conditions of service.

Unless we are prepared to make considerable reductions in the price of current, we must get this class of business by removing every possible waste, increasing the output of each machine and improving the operation of them by the application of devices that can be operated electrically and automatically.

While investigating the progress made in the manufacture of alternating-current elevators, the improvements in the electric traction elevator were brought to my notice, and I thought a word at this time, while somewhat outside of the scope of this paper, might not be amiss regarding high-speed electric elevators for office buildings.

Today in the larger cities the use of electric elevators has increased to a very large extent, so that owners and builders of high buildings seriously consider, and very often favorably, the installation of electric elevators instead of hydraulic. Not only the first cost is less, but the electric elevator has been perfected to such an extent that the smoothness of operation compares favorably with all types of hydraulic elevators, not only for local but for express service, either in dry-goods stores or office buildings.

The traction elevator has practically solved the high-speed, high-lift electric-elevator problem, and while there will no doubt be many improvements in electric elevators in the future, still this type of elevator is bound to have a great influence in favor of central-station service in office buildings and stores in our large cities, owing to smoothness of running and economy of operation.

The traction elevator can be placed either on the roof of a building or in the basement, whichever is the more desirable and economical, taking up little space in either location.

The main objection to the traction elevator today is that it is not quite as economical in the consumption of current as the drum type of elevator, owing to the very low motor speed and correspondingly large size of the motor.

The present motor for this type of elevator has a speed of from 60 to 100 revolutions per minute.

To make a commercial piece of apparatus of this speed, the efficiency of the motor is sacrificed to some extent. Necessarily the size of a motor of this speed is larger than that of the standard commercial motor, and the shop and material costs are greater.

Experiments are at present being made with high-speed motors for traction-elevator work, and the prospects of obtaining satisfactory results look very bright. If this feat is accomplished it will further reduce the initial and operating cost of the traction elevator.

The drum type of machine has been improved greatly in the last few years. The magnet control has had a wonderful influence on the smooth running of machines of this type.

The electric brake has also been improved, and this type of brake is not only now applied to the worm shaft, but is also applied internally to the drum itself in such a way that it greatly increases the smoothness of the operation of this type of elevator in stopping, thus permitting the operation of drum types of elevators at high speed, and, according to the manufacturers, up to 400 feet a minute.

More strenuous missionary work among architects and owners of buildings about to be erected, with information of the proper sort in regard to electric elevators, would go a long way toward increasing the popularity of this type of machine.

The elevator companies are in this position: They are able to build any type of machine, and it makes little difference to them whether or not the customer uses central-station service. It is up to the electric-light companies to take hold of the situation in a methodical manner, obtaining accurate information regarding the cost of operation of different types of elevators. There have been many figures submitted regarding these costs, but I believe the subject will stand closer investigation.

With the advance in the design and manufacture of electric elevators, placing this machine on a high plane, it seems to me that enough evidence could be secured so that we would not be afraid to present the true costs of operation to our customers, with great advantage to ourselves.

Proposed Telephone Competition in Chicago.

The Manufacturers' Telephone Company of Chicago, organized by the Illinois Manufacturers' Association, submitted a proposed ordinance to the City Council at its meeting on September 24th. It provides for a grant extending over a period of 30 years. The city, however, may take over the property at the expiration of 20 years upon the payment of the cost of duplicating the plant, plus a 5 per cent. addition as compensation for the compulsory sale.

On or before January 1, 1909, the company agrees to have telephone exchanges in operation and be ready to serve at least 25,000 subscribers. On or before January 1, 1910, it is to be able to serve twice this number. In case of failure to carry out these provisions, it shall forfeit to the city $50,000 within four months under penalty of having the ordinance repealed. The city is to have one-fourth the annual net profits if the company is given an exclusive franchise.

Business telephones on a direct line and for unlimited service are to be $90 a year. On a two-party line this service would be $60. Similar service for residences is proposed at $60 and 45, respectively. Direct business lines on a measured service (1,000 outgoing calls a year) will be $50 a year; and on a two-party line (700 calls) $35. This class of service for residences will be placed at $30 and $20, respectively, the limit to outgoing calls being 600 and 400. Four-party measured service will be offered business houses at $25 and residences at $15. Extension sets and private switchboards are proposed at prices considerably lower than those now prevailing.

The proposed ordinance provides that the company shall furnish free of charge telephone service in the various municipal offices in the City Hall and shall also, if required, rent to the city telephones for the exclusive use of the police and fire-alarm systems at the annual rental of $1.50 for each combined transmitter and receiver. Either the mayor or the commissioner of public works shall be a director of the company. The books of the company shall be open to examination by the city comptroller at all times during business hours.

The Council sent the ordinance to the gas, oil and electric-light committee.

Ohio Telephone Notes.

Up to this time the Ohio telephone syndicate has paid to the Federal Telephone Company over $1,000,000 on the securities purchased some time ago, the last payment being $225,000. As fast as the money is paid in securities are released for this syndicate or for disposal in other ways. The securities that were not taken by this syndicate have been underwritten by the Everett-Moore syndicate. It is thought that the remainder of the payments will be made within a short time, after which the Federal Telephone Company will be dissolved. The Cuyahoga and United States telephone companies will be left in the hands of a voting trust for five years. The latter has taken over the control of the smaller companies that came into the hands of the Ohio syndicate by purchase of securities, and their affairs are all in good shape.

The Black River Telephone Company of Lorain is spending quite an amount for improvements, providing for additional service.

A new lamp-line multiple switchboard has been received for installation by the Marietta Telephone Company at Marietta. Besides this, 100,000 feet of new cable will be hung, 18,000 feet of cable will be placed underground, new telephone instruments will replace the old ones and the houses will be rewired. The company will spend about $65,000 in improvements, and the plant will be in reality a new one.

Frank L. Beam, manager of the Ohio Telephone Association, is preparing a schedule for the nine district meetings to be held this fall. The first one will be held in Cleveland early next month.

The Geauga County Telephone Company has brought action in the Probate Court asking that the mode of use of the streets and highways in the village of Chardon be determined. The company has fought for a long time to secure a franchise in the village, but failed. C.

Indiana Telephone Items.

At a recent meeting of the directors of the Lafayette Independent Telephone system, Frank O. Cuppy was elected manager, succeeding O. T. Friberg, who was elected secretary of the company. The board practically decided upon the installation of an automatic telephone system in Lafayette.

A dispatch from Laporte announces that a combination of Independent telephone managers was formed at a meeting held in that city for the purpose of constructing a toll line from Indianapolis to Chicago. This announcement is regarded with some surprise by the officials of the Indianapolis Telephone Company, since it is alleged to be a party to the combination. According to the dispatch, the companies interested represent 20,000 subscribers, and the line is to be built to establish competition with the Bell company. The plan is said to have emanated with the automatic telephone interests. The New Long-distance Telephone Company, which is building a toll line from Indianapolis to South Bend, by way of Logansport and Wabash, disclaims any knowledge of the combination.

The City Council of Columbus has instructed the city attorney to make a close investigation of the franchise of the Citizens' Telephone Company with a view of requiring the company to make such improvements in its plant as will assure a better service. S.

Telephone News from the Northwest.

The Mazeppa (Minn.) Telephone Company has anounced a reduction of rates to $1 per month for either business or residence service.

The Dakota Central Telephone Company of Aberdeen, S. D., will make improvements to its local and toll systems to cost $250,000 or more.

George M. Miles of Winona, Minn., has been placed in charge of the local telephone exchange at Wadena, Minn., succeeding E. G. Heinrich, resigned.

The Seiple Sectional Pole Company of Minneapolis has been incorporated to engage in the manufacture of a jointed iron telephone pole. The company is capitalized at $140,000. Henry and Oliver M. Seiple are at the head of the company.

The Fergus Falls Telephone Company has sold its exchanges at Fergus Falls, Battle Lake and Henning, Minn., and 220 miles of toll lines, to the Northwestern Telephone Exchange Company.

Franchises looking toward the establishment of an Independent telephone system in Omaha, Neb., have been introduced by the Gate City Telephone Company and the Home Telephone Company and are being considered by the council of that city. R.

GENERAL TELEPHONE NEWS.

The Telegraphone Company of Little Rock, Ark., has been incorporated with a capital stock of $300,000.

The Roosevelt County Telephone Company of Portales, N. M., has been incorporated with a capital stock of $25,000.

The Mexican Telephone Company has a proposition to connect the City of Mexico with Monterey and intermediate points by telephone.

CORRESPONDENCE.

Continental Europe.

Paris, September 12.—A Paris scientist, Mr. Maiche, says that he has invented a system of space telephony which already works for a hundred feet or more, but as the present apparatus is a small and an experimental one, he expects to give it a much greater power so as to cover long distances. He is now able to operate between two telephone posts which are set up on his premises in the suburbs, and the articulation is said to be very clear. The apparatus consists of a wire-wound frame for each post. To the frame are connected a specially designed induction coil, battery and a telephone receiver.

Different questions relating to electric traction were well discussed at the international congress which was held at Milan during the month of September. The congress dealt with the subject of tramways and smaller railroad lines, the latter including especially the narrow-gauge roads, of which a great number are now operating on the Continent, using electric locomotives or motor cars. Among the subjects taken up were electric stations and construction of narrow-gauge or local railroad lines; also the speed of running the trains. City traction was also dealt with in a number of interesting papers, among which I may mention one on the use of meters on tramway cars.

The French army has gone very extensively into the use of the telephone for field work. This was seen during the recent army maneuvers, where the general's headquarters were connected with different field posts by lines which were laid in all directions. Special brigades are charged with running the lines along the ground, and the men have acquired great skill in doing this. Field telephone sets of an improved pattern are now used, and during the maneuvers a considerable proportion of the orders for the different movements were sent by telephone. The officers are greatly pleased with this year's performance, and it is the first time that the army has used the telephone on such a large scale.

A new process for preserving wood poles for electric lines has been brought out by a Swiss company. The poles can be treated while standing in the ground or before setting them up. In the former case the base is uncovered to a depth of two feet and a coat of tar is given the pole to 18 inches above the ground level. Over the tar is put a wrapping of fibrine fabric, which is nailed on and then given a tar coat. Lastly, a covering of galvanized iron is placed around the whole, and it is solidly nailed on so as to press the whole well together. A like process can be applied to new poles before putting them in the ground, and the cost is stated to be small, taking one hour's work for each pole and costing from 20 to 25 cents for material.

Among the most recent hydro-electric plants is the large station which has been erected at Wangen, on the Aare River. It supplies current throughout a considerable area for lighting and motors. From the dam on the Aare, a canal followed by a set of penstocks leads to the wheel-house. The water head is about 25 feet. When finished the plant is to have seven turbine-alternator sets of 1,500 horsepower each. At present three of the groups are set up. The alternators are of the Lahmeyer type and are rated at 1,000 kilowatts, giving 10,000 volts three-phase current. From the switchboard the feeders are connected direct to the overhead lines. At eight miles from the station is a transformer post which raises the Jura branch line to 25,000 volts, and this line will be extended as far as Basle. The second line runs to Gerlafingen and Kirschberg.

The railroad car shops of the Beaume & Marpent Company, in France, are using their waste wood to operate a gas producer. The resulting gas it employs in several gas engines of different sizes, each having a direct-current machine coupled to it. At scarcely any cost it has all the current it needs in the factory. A Riché gas producer is used, and it supplies motors of 160, 140 and 60 horsepower. Previous experiments made in France showed that straw, dried leaves and other farm waste could be used in the same way, so as to give current for running the motor-driven machines on the farm.

A new form of electric pyrometer is brought out at Paris by Chauvin & Arnoux, which is of a solid build, and furnace temperatures can be readily taken with it. They are successful in using an iron thermo-electric couple, the second metal being an alloy of copper, nickel and manganese. The pyrometer couple takes the form of a long iron pipe having a wooden handle. Inside the pipe and insulated by asbestos runs a wire of the alloy, which is carefully fused to the outer end of the pipe so as to form the thermo-electric joint. The current caused by the heat is sent by flexible cable to a sensitive galvanometer contained in a portable box. It is graduated in a Centigrade scale and reads either to 1,000 or to 1,600 degrees.

The annual congress of the French Association for the Advancement of Science was held at Lyons during the month of August. Mr. Lippman treated of "Industry and Universities" in his opening address. A paper on a new mercury break for rectifying alternating currents was read by Mr. Blondel. Mr. Stephane Leduc showed a photographic method of registering high-frequency currents. Papers were read on steam turbines, electric traction and other questions. A. DE C.

Great Britain.

London, September 12.—From the point of view of the future of electric power supply companies, it must be somewhat disconcerting to know that large private electrical installations continue to be erected, despite the anticipation expressed in the past that the advent of the Electric Power Company would, from the point of view of price, render it practically impossible, economically, for any further private plants to be built. It is a fact, of course, that the work of the power companies is progressing but slowly in proportion to their respective areas—exception always being made in the case of the Newcastle company—and that the high cost of transmission mains, even if they be overhead, leaves it open for a private plant, with its absence of distributing costs, to generate as cheaply, and even cheaper, than energy can be offered by the power company. This has been demonstrated already in the South Wales district, and further examples are to hand. Thus it is to be noted that the Great Western Colliery Company is putting up an electrical winding plant capable of dealing with 1,500 tons per day of 10 hours, the contract having been given to the Westinghouse company for the installation of its converter equalizer system. Similarly, the Cambrian Collieries Company is having a three-phase generating station put it. These smaller firms also are putting in their own plants, while the Duffryn Rhondda Company, in conjunction with a large electrical installation being put in by Siemens Bros., is having two large electrical winding engines erected, one to draw 1,500 tons per day of eight hours from 600 yards and the other 800 tons per day from 300 yards. Large extensions are also being made to the plant of the Powell Duffryn company, including what are believed to be the two largest electrically driven pumps erected at a colliery. These will have a capacity of 1,000 horsepower and will be capable of delivering 81,000 gallons of water per hour against a vertical head of 1,700 feet. The pumps are of the centrifugal type and will be driven by three-phase motors. This colliery company is proceeding with its electrical installation under the advice of Mr. C. P. Sparks of the County of London Electric Supply Company upon very scientific lines. It is intended to do the whole of the pumping at night, and the effect upon the load factor of the plant is apparent.

The agreements between the corporations of Glasgow and Brighton and the postmaster-general for the purchase of the respective municipal telephone undertakings in those towns have been completed. In the case of Glasgow, the service has already been taken over as from June 1, 1906, and the purchase price of $1,525,000 paid. At the last moment, however, the postmaster-general insisted upon having a free hand with respect to the taking over of the staff and the rates to be charged to subscribers. It may be remembered that the Glasgow Corporation wished to make it compulsory on the part of the postmaster-general to take over the whole of the staff and to maintain the very cheap rates in vogue for several years. At Glasgow it has already been decided to apply the purchase money to the reduction of the debt on the undertaking, but at Brighton they do not yet appear to have made up their minds.

The historical Hampton Court Palace, near London, has at last been wired for electric light.

The city electrical engineer at Sydney, New South Wales, has been making an extended tour of Europe and other continents in order to investigate the various types of steam turbine now on the market. After visiting a large number of works where these are made, he has decided to recommend the City Council to adopt the Williams-Parsons type.

For many years past the railway companies of the United Kingdom have complained bitterly of the competition of municipal electric tramways. A network of tramways partly owned by the South Lancashire Tramways Company and a number of municipal authorities, however, is calculated to extend this class of competition considerably, for by an extension just opened it is now possible to run between Liverpool and Manchester by tramway, via 15 other towns. There is also in contemplation a system of carrying goods between these places, and a clearing-house system is being evolved for through bookings all round. G.

New England.

Boston, Mass., September 22.—The Hoosac Valley Street Railway Company will install a telephone system over its road with a central office at Pittsfield, Mass. A telephone will be located at every switch on the road.

An interesting controversy regarding the carrying of school pupils for half fare is developing in Massachusetts. Last spring the law was amended to include pupils in private schools, and a question

as to the latitude of this law is being raised by state normal schools. The amendment was made in favor of parochial schools, primarily. If the law is liberally interpreted, the students of the Massachusetts Institute of Technology will benefit by it.

The Boston and Northern Street Railway Company will absorb the Lowell & Woburn and the Georgetown, Rowley and Ipswich street railway companies, provided the Massachusetts railroad commissioners approve. The latter are considering the matter.

To meet electric railway competition, the fares on the Boston & Albany Railroad are to be reduced to two cents per mile on November 1st.

The Boston Elevated Railway Company has bought 4½ acres of land adjoining its property on Salem Street in Medford, Mass. The tax valuatin is $20,000.

The Boston City Council's committee on municipal lighting met again last Tuesday and examined the attorney for the Edison Electric Illuminating Company without obtaining any new information.

The holders of the Southbridge (Mass.) Gas and Electric Company's stock have agreed to sell their stock to a Worcester firm which is acting for Lee, Higginson & Co., Boston brokers. The stockholders will receive $62.50 per share, the par value being $50, and the transfer will be made October 15th.

The Maine Railroad Commission has approved the Rumford Falls and Bethel Street Railway Company's articles of association. The company proposes to build a railway 30 miles long, to be operated by electricity or compressed air. The capital is $120,000 and the incorporators are headed by Elliott W. Howe of Rumford.

The Maine Railroad Commission has approved the Augusta, Oakland and Waterville Street Railway Company's articles of association which are signed by Amos F. Gerald and Edwin J. Lawrence of Fairfield, Me., and others. The company proposes to build an electric railway between Oakland and Augusta, Me., a distance of 18 miles.

The Old Colony Street Railway Company has installed a freight and express route between Taunton and Middleboro, Mass., via Bridgewater, a distance of 19 miles. B.

New York.

New York, September 22.—The annual reports of the local transit system show a marked reduction of earnings on the part of the elevated roads, going hand in hand with an increase of earnings on the part of the Subway. The expenses of the Subway show a corresponding increase, while there has been a steady reduction of the expenses on the elevated. The incomes of these roads seem to rise and fall with their expenditures, which would argue for increasing facilities in order to secure more business. The state railway commissioner reported that the cash fares of the Manhattan division had increased seven per cent., though the car mileage had decreased by three per cent. On the surface cars an increase of three per cent. in the fares was secured, despite a mileage decrease of five per cent., while the Subway, with its 38 per cent. increase of receipts, has increased the car mileage by only 12 per cent.

At the urging of Controller Metz the Rapid Transit Commission has decided to rush through the plans for both elevated and subway loops between the Williamsburg Bridge and the Brooklyn Bridge and then to build that route which the board finds it can first complete.

Commissioners appointed by the Appellate Division of the Supreme Court are hearing objections to the proposed subway routes in Brooklyn.

Partly owing to the persistent agitation of the public concerned, and mainly, perhaps, in obedience to the orders of the State Railroad Commission, the Brooklyn Rapid Transit Company resumed service by all trains at the Avenue C station. The company claims that it discontinued the use of the station because it could use only one track at that point while the work of depressing the road was going on. The temporary discontinuance caused much inconvenience to that densely populated neighborhood.

Malefactors and others seeking to avoid pursuit are in growing dread of wireless telegraphy. A stowaway was discovered on board the steamship Advance on her way from New York to Panama. At the time the Advance and Finance were holding a wireless conversation, the upshot being that the skipper of the Advance told the skipper of the Finance about Allen and asked him to stop long enough to take the stowaway on board. Both vessels were in the Caribbean Sea and about 100 miles apart. Four hours later they sighted each other, and the Finance stopped to await the arrival of a boat from the Advance, in which was Manning. Manning was as angry as he could be, but it was no use, and he was hauled on board the New York-bound vessel.

On September 27th the Fifth National Business Show will be opened at Madison Square Garden under the management of Messrs. Cochrane and Payne. Office devices and appliances of all kinds to assist in the transaction of business and keeping of accounts will be exhibited. A number of important conventions will be held at the Garden during the show week, among others those of the National Association of Manufacturers, the New York Boost Club of Stationers, the meeting of typewriter salesmen and that of the adding-machine salesmen. Special nights will be set aside for different interests, such as the Chamber of Commerce Night, Railroad and Express Company Night, Stationers' Night, Stock Exchange Night, City Department Night, Government Night, Salesmen's Night, and several others. C. I. C.

Southeastern States.

Charlotte, N. C., September 22.—The North Georgia Electric Company has filed application to increase its capital from $5,000,000 to $7,500,000. The company has a franchise to build a railway from Atlanta to its power plant near Gainesville.

The City Council of Waycross, Ga., has taken unfavorable action on a petition from persons desiring to inaugurate a local electric street-railway system.

A permit has been granted the Birmingham Railway, Light and Power Company to erect a handsomely designed building in Ensley, Ala.

The Evansville and Cannelton Traction Company has applied for a charter, and if granted, this will make the fourth electric railway projected into New Albany, Ky. C. C. Tennis, C. H. Battin and others are promoters of the new road.

The Spartanburg (S. C.) Electric Power and Manufacturing Company has asked for a lighting franchise in that city, and the matter is being investigated. The company is making large power developments on neighboring rivers for electric purposes.

Burton Vance of Louisville has asked for a franchise for an electric railway through the town of Lancaster, Ky., on the route of a line between Hubble and Hickman, the company being interested in mineral developments.

On October 15 a special meeting will be held at Gadsden, Ala., of the Alabama City, Gadsden and Attalla Street Railway at which the directors will ask for the consent of a majority of stockholders to a $300,000 face value issue and sale of bonds. It is understood that the proceeds will be used for extensions, etc., to that line. L.

Ohio.

Cleveland, September 22.—S. S. Burtsfield, president of the Sandusky, Mansfield and Norwalk electric road, states that cars will be in operation between Norwalk and Mansfield by November 1st.

Traction companies of the state are getting matters in shape to pass under the supervision of the State Railroad Commission. It is said that a few of them fear that considerable money will have to be expended to enable them to comply with the rules, but others are now operating under rules that are even more strict than will be required by the commission.

Architects are preparing plans for a new pumping station in Cleveland which will be largely operated by electrical machinery. In addition it will contain a lighting plant to furnish light for the public buildings and possibly for the downtown streets. The plant will probably be located at the foot of East Ninth Street and will form a part of the group plan, of which much has been said and written during the last two or three years.

Securities of the reorganized Springfield and Xenia Railway Company will be placed upon the market at an early date. The details of the reorganization are well under way.

It is said that the Cleveland Electric Railway Company will oppose the introduction of postal cars in the city. After going over the matter the officers feel that they would not be practical and would not be able to perform the service expected of them.

Councilman Edmund Hitchens, it is said, will endeavor to force the referendum vote on the proposition of the Cleveland Electric Railway Company. The vote in his ward showed that people were in favor of the offer made by the company, and he believes that the same thing is true all over the city. He has announced that he will introduce a resolution in council at once providing for such a vote.

Plans for a new repair shop to be located at Elyria are being made by the Cleveland and Southwestern electric road. The cost will be between $50,000 and $75,000.

Plans are being made for a traction line from Columbus to the large stock farm of Dr. S. B. Hartman of Peruna fame.

Business men of Richmond are endeavoring to secure a line from that place to Columbus. Business men of the latter city are taking an interest in the plan because of the trade relations that would be established with Richwood and other towns along the line.

M. K. Duty of Pennsboro, W. Va., has been granted a 25-year franchise for an electric road in Gallipolis. It is the intention to extend the road to the Point Pleasant bridge, above the city.

It is probable that the work of connecting up the Schoepf lines between Columbus and Toledo will be taken up at no distant date. That, of course, would mean connection with Cincinnati also. That plans have been made for a complete system across the state is certain. Engineers are now at work determining the best routes. It is said that the line may be extended to Battle Creek, Mich.

The organization of the Lima and Eastern Railway Company has been completed, with Joseph A. Vandergrif of New York as president. The line will extend from Lima to Marion, by way of Kenton, and will be operated with Strang gasoline cars.

The Merchants' Lighting Company of Ashtabula has been incorporated with a capital stock of $10,000 by H. Milton Brown and others.

The Mansfield and Southern Traction Company of Mansfield has increased its capital stock from $1,000 to $250,000.

Theodore Clauss, secretary of the Union Gas and Electric Company of Cincinnati, has been elected to a like position with the Cincinnati Gas and Electric Company.

The Columbus Railway and Light Company is equipping some of its cars with automatic street annunciators, which will be exhibited at the forthcoming convention in that city. If satisfactory, they will be adopted by the company.

The Cleveland Electric Railway Company has agreed to recognize the union recently formed there on condition that everything be submitted to arbitration that cannot be agreed upon in any other way, and the decision of the arbitrators is to be final. O. M. C.

Northwestern States.

Minneapolis, September 22.—The Wausau Electric Company of Wausau, Wis., has increased its capital stock from $75,000 to $150,000.

The new power house of the Grand Forks (N. D.) Gas and Electric Company is nearing completion. It will have cost about $30,000 when completed.

The Polk interests of Des Moines are planning a number of new electric railways and extensions of old ones, which will make Des Moines very important as an interurban railway center.

The Minneapolis General Electric Company has about completed its work at Taylors Falls, Minn., sufficiently to make it possible to deliver electrical power to the Twin Cities. The current of 50,000 volts will be transmitted to a station in northeast Minneapolis and there distributed to various localities.

The Spearfish (S. D.) Traction Company will have its large power plant completed about December 1st. About 1,500 horsepower will be developed.

The new plant of the Menominee (Mich.) Electrical Company has been completed.

The Asmus Boysen Mining Company has decided to build a large power plant on the Big Horn River 12 miles east of Thermopolis, Wyo. About 4,000 horsepower is to be developed.

The Fort Dodge, Des Moines and Southern Railway Company has let the contract to W. J. Zitterell of Webster City, Iowa, for the construction of four sub-stations and of a main power plant, the latter to cost $150,000 and to be located at Fraser, Iowa. The total cost of the sub-stations will be $20,000.

Permission has been voted to the Boone, Webster City and Interurban Railroad Company to build its line into Webster City, Iowa.

The Belgrade (Neb.) Improvement Company is installing an electric-light plant.

The Plymouth Gypsum Company of Fort Dodge, Iowa, has let the contract to the Downing Electrical Company for a 250-light electric plant for its mill.

The Lehigh (Iowa) Clay Products Company will put in an electric-light plant at its factory and it may decide to make a plant large enough to furnish the village with lights. R.

Pacific Slope.

San Francisco, September 20.—The Northern California Power Company, which is in the market for additional water for its power plants, has purchased the Gould ranch of 160 acres above Plateau, Cal., in order to secure the right to 1,400 miners inches of water. The water diverted on this property will be utilized at Volta, where an additional power plant will be installed.

W. T. Forsman, owner of several electric franchises in Woodland and Yolo County, says that the delay in construction is due to the San Francisco disaster. He says everything had been arranged looking to the disposal of the bonds of the new road to run from Sacramento to Woodland, Cal., but the catastrophe ruined his calculations, and since then he has been engaged in trying to raise more capital.

The City Council of Oakland, Cal., at the request of the Electrical Workers' Union has passed to print an ordinance regulating the use and erection of poles and wires. The bill is designed to protect linemen and the public generally from the dangers of the several overhead power transmission systems operating at 60,000 volts which pass through the city.

Without waiting for the outcome of the pending arbitration proceedings in San Francisco concerning the strike of conductors and motormen employed by the United Railroads for $3 a day of eight hours, the management of Oakland Traction Consolidated and the Key Route has voluntarily advanced wages, increasing the amount of the pay roll about $8,500 a month. The Oakland motormen and conductors have had their pay increased to 35 cents an hour.

Gatemen are paid 28 cents an hour for the first year, 29 cents for the second and 30 cents for the third.

Maurice Shibler, civil engineer of New York, recently arrived in San Francisco in the interest of the Consolidated Gas Companies, which is a stockholder in the San Francisco Coke and Gas Company, of which Leopold Michaels is the president. He has, with President Michaels, been looking over the Mission District of the city with a view of determining upon a site for a gas and electric power plant soon to be built. It was stated that the San Francisco Coke and Gas Company has been planning a new plant, which will be the medium through which the company will receive and distribute the electric power of the Stanislaus Electric Power Company, with which the local company has entered into contract.

Plans for the permanent power house for the Pacific Electric Railroad Company at Santa Ana, Cal., are out, but it will be some time before the building is commenced. Part of the machinery has arrived from the General Electric Company's works at Schenectady, N. Y.

The Dawson Electric Light and Power Company of Dawson, Alaska, recently sold under foreclosure of mortgage, has been taken over by N. A. Fuher of Tanana and Dawson and Dr. A. S. Grant, who are preparing to furnish all the power needed in the future over a 50-mile transmission line from Coal Creek coal mines. Coal will be used to generate electricity in a steam plant without having to be hauled to the city. A.

Spokane, Wash., September 19.—Nine hundred miles of electric railway lines are said to be under construction or projected in the Pacific Northwest.

The Lewiston and Southeastern has under construction 115 miles of electric railway to connect Lewiston, Grangeville, Nez Perce and smaller towns in Central Idaho and Eastern Washington. The Spokane and Inland will connect Spokane, Waverly, Rosalia, Thornton, Colfax and Palouse early in October. This system covers 106 miles. A branch line from Spokane to Lake Pend d'Oreille, 56 miles, is expected to be in operation within a year.

The Northern Pacific Railway Company announces that it will operate an electric railway over the old Union Pacific grade, between Portland and Tacoma, 145 miles, and the Willamette Valley Company has begun construction of a line between Salem and Mehama, Ore., 25 miles, while the United Railway Company will build 100 miles of line in and outside the city of Portland, Ore. The Oregon Water Power Company will extend its line from Lents to Trentsdale and establish a ferry over the Columbia River.

Frank MacKean of Chicago announced in Spokane this week that he has secured a contract to install a $2,000,000 power plant for the Spokane Western Power and Traction Company. It is expected to develop 2,000 horsepower, which can be expanded to 40,000 horsepower. The company was incorporated in Washington for $3,000,000. B.

PERSONAL.

The death is reported of Charles Evans of Higbee, Mo., president of the Higbee Electric Light, Heat and Power Company.

L. B. Van Nuys, who has long been identified with the electric trade in Peoria, Ill., has accepted a position with the Central Electric Company of Peoria.

A. M. Barron, after acting as general manager an treasurer of the Consolidated Light, Power and Ice Company of Joplin, Mo., for four years, has decided to resign October 15th. C. W. Hough of Kansas City will succeed Mr. Barron, it is said.

On the sub-committees of the local committee of arrangements for the convention of the League of American Municipalities held this week in Chicago were B. E. Sunny of the General Electric Company, Samuel Insull, L. A. Ferguson and William A. Fox of the Chicago Edison Company, Charles E. Brown of the Central Electric Company and Frank J. Baker of the North Shore Electric Company.

The special committee to select a successor to Dr. Pritchett as president of the Massachusetts Institute of Technology, is composed of Col. Thomas L. Livermore, Dr. F. H. Williams and Mr. C. A. Stone. It is said that there are three men under consideration for the office and that the committee is finding it difficult to decide upon one. The matter may be referred to the executive committee of the corporation. Dr. Pritchett will act as president until his successor is appointed.

Francis E. Drake has just been appointed general manager of the Société Anonyme Westinghouse of Paris and Le Havre. Several years ago he was sales manager of the Standard Electric Company of Chicago, and later manager of the Walker Electric Company, Cleveland. In 1900 he was director of machinery and electricity at the Paris Exposition for the United States government. After the exposition Mr. Drake reorganized the works of the Union Electricitäts Gesellschaft of Berlin. He returned to the United States and became president of the Lanyon Zinc Company. In April, 1905, Mr. Drake returned to Europe to organize the continental business of the Chicago Pneumatic Tool Company.

C. W. Phipps, manager of the British Thomson-Houston Company at Rugby, England, died on August 30th at the age of 47. Born in England, Mr. Phipps came to America in his youth, and carried on much pioneer work in connection with the electrical industry here. He was successively with the Brush company at Cleveland, the Adams-Bagnall Company and the General Electric Company in New York. He was a member of the American Institute of Mining Engineers.

Richard S. Buck, American Society of Civil Engineers, has been admitted as a member of the firm of Sanderson & Porter of New York. Mr. Buck is now consulting engineer of the department of bridges, New York city, engaged on the Manhattan and Blackwell's Island bridges, and will retain this connection for a time at least. The firm of Sanderson & Porter executes work in various branches of civil, mechanical and electrical engineering and construction. It now consists of Edwin N. Sanderson, H. Hobart Porter, Francis Blossom, Richmond Talbot and Richard S. Buck.

Paul Lüpke of Philadelphia has accepted President Arthur Williams' invitation to serve again as editor of the Question Box of the National Electric Light Association and has already begun the preliminary work. Mr. Lüpke's work in this department of the Atlantic City programme was most excellent, especially when it is considered that he was asked to undertake the work but a short time before the convention. With the experience gained, and opportunity now given for more leisurely and careful editing, there is every reason to believe that the 1907 Question Box will be far in advance of its predecessors.

Edward J. Nally of Chicago, whose promotion to the position of vice-president and director of the Postal Telegraph-cable Company was mentioned in the Western Electrician last week, has been general superintendent of the Postal company since December, 1900. In 1890 he accepted a position with the company as assistant to General Superintendent L. D. Parker in Chicago, and soon after was made assistant general superintendent for the western division. Mr. Nally is 46 years old. He was born in Philadelphia, and moved to St. Louis in 1868, where, at the age of 15, he took employment with the Western Union Telegraph Company under Col. R. C. Clowry, and he has been in the business ever since. He is one of the most popular and most capable men in the telegraph business. His rise has been by hard and conscientious work which has won for him the confidence of the men in the big company, who also recognize his ability. Mr. Nally will leave his beautiful home in Highland Park and move his family to New York. In Chicago he is a member of the Union League, Highland Park and Chicago Commercial clubs, and is one of the executive committee of the United States Business League. He is married and has two children—a boy and a girl. Since his promotion he has been receiving numerous congratulations from a large circle of friends.

EDWARD J. NALLY.

ELECTRIC LIGHTING.

W. A. Curtis has been granted a franchise for an electric-light plant in Cambridge, Iowa.

J. D. Smith has completed estimates for a lighting plant in Terrell, Texas, to cost $15,000.

Elm Creek, Neb., has voted $10,000 for the purpose of putting in waterworks and an electric-light plant.

At the November election the proposition will be submitted to the voters of Camden, N. J., to issue bonds for municipal lighting.

The Odd Fellows of Kansas will erect an electric-light and heating plant at their state home for orphans and aged in Manhattan, Kan.

Plans have been prepared by John W. Hill & Son of Cincinnati for a power plant for the Little Miami Lighting and Power Company at Milford, Ohio. The estimated cost is $20,000.

The city of Ashland, Wis., will establish a municipal lighting plant. The Rhinelander Power Company, which is developing waterpower on White River, has asked the city for a franchise to transmit current into the city for power and lighting purposes, and agrees to supply the city with current to operate the municipal plant.

Articles of incorporation have been filed by the Manhattan Pure Water Company, with Reno, Nev., as the principal place of business. It is the purpose of the company to furnish water, light and power for municipalities or corporations. The company has a capital stock of $175,000. The stockholders are M. Scheeline, S. H. Wheeler, Henry Anderson, W. H. Patterson, P. S. Jensen and James T. Boyd.

Mayor Dunne, in a brief communication to the Chicago City Council at this week's meeting, urged that the gas, oil and electric-light committee draft an ordinance in pursuance of the terms of the act empowering the city to regulate the price of electric light and power, after full investigation has been made as to what are reasonable rates. The communication was referred to the committee named.

ELECTRIC RAILWAYS

J. H. Godden of Spirit Lake, Iowa, is interested in a proposed trolley road to encircle Spirit Lake.

The Southern Traction Company has purchased a site south of Manteno, Ill., where it will erect a large sub-station for the operation of its railway.

The Knoxville (Tenn.) Railway and Light Company proposes to build lines to Vestal and Lion View. Other improvements are also to be made.

The controlling interest in the Tulsa (I. T.) Street Railway Company has been acquired by T. A. Bosler, president of the Dayton (Ohio) street-railway system. Mr. Bosler predicts cars will be running by May 1, 1907. Six miles of track will be laid and a city park to cost $75,000 is included in the project.

Alderman Cullerton of Chicago presented an ordinance to the City Council this week reducing street-car fares to four cents and compelling the street-car companies to sell seven rides for 25 cents by the issuance of tickets paid for in advance. The proposed ordinance was sent to the local transportation committee.

The electric railway built by the Pennsylvania Railroad from Camden, N. J., and Atlantic City has been opened to the general public. The trains, consisting of three cars each, are scheduled to make the run of nearly 60 miles in 90 minutes. Trains leave the terminals in Camden and Atlantic City on the hour from 7 a. m. to 11 p. m.

Damascus, said to be the oldest of living cities, is losing its character. A Belgian company is cutting through it with an electric street railway and is sprinkling electric lights in its ancient streets. The motive power for these installations is derived from the "harnessing" of the river falls 22 miles off. Three and a half miles of the street railway are already being laid.

It is said that plans are being matured by officials of the Portland (Ore.) Railway, Light and Power Company for the establishment of a central passenger station at the corner of Second and Alder streets, where all trolley cars in the city will stop to discharge and receive passengers. The old Chinese Theater Building may be used. Now that all the electric roads in Portland are directed by the same holding company, an arrangement whereby all the cars will converge at a common point is possible.

Residents of Rockford, Ill., are looking for lower fares to and from Chicago as soon as direct electric-railway service is opened up between the two cities, probably this month. The new line from Rockford connects with the Aurora, Elgin and Chicago third-rail line and parallels the Northwestern steam road all the way. Electric officials promise lower rates, which may be met by the steam roads. Express trains are contemplated by the electric road to make the run of about 90 miles in little over three hours.

Application for a franchise has been made to the city of St. Louis to build and operate an extensive system of elevated railways in St. Louis. The promoters ask for a 50-year franchise, guaranteeing the city $30,000 a year and the privilege to buy the property at stated periods. The company asking for the franchise is the People's Elevated and Open-subway Railroad Company and the names of the men interested are Thomas A. Bell, Edward A. Garvey, John J. Raleigh, Frank S. Rosebrough, Thomas M. Jenkins and associates. Mr. Jenkins was formerly general manager of the St. Louis and Suburban Railroad Company.

PUBLICATIONS.

One of the latest publications of the Allis-Chalmers Company is Bulletin No. 1507, descriptive of air compressors. It contains some excellent illustrations of complete units and of parts of the compressors, also several installations. Detailed information is given on the subject of air compressors.

The Lamp-oon is "a magazine devoted to better illumination, issued by the Sterling Electrical Manufacturing Company of Warren, Ohio." It announces itself as the "official megaphone of the Society for the Prevention of Lost Candlepower and the Promotion of Real, Live, Honest, Sterling Light." The issue for September contains arti-

cles about the Sterling tantalum lamp, Sterling Gem lamp, Sterling Special lamp, "Advertising Value of Electric Light," and other subjects. The little paper is one of the most attractive of the numerous house-organ family.

A convenient catalogue of G. E. specialties, just issued by the General Electric Company, is for the purpose of assisting its customers in the placing of orders for incandescent lamp sockets and receptacles, attachment plugs, switches, contents of various types, fuses and general wiring appliances. Only catalogue numbers and brief descriptions necessary for identification are given in most cases. A loose-leaf price list is removably attached.

SOCIETIES AND SCHOOLS.

The annual meeting of the Western Association of Electrical Inspectors will be held in the assembly room of the Denison Hotel, Indianapolis, on October 17th, 18th and 19th. As matters of importance come before the meeting, it is desirable that every member shall be present. William S. Boyd, 382 Ohio Street, Chicago, is secretary of the association.

C. J. Davidson was elected president of the Engineers' Society of Milwaukee at the annual meeting held on September 19th. Other officers elected were S. L. G. Knox, vice-president; W. G. Starkweather, secretary; E. P. Worden, treasurer, and Thomas Capen, R. W. Grace and R. E. Newton, directors. All of the elections were unanimous. Meetings will be held throughout the fall and winter on the second Wednesday of each month at the Plankinton House.

At the second annual meeting of the American Public Works Association, held in Atlanta, Ga., recently, these officers were elected: President, R. C. Huston, Hattiesburg, Miss.; vice-presidents, M. F. Cole of Newman, Ga.; Charles C. Wilson of Columbia, S. C., and George O. Tenny of Spartanburg, N. C.; secretary, W. H. Flint, Chattanooga, Tenn.; treasurer, Morgan Llewellyn, Chattanooga, Tenn.; executive committee: Edward J. O'Beirne, Atlanta, Ga.; A. J. Bowron, Birmingham, Ala.; C. M. Ladd, Chicago, Ill.; A. M. Lockett New Orleans, La.; Charles F. MacKenzie, Augusta, Ga.; Maurice W. Tnomas, Atlanta, Ga.; John Neal, Cincinnati, Ohio; William B. King, Washington, D. C.; J. S. Slicer, Atlanta, Ga.

SPACE TELEGRAPHY.

Space-telegraph experiments have been conducted by army engineer officers for two years past from the Eiffel Tower. The minister of war is now applying to the city of Paris for the lease of a plot of ground on the Champs de Mars, near the tower, whereon to build a special permanent post. The Eiffel Tower experiments have succeeded so well that the Paris headquarters are now in regular wireless communication with all the frontier forts and principal naval ports. The "palace of wireless telegraphy" is to be the permanent post for these communications.

MISCELLANEOUS.

W. R. McKeen, superintendent of motive power of the Union Pacific Railroad, announces that the experiments of his company in the use of gasoline for propelling passenger cars have at last proved successful. Mr. McKeen recently took a party of railroad men over the line from Columbus, Neb., to Omaha in a motor car, an average speed of 45 miles being maintained for the 91 miles. Some of the branch lines of the system will be equipped with these cars.

The Pacific Commercial Cable Company's steamer Restorer salved the steamship Manchuria, recently stranded on an island in the Pacific Ocean, and its owner has libeled the Manchuria at Honolulu for a bill of $300,000. It is alleged that the Restorer constantly towed the Manchuria at great risk from August 20th, the day the Manchuria went aground, until September 16th, the day she was floated. Pay also is demanded for the service of the Restorer's towing the Manchuria to Honolulu after she was floated. The libel alleges that the Manchuria is worth $2,000,000 and that she had a cargo valued at $500,000.

TRADE NEWS.

D. J. Drake is engaging in the electrical supply business in Crete, Neb.

The Scott-Rankin Company will, it is said, discontinue its electrical supply business in El Paso, Tex.

The C. J. Toerring Company, manufacturer of arc lamps, announces the removal of its offices and factory to its new building located at Twenty-first and Toronto streets (south of Allegheny Avenue), Philadelphia. Here the company has increased facilities, and its earnest desire to please will continue undiminished in the new location.

The office of the Novelty Incandescent Lamp Company, formerly at St. Marys, Pa., is now at the new lamp factory of the company in Emporium, Pa.

The Buckeye Electric Company, manufacturer of incandescent lamps, has now an office in Dallas, Texas, located at 216 Commerce Street, in charge of Mr. H. E. Wells, who will look after the business in that territory.

Under date of September 12th the London correspondent of the Western Electrician writes: "Two new companies have been registered in London, one being the Westinghouse Metal Filament Lamp Company and the other the Westinghouse-Cooper Hewitt Company. The former company adopts an agreement between Felix Kuschenitz and G. Westinghouse and the latter is formed to enter into any arrangements or contracts or take any licenses from the Cooper Hewitt Electric Company of New York in relation to the Cooper Hewitt mercury-vapor lamp."

BUSINESS.

A. Grothwell of 2517 Castro Street, San Francisco, calls attention to his Mogul electrical compound, Mogul armature varnish, Mogul slow dryer for poles (wood or iron), cross-arms and other line construction, and Mogul acid and alkali-proof compound for storage-battery and other electrochemical work. In addition, he supplies other compounds and paints. "The Portland Exposition was insulated throughout with Mogul," says Mr. Grothwell, who lays particular stress on the fact that these products emit no dangerous, disagreeable or poisonous fumes.

Work at the foundries and machine shops of the Allis-Chalmers Company of Milwaukee has been prosecuted with uncommon vigor throughout the hot weather of the last three months, with a view of making prompt deliveries on large sales of heavy machinery; and shipments from both the Reliance and West Allis works were never greater in volume than at the present time. In fact, the tonnage exceeds all previous records. A trainload of finished work from the Reliance foundry on Clinton Street is shown in a photograph recently sent to the Western Electrician.

ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued (United States Patent Office) September 18, 1906.

831,030. Automatic Work-recording Appliance. Samuel S. Berry, Manchester, England. Application filed May 22, 1905.

A device by which work done is automatically recorded on a time sheet, is operated by electrical means.

831,071. Safety Device. George H. Hill, Montreal, Quebec, Canada, assignor of one-half to Michael Joseph Doherty, Montreal, Canada. Application filed July 7, 1902.

Combined with a circuit to be protected, an additional circuit permanently in shunt with and protecting the circuit and electrical means for opening the circuit to be protected are means whereby the circuit will be opened upon an abnormal condition obtaining therein.

831,101. Device for Single-phase Collector Motors with Compensation Wiring. Rudolf Richter, Wilmersdorf, near Berlin, Germany, assignor to the Siemens-Schuckert Werke, G. M. B. H., Berlin, Germany. Application filed November 21, 1905.

In a single-phase commutator-motor the combination, with field and armature coils and compensation winding in series with the armature-coils, consists of a circuit in parallel with the armature and adapted to cooperate with the compensation winding in neutralizing the cross field of the armature.

831,131. Multiconductor Cable. Walter C. Yeatman, Chicago, Ill., assignor to the American Telephone and Telegraph Company. Application filed June 13, 1903.

In a cable is a group of four insulated conductors comprising two pairs of helically twisted conductors, the conductors of one of the pairs being twisted in a right-handed helix, those of the other pair in a left-handed helix, and the two pairs twisted together and held together by a wrapping of flexible material.

831,168. Insulator. Arthur J. L. Lembeck, Sioux City, Iowa, assignor of one-half to John P. Wall, Sioux City, Iowa. Application filed November 26, 1904.

The patent covers an insulator having two integrally connected members of different dimensions arranged in planes at right angles to each other to receive wire terminals also having an angular relation to each other, the insulator as an entirety being composed of non-conducting material.

831,180. Frequency Meter. Edward McGarvey, Bellefonte, Pa. Application filed December 7, 1904.

With an armature-bar provided with a series of indicating-reeds and supplemental cushioning mechanism for the bar are combined a magnetic coil in operative relation to the bar and means for establishing a circuit through the coil.

831,186. Electric Heating Unit. Earl H. Richardson, Ontario, Cal., assignor to the Pacific Electric Heating Company, Los Angeles, Cal. Application filed December 19, 1905.

An electric heating unit comprises a body with a channel having a substantially uniform width, a core in the channel with a contracted intermediate portion, wire wound on the intermediate portion and means for preventing short-circuiting of the wire, the wire-wound core thus formed having a substantially uniform width and filling the channel laterally.

831,226. Electric Cut-out. Frank B. Hinkson, Newcastle, Pa. Application filed March 25, 1905.

The patent covers a water-service pipe having a valve mounted therein which is closed when the pressure in the pipe is static and opened when the pressure becomes dynamic. An insulated base is carried by the pipe and there is a pair of binding-posts secured to the base, and normally separated contacts mounted upon the binding-posts for movement in the same direction.

831,244. Combined Mechanical and Electric Motive Power for Trains. George G. Schroeder, Washington, D. C. Application filed April 17, 1905.

A combined mechanical and electrical motive power for cars consists of an engine mounted upon the car and having its shaft geared to the axles of one truck, a generator located upon the car and adapted to be operated by the engine, storage-cells carried by the car and electrically connected with the generator and a motor located upon one of the trucks being operatively connected with the axles thereof and electrically connected with the battery.

831,263. Automatic Transporting Device. William C. Carr, Buffalo, N. Y. Application filed June 5, 1906.

One claim combines electrically charged elevated rails, one at least of which is grooved on its under surface, a station, slow-speed flanges on those portions of the rails in proximity to the station, and an automatic collecting and delivering car suspended from the rails and having wheels engaging the rails, reduced rollers engaging the slow-speed flanges, an electric driving-motor and a trolley-wheel engaging in the groove.

831,269. Storage-battery Electrode Plate. Thomas A. Edison, Llewellyn Park, N. J., assignor to the Edison Storage Battery Company, West Orange, N. J. Application filed March 5, 1903.

In a storage battery, in combination with an alkaline electrolyte, is an inactive and insoluble electrode-plate having pockets containing active material, one portion of the pocket being of comparatively thick metal and another portion of thin elastic metal supported by the thicker metal. (See cut on next page.)

831,274. Electric Sparking Mechanism for Explosive Engines. Hiram A. Frantz, Cherryville, Pa. Application filed January 9, 1905.

The sparking mechanism includes a cooling jacket adjacent the cylinder head.

831,282. Arc Lamp. Alvin Hausold, Allegheny, Pa., assignor to the Keystone Electric and Manufacturing Company, Pittsburg, Pa. Application filed January 12, 1906.

The combination consists of a central frame-tube forming a portion of the lamp-circuit, an armature working in the tube, a carbon-clutch carried by the armature, a spiral conductor connecting the lower end of the frame-tube and the carbon-clutch, and a connecting member secured to one or both ends of the conductor and arranged to frictionally engage the exterior of the frame-tube or clutch-carrier.

831,284. Protective Device for Ventilating Fans. Robert A. Ilg, Chicago, Ill., assignor of one-half to Theresa Ilg, Chicago, Ill. Application filed February 3, 1905.

The combination with a ventilating-fan and a motor mounted on the shaft thereof consists of a protective device for the motor comprising a cylindrical member surrounding the same, a removable cap or cover closing that end of the cylindrical member which is remote from the fan, an annular member secured to the opposite end of the cylindrical member inwardly convergent or flaring toward the fan-shaft, and a suction-pipe leading from a point exterior to the room or chamber containing the motor and tapping the cylindrical member laterally to thereby induce a cooling-current upon the motor.

831,288. Telegraphy. Isidor Kitsee, Philadelphia, Pa., assignor of one-half to William J. Latta, Philadelphia, Pa. Application filed November 22, 1905.

One claim reads as follows: A telegraphic system embracing at the receiving-station a polarized relay, a localized circuit for the relay, an electromagnetic device for the circuit, two sets of electromagnets for the device, and means therefore to establish a short circuit around the localized circuit; the relay, the electromagnetic device, the localized and short circuit all in operative relation as to each other. (See cut on next page.)

831,302. Aerial Electric Trackway. George G. Schroeder, Washington, D. C., assignor to the Industrial Motor Company, a corporation of the District of Columbia. Application filed May 29, 1906.

Among the features mentioned are a track-support consisting of uprights, an arch member connecting the upper ends of the uprights together, a hanger depending from the arch, a track supported by the hanger, a pivoted bolster interposed between the track and the hanger, a yard-arm extending laterally from the hanger, a track supported by the yard-arm, a second yard-arm supported by the hanger and current wires supported by the second yard-arm.

831,304. Electric Controller. Charles C. Shedrick, Sherbrooke, Quebec, Canada. Application filed August 12, 1905.

In the device are a number of rockable receptacles, means for rocking the receptacles, means for electrically separating the receptacles, means for automatically making a connection between the receptacles, and means for adjusting the device to currents of varying intensity, comprising a rod carried by the receptacles and weights adjustably disposed thereon.

831,311. Lamp Shade and Protector. Gregory Strootman, Buffalo, and Henry J. Caner, Rochester, N. Y. Application filed January 26, 1906.

A shade and protector for incandescent lights and bulbs consists of two sections of fluted material made in the form of two conic frusta, one inverted upon the other, and a band provided with ventilating flues connecting the two.

831,321. Insulating Material and Process of Manufacturing Same. Johann Billwiller, Goldach, Switzerland. Application filed April 19, 1904.

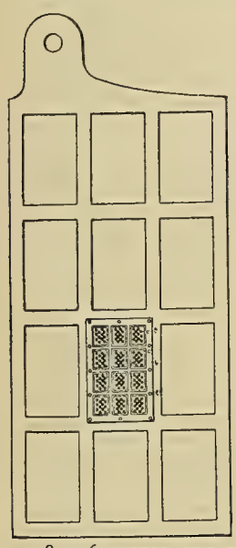
An insulating-block of pulverulent material cemented together by a hydrating magnesia cement and impregnated with oil is the basis of the patent.

831,326. Electric Fixture. John H. Dale, New York, N. Y. Application filed May 20, 1905.

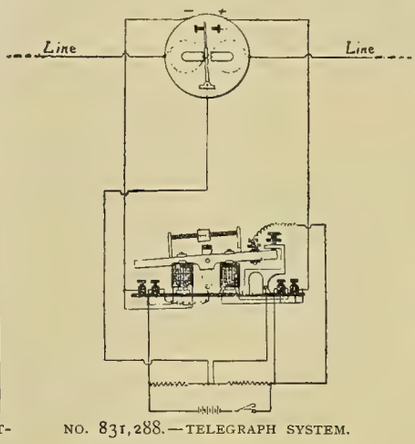
In this hammer the solenoid principle is used to give the hammering effect. The solenoid is slidably mounted within a suitable casing.

831,327. Post and Box for Cable Terminals and the Like. Benjamin F. Daly, New York, N. Y. Application filed December 15, 1905.

The device comprises a hollow base, a hollow casing secured on the base and provided with a door for access to its interior, a terminal box for an electric cable mounted in the casing, the box having a door accessible through the door in the casing, pendent conduits for the cable, and a plate with apertures to receive binding-posts for connecting the conductors of the cable.



NO. 831,269.—STORAGE-BATTERY ELECTRODE.



NO. 831,288.—TELEGRAPH SYSTEM.

831,338. Insulator. Monroe J. Glick, Westfield, Ill., assignor to Jackson Rardin and Timothy Rardin, Westfield, Ill. Application filed October 2, 1905.

A body portion has a slot formed through one side and oppositely disposed alining slots arranged beneath the slot communicating with the latter through a passage arranged centrally and vertically of the body portion of the insulator.

831,348. Telephone Receiver Support. Frank F. Howe, Marietta, Ohio. Application filed March 31, 1906.

An improvement in telephone attachments is described.

831,355. Telegraphic Transmitting Device. Isidor Kitsee, Philadelphia, Pa. Application filed June 21, 1906.

A telegraphic transmitting device is covered, comprising two unequal sources of current connected in series as to the line and in opposition as to each other, a transmitting-key adapted to shunt one of the sources, and a resistance and static means in the region of the shunt.

831,364. Selector or Lock-out for Party Lines. Alexis Marchand, Buckingham, Wash., assignor of one-half to James B. Valentine, Bridgeport, Wash. Application filed September 5, 1905.

A selective party-line telephone system is the basis of the patent.

831,376. Railroad Signaling. Petrus J. Portman, Amsterdam, Netherlands. Application filed July 6, 1905.

The rails serve as conductors. Other features are a main conductor, contacts on the vehicles to travel against the main conductor, electric connections on the vehicles between the respective contacts and the rails, each having a generator and a signal, auxiliary conductors arranged at intervals along the railway and to be traversed by the contacts, and means for putting two auxiliary conductors into electric connection.

831,383. Protector for Incandescent Globes. Charles Schmidt, Allegheny, Fredrich Wunderlich, Pittsburg, and James A. Thibodeau, Turtle Creek, Pa. Application filed January 12, 1906.

A protective cap is provided for the tip of the lamp, the cap being formed of elastic material and embodying an inverted-cone-shaped body to receive the lamp-tip, with an integral flange flared to fit against the lower end of the lamp and adhesively secured thereto.

831,400. Electric Vapor Lamp. Howard I. Wood, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed July 21, 1902.

The combination, with the inclosing envelop of a vapor-lamp, includes main terminals, an auxiliary terminal in contact with one of the main terminals when the lamp is inoperative, means for separating the last-named terminals operated by the current passing between them to start an arc, a flexible conducting rod or filament and a vaporizable main terminal having a pivoted auxiliary terminal adjacent thereto.

831,401. Vapor Electric Apparatus. Howard I. Wood, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed March 31, 1904.

In a vapor electric apparatus, the combination consists of an exhausted envelop, electrodes at opposite ends of the envelop, one at least of the electrodes being a fluid, and insulated leads extending each from the inside of one end of the envelop, one lead dipping into the fluid electrode and the other connected to the other electrode.

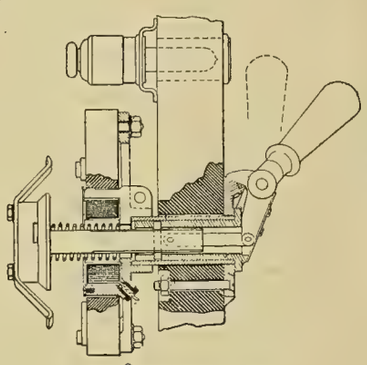
831,404. Controlling Switch. Henry P. Ball, New York, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed February 23, 1905.

In the combination are two parallel circuits including the motor, a manual switch for severally closing the parallel circuits biased to open when closed, means operated by the closing of one of the parallel circuits to hold the switch closed, and means actuated by the motor to break the circuit last manually closed and place the other in condition to be closed by the manual switch. (See cut.)

831,430. Incandescent Lamp Socket. James J. Hartley, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed April 27, 1905.

An incandescent lamp socket having a one-piece base and a screw-shell contact mounted thereon is described.

831,431. Control of Bulkhead Doors. Laurence A. Hawkins, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed December 29, 1905.



NO. 831,404.—SWITCH.

The patent covers a system of electrically controlled doors, a number of control-circuits each controlling a number of doors, a number of independently movable control-switches adapted to energize the several control-circuits, and automatic means for preventing the closing of any of the switches when the sum of the currents in the control-circuits exceeds a predetermined amount.

831,442. Inductor Alternator. Charles A. Kelsey, Pittsfield, Mass., assignor to the Stanley G. I. Electric Manufacturing Company, Pittsfield, Mass. Application filed July 6, 1905.

In a dynamo-electric machine are a revolving inductor having a helical polar projection, a field-winding adapted to magnetize the inductor, and helically arranged stationary armature-coils.

831,446. Alternating-current Motor. Marius C. A. Latour, Paris, France, assignor to the General Electric Company, Schenectady, N. Y. Application filed January 21, 1905.

In an alternating-current machine of the commutator type are electrically controlled means for automatically lifting a portion of the brushes out of engagement with the commutator without changing the circuit connections of the machine when the speed of the machines rises above a predetermined limit.

831,451. System of Motor Control. Charles E. Mandelick, New York, N. Y., assignor to the Sprague Electric Company. Application filed December 19, 1905.

In a system of motor control are a motor-circuit, a controller and a relay for governing the motor-circuit, actuating and maintaining circuits for the relay, contacts on the controller arranged to interrupt the actuating-circuit in certain positions of the controller, a normally open station-switch arranged to close either the actuating or the maintaining circuit, an electromagnet for holding the station-switch in maintaining-circuit-closing position, and a switch for controlling the electromagnet.

831,467. Trolley Head. William H. Pfrimmer, New Albany, Ind., assignor of one-sixth to Jacob W. Roberts and one-sixth to David E. Jones, New Albany, Ind. Application filed November 2, 1905.

A trolley-head is described embodying a trolley-wheel, reversely inclined guards extending over the wheel, means pivotally mounted on the head and adapted to pass between and separate the guards, and means for actuating the guard-sparating means.

831,474. Electrolytic Diaphragm. Isaiah L. Roberts, New York, N. Y., assignor to the Roberts Chemical Company, New York, N. Y. Application filed December 23, 1904. Renewed August 27, 1906.

An electrolytic diaphragm comprises a rigid body of porous material, a layer of non-porous material thereon, and a fabric on the non-porous material to retain the same on the rigid body.

831,475. Inductor Alternator. David B. Rushmore, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed October 5, 1905.

In a dynamo-electric machine are a revolving inductor having a helical polar projection at each end, a field-coil surrounding the inductor between the projections, and a stationary armature provided with coils in inductive relation to the projections.

831,478. Metering System. Ernest Schattner, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed August 19, 1905.

This method of metering the supply of electric energy consists in causing the energy to actuate a registering device, increasing the actuation of the registering device per unit of energy as the energy supplied increases, and maintaining the actuation of the registering device at the rate to which it is increased.

831,482. Electric Hammer. Robert Smith, Middletown, Ohio. Application filed August 8, 1905.

The patent covers the mechanism of an electrically operated hammer.

831,490. Electric Cigar Lighter. Julius C. Tournier, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed September 25, 1905.

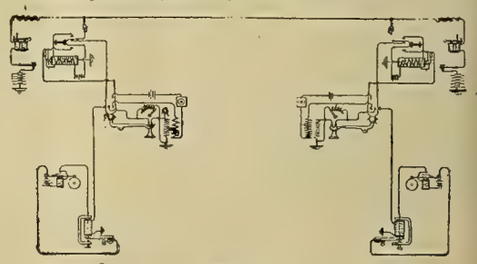
An igniting device comprises telescoping casings, and a socket carrying circuit-terminals and a switch therefor within the same, the casings being cut away to form an opening into the receptacle.

831,509. Trolley. Jacob T. Haudenshield, Scott Township, Allegheny County, Pa. Application filed November 10, 1905.

A trolley harp comprising a bifurcated member is covered by the patent.

831,525. Composite Telephony and Telegraphy. Harry O. Rugh, Chicago, Ill., assignor to the Western Telegraphone Company, Minneapolis, Minn. Application filed January 13, 1903.

In a composite telephone and telegraph system are means for shunting the telegraph currents from the telephone instrument at the substations, the means comprising an impedance device of low ohmic resistance in a shunt or by-path about the corresponding receiver and secondary coil. (See cut.)



NO. 831,525.—COMPOSITE TELEPHONY AND TELEGRAPHY.

831,526. Signaling Apparatus. Harry O. Rugh, Chicago, Ill., assignor to the Western Telegraphone Company, Minneapolis, Minn. Application filed January 8, 1904.

The combination is in connection with a relay having two opposed polar portions and provided with coils wound to secure in the polar portions polarities of unlike sign and having a permanently polarized armature interposed between the same. There is a source of high-frequency current in circuit with the coils to simultaneously cause in the polar portions polarities of unlike sign. Signal-producing means are controlled by the armature and there is a subsidiary signaling-circuit placed in one operative condition by the armature when it is idle and attracted toward one or the other of the poles and placed in an alternatively operative condition when the armature is alternately attracted by the poles.

PATENTS THAT HAVE EXPIRED.

Following is a list of electrical patents (issued by the United States Patent Office) that expired September 24, 1906:

411,414. Electromagnetic Separator. W. A. Anthony, Manchester, Conn.

411,423. Safety Switch for Incandescent Lights and Other Electrically Controlled Devices. O. S. Bussmann, Somerville, Mass.

411,426. Process of Generating Electricity by Gas Batteries. O. Dahl, Brooklyn, N. Y.

411,427. Conduit for Electrical Wires. C. O. Dashiell, Washington, D. C.

411,448. Globe Frame for Electric Arc Lights. J. W. Jones, Harrisburg, Pa.

411,452. Incandescent Electric Light Fixture. P. H. Klein, Jr., New York, N. Y.

411,474. Manufacture of Carbons for Incandescent Electric Lamps. J. S. Sellon, Hatton Gardens, County of Middlesex, England.

411,496. Electric Railway. G. B. Fraley, San Francisco, Cal.

411,539. Underground Conduit for Electric Wires. G. A. Wheeler, New York, N. Y.

411,551. Regulator for Shunt Wound Dynamos or Other Electrical Apparatus. L. S. Harris, Detroit, Mich.

411,588. Telephone Holder. C. T. Dickson, Cincinnati, O.

411,595. Underground Conduit. D. M. Hyland, Chicago, Ill.

411,611, 411,612. System for Synchronizing Electric Motors. R. H. Read, Washington, D. C.

411,613. Trolley for Electric Railway Systems. A. L. Riker, New York, N. Y.

411,629. Armature. C. F. Winkler, Hoosick Falls, N. Y.

411,689. Electric Attachment for Eyeglasses. C. C. Smith, Mohawk, and H. W. Martin, Lyons, N. Y.

411,737. Electric Water Heater. D. W. Smith, St. Louis, Mo.

411,742. Railway Signal. A. B. Fisk, Winthrop, Mass.

411,749. Electric Insulator. L. McCarthy, Boston, Mass.

411,762. Cable Railway. J. D. Davis, Cincinnati, Ohio.

411,767. Mechanical Telephone. W. H. Eastman, Concord, N. H.

411,770. Telegraph Key. H. S. Tebbs, N. C. Lane and V. Coombs, Washington, D. C.

WESTERN ELECTRICIAN

EVERY SATURDAY

Vol. XXXIX. CHICAGO, OCTOBER 6, 1906 No. 14

Single-phase Electric Railway at Milan Exhibition.

By Dr. Alfred Gradenwitz.

The elevated electric railway connecting the two parts of the Milan Exhibition—the Park and the Piazza d'Armi—is the first single-phase railway installed in Italy. The service is secured by trains of four cars having two motors in each head and rear car and one in each of the intervening cars. These motors have an output of about 30 horsepower each. In both the head and the rear car there is installed a transformer reducing the potential in the line from 2,000 volts to the feeding tension of the motors. Two controllers, one at each end of the train, enable the motors by means of multiple switches to be operated at pressures varying from 150 to 300 volts, the frequency being about 15 cycles.

Originally suggested by Dr. Giorgio Finzi, the scheme has been carried out in a somewhat modified shape by the Unione Elettrotecnica Italiana Gadda & Co., which supplied the whole of the electrical equipment.

The diagram of connections is represented in Fig. 2 on the next page. Each train includes two transformers, one at the head and another at the rear, each one of which is able to feed all the six motors, and which are worked alternately. These transformers serve to reduce the potential from 2,000 volts to 150-300 volts, according to the position of the steering wheel of the controller. The motors (one of which, with transformer, is shown in Fig 3) are connected in series in two groups of three.

The cars are provided with transverse benches, those on one side of the car having two seats and those on the other side one seat. At the ends there are spacious platforms.

Each of the trains, as has been said, comprises four motor cars, the first and last ones of which are able to accommodate 50 passengers each, and the two intervening cars 30 passengers, making an aggregate capacity of 160 passengers. In the course of the tests recently made it has been possible to complete the whole of the run in only three minutes, but owing to the official regulations, a slower speed has generally to be used.

As regards the electric equipment of the rolling stock it will be sufficient to state that the controllers have been constructed by Messrs. Glöckner of Cologne, and the continuous pneumatic brakes by the Continentale Bremsen Gesellschaft, while the current collectors sliding along the trolley wire are the well-known Siemens bows. The cars are lighted by electricity by means of Hensemberger accumulators.

The line, 1,350 meters in length, has a double track outside the stations, in which latter a single track is laid. In the neighborhood of each of the stations there is, however, a special safety track. The elevated structure is made of wood nearly throughout, while at some places a mixed wood and iron construction has been made use of; there are also a few iron concrete supports. A portion of the elevated railway with a train about to start is seen in Fig. 1. In order to comply with the esthetic requirements of the case, rather considerable gradients (up to 3½ per cent.) had to be dealt with, as well as short radius curves (20 meters), concentrating, so to speak, in this short length of track all the difficulties electric railway engineers may be confronted with. The track switches and signals in the two stations are of the G. Servettaz type and are controlled by central hydro-dynamical and mechanical transmission apparatus of the normal type in use on Italian railways.

Operation of the trains is regulated by signals dividing the whole line into six sections of a length proportionate to the practically admissible speeds, the maximum length corresponding to those portions on which high speeds may be used, and vice versa. The train service on the short sections, the signals of which are operated by the same central apparatus, is controlled from the motorman's cabin, whence, owing to the short range, the relative position of the trains in regard to the signals may always be inspected; it is furthermore checked by mechanical safety connections. The service on the section, about 1,000 meters in length, which is traversed at maximum speeds, is, however, regulated by the absolute block system, with the usual telegraphic communication.

FIG. 1. THE ELEVATED SINGLE-PHASE RAILWAY AT THE MILAN EXPOSITION.

Below the Piazza d'Armi station the electric power station has been installed. This includes two generator sets (one serving as a reserve), one of which, of 600-horsepower output, consists of a three-phase motor at 3,600 volts and 42 cycles, fed from the mains of the Edison Company, which drives a single-phase alternator. The other set (of 500 horsepower) is a Langen & Wolff gas motor, driving another single-phase alternator. The single-phase current is in both cases generated at a potential of 2,000 volts and a frequency of about 15 cycles.

There are besides two sets (one of which serves as a reserve), consisting each of a three-phase low-potential motor, driving an exciter dynamo. There is also a battery of Tudor accumulators affording another reserve for the excitation.

This electric railway is certainly one of the most interesting exhibits, apart from the fact that this is the pioneer single-phase electric railway of the country. It attracts much attention from electrical visitors, who seek to obtain all possible information about it.

Municipal Ownership.[1]

By Arthur Williams.

Public action by private corporations should be carefully considered, and well directed. It should be united, since the cause of one is the cause of all, and the conditions controlling one surround all. While united and co-operative, it should be individual, personal, direct and local. Helping all the others by example and experience, each must do its own work in its own field of operation.

Educational publicity without and the attainment of higher ideals within are concededly the effective ways of meeting this movement. No others are needed; no others should be wanted. Quick, perhaps, to see the defects in others, we should apply a magnifying glass, with searchlight rays, to our own methods and relations with the public.

A first essential is that courteous, considerate treatment which the public so thoroughly appreciates and enjoys. Compare what we can do with the brusque indifference of the employes in almost every department and office of a municipality. Our own methods, instead of resembling them, should stand out in marked contrast. The beginning should be with the directors and president and it should extend through the entire organization to the office boy and janitor.

The quality of the service should be as nearly perfect as modern invention, construction and operation can make it. Bad, indifferent or poor service should be corrected at any cost. More should be given, not less, than the public has been led to expect. What we are to the public makes good opinion or bad, friends or opponents.

Good service means not alone the kind of light we supply—it includes everything relating to the affairs of the company; the manner with which poles are erected and wires are strung; with which streets are opened and the pavement again laid; the promptness with which customers' wants are met; with which service interrupted is restored; the convenience and promptness with which the public may become users of electric current.

The complaint bureau of a public-service corporation cannot be too highly rated. Every complaint made gives an opportunity to make a new and lasting friend—the kind it pays to have—one who has been cured of a grievance. It is not that a rebate has been made or an employe discharged, but the manner in which the complaint is received and the evidence of careful consideration that counts with the public.

Another very important consideration is the treatment which private corporations accord to their employes. There is probably little question but that a large percentage of those whose votes must be relied upon in any municipal ownership or socialistic movement are the employes of public-service corporations. In 1903 there were more than 1,300,000 employes in the service of American steam railways alone; the number is undoubtedly greater today. Thus in this single serivce alone are more than 10 per cent. of the voters of the country.

The highest wages are now paid by the private corporations. But there is something more than wages to which employes are entitled—the conveniences with which they are surrounded; the care and protection accorded them; the appreciation of their work—for they are a part of every success their employers achieve; the assistance rendered during illness; reading and meeting rooms and other means of entertainment, and pensions for old age.

Many street-railway companies now provide, at convenient points, meeting rooms in which are billiard tables and other forms of recreation. The employes of one company conduct a magazine in which recently was an article by Mr. James Dalrymple of Glasgow, and one will soon appear by Mr. H. T. Newcomb, whose work against municipal socialism has been of such an important nature. Several electric-light companies provide meeting halls, libraries and reading rooms, and encourage entertainment and benefit associations. One of these benefit associations upon the death of a member provides the family with $200 for burial expenses, of which $100 is contributed by the company.

The Pennsylvania Railroad Company continues, as long as they shall live, a pension to its employes after reaching a predetermined age and rendering a certain number of years of continuous service. It is said that since the adoption of this system strikes have become unknown and the men are absolutely loyal to the company. It is doubtful whether any of these men could be prevailed upon to take an active part in any socialistic or anti-corporation cause. The cost of pensions is not great, averaging in different classes of service between one-half and one per cent. of the annual payroll.

At the recent summer meeting of the American Association for the Advancement of Science, Mr. H. T. Newcomb brought out quite clearly that to the employes private was far preferable to public employment. He states in that connection: "I propose to prove not only that the government is not the best employer, but that it is not even a fair employer. Nor is this all. I shall show conclusively that when government engages in industry on a large scale, the condition of its employes naturally and inevitably degenerates to that of slavery."

He then proceeds to make good this challenge, as he calls it, by showing that while from 1896 to 1904 the average cost of food in this country had advanced nearly 17 per cent., and while during that period the average rate of wages in private employment had increased something over 17 per cent., there had been no increase at all in the wages of government employes.

Comparisons in the Government Printing Office are only available since March 3, 1899. Since then, however, the cost of food has increased more than 12 per cent. and the wages of printers in private establishments have been raised from 12 per cent. to 22 per cent., though no advance has been allowed the employes of the Government Printing Office.

Mr. Newcomb also shows how government employes have been successfully sued by the government for obeying the orders of their superiors; how in some cases, at least, they are not permitted to withdraw from the government service without what shall be considered justifiable cause; and points out that in New Zealand, where government ownership has reached perhaps its highest point, labor for the government is practically compulsory, the government making its own terms.

With all other considerations, the prices of our companies must be included. Not only should they be as low as circumstances justify, but as simple and as readily understood. Differential are not preferential rates. But this it is sometimes difficult to make the public understand.

While a differential rate is the more equitable method of charging for electric current, under municipal ownership the more simple flat rate would probably prevail. The government sets an example in a two-cent postage stamp—whatever the distance. Manifestly, does it seem unfair to charge as much to deliver a letter a half dozen city blocks as, say, between New York and Chicago? Yet this the government does; and probably in the general good few could ask a change.

One method of charge for public service—gas and electric—now receiving a great deal of attention might be mentioned—the English sliding scale, recently adopted by the gas companies of Boston. The method seems to contain elements in satisfying the public which no other rate system thus far devised appears to have accomplished. After assuring to the company a fair return upon its investment, and the public a maximum price beyond which it shall not be charged, the further profits are divided, in ratios agreed upon between the public and the company.

How the plan is looked upon by an outsider may be understood in the following editorial paragraphs, taken from Collier's, August 4, 1906:

"The Boston Consolidated Gas Company on the same date (July 1, 1906), acting on the sliding scale, introduced through the energy and intelligence of the Public Franchise League in its three years' fight, reduced the price to 85 cents, a drop of 15 per cent. and a direct saving to the public for the coming year of $562,500.

"The gas company, under its present exceptionally liberal-minded management, accepts enthusiastically the sliding scale and speaks of itself as in partnership with the public, by which the gain of either under the new law means the gain of each. Unusual, indeed, is it for a corporation to state in an advertisement that the 'immediate effect' of a drastic law made for its regulation 'is another reduction in the price of gas.' Other towns and other public-service corporations may well take notice, for both may learn from the Boston gas settlement about the right spirit in which to work out some of our widespread difficulties, without rancor, sound and fury."

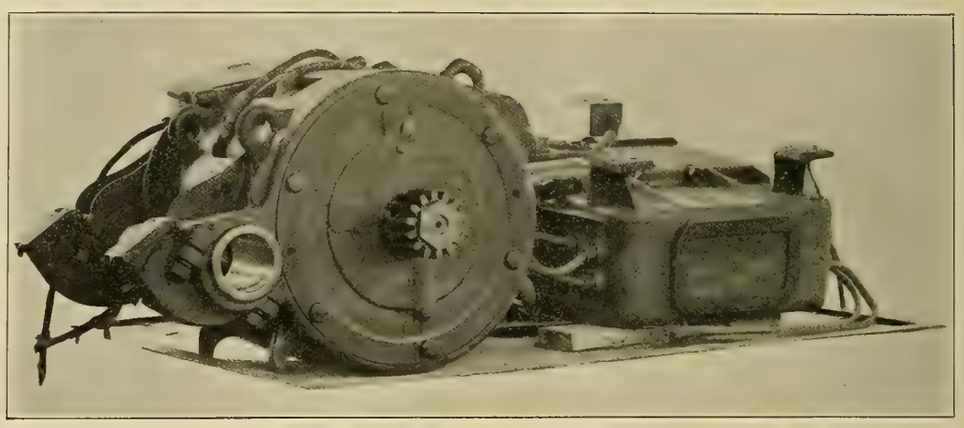


FIG. 3. SINGLE-PHASE MOTOR AND TRANSFORMER USED ON MILAN EXPOSITION RAILWAY. (SEE PAGE 261.)

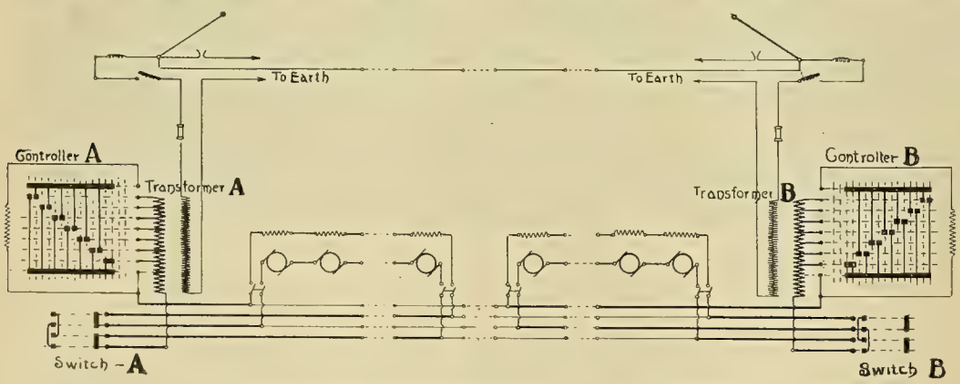


FIG. 2. DIAGRAM OF CONNECTIONS FOR SINGLE-PHASE RAILWAY AT MILAN EXPOSITION. (SEE PAGE 261.)

1. From a paper read before the Association of Edison Illuminating Companies at Frontenac, Thousand Islands, N. Y., September 6, 1906. Mr. Williams is general inspector of the New York Edison Co. and president of National Electric Light Association.

Collapse of a Concrete Smokestack.

A serious accident occurred a few days ago at the Illinois Traction Company's new power house in Peoria, by the collapsing of the southeast stack. The stack, which was the east one of twin stacks, was 200 feet high, with a diameter of 11 feet, and built of reinforced concrete. Owing to the heavy rain very few men were working on the power house and no one was injured. The damage to the stack, which is a total loss, is $5,000, while the damage to the power house will amount to $2,000.

The stack collapsed a few feet above the collar which divides the first section from the smaller second section. The break was about 85 feet from the ground, and the 118 feet of solid concrete fell in a heap inside of the partly finished boiler room, hardly any falling outside. This stack was built by a chimney-erecting company of Chicago and was finished only three weeks ago. It rested on a 25-foot concrete foundation, and an examination shows that this is intact. Part of the debris fell on the roof of the turbine room, where one of the 2,000-kilowatt turbines has been erected, but the roof is of concrete and withstood the shock. The roof of the boiler room had not been put on, so the concrete fell directly into the room.

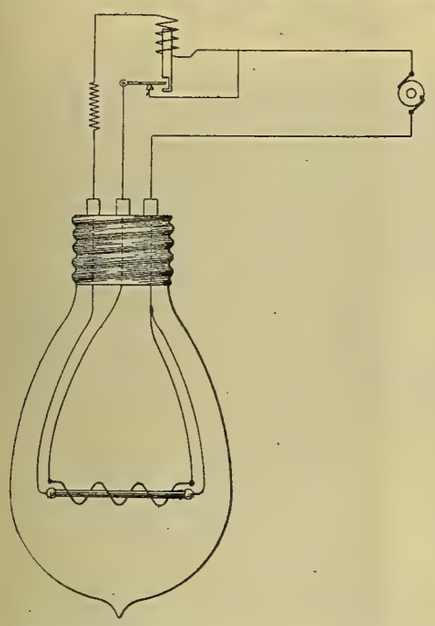
No cause is given, but it is thought that faulty material gave way under the immense weight. The company building the chimney will be the loser, as the contract calls for the maintenance of the stack for 10 years. The stack, which will be rebuilt at once, represents the first instance of such a concrete structure giving way, the company having built 200 of them in various parts of the country. The same company is building a larger one for the

Peoria Gas and Electric Company, and it is now 25 feet above the ground.

The traction company will experience no delay, as the other stack is sound and can be used until the fallen one is rebuilt.

A Nernst Lamp with Carbon Heating Filament.

The growing interest taken in high-efficiency, long-lived incandescent lamps is illustrated by the number of patents taken out for devices of this nature. The Nernst lamp, while having achieved



A NERNST LAMP WITH CARBON HEATING FILAMENT.

marked success, had the disadvantage of requiring special preheating appliances and a certain interval between turning on the switch and securing illumination. Albert Ackerman of Pittsburg has been granted a patent for an improvement tending to minimize this advantage. To attain this purpose the glower is enclosed in an exhausted bulb similar to that of an ordinary incandescent lamp, except that there are three leading-in wires and that the carbon filament is looped around the glower rod, so that the latter becomes quickly heated when the current is passed through the carbon filament. The exhausted bulb is used to protect the carbon from burning out.

The filament circuit is arranged as a shunt in the glower circuit, the third leading-in wire being for the glower only, while the glower return wire takes up the filament return. When the lamp is switched on, the current passes mainly through the filament circuit, owing to the high resistance of the glower rod when cold. When the resistance in the glower circuit is sufficiently lowered by the heating of the rod, enough current passes around a solenoid placed in that circuit to cause it to draw up a core carrying a tripper hook, which, lifting a contact lever of the filament circuit, shunts out the latter. A ballast conductor or resistance is provided in the glower circuit to prevent an excess of current from passing through the glower rod in case its resistance becomes very low.

In his patent specifications Mr. Ackerman does not mention the fact that the lamp gives light as soon as the switch is turned on, nor is there any claim made for this palpably valuable feature. Yet it is clear that the carbon filament becomes incandescent as soon as the switch is turned, so that the interval above referred to wholly disappears in case this lamp operates as designed.

No Municipal Lighting for Boston.

Writing under date of September 29th the Boston correspondent of the Western Electrician says: "The Boston City Council's special committee on municipal lighting managed to get 12 of its 15 members to a meeting last week. When it took a vote on an order recommending the establishment of a municipal light plant the vote resulted in a tie. Less than six advocates of municipal lighting have appeared at the committee's many hearings, which indicates that Boston is not anxious to take the lighting business away from private interests. The following day 14 of the members held a meeting, at which, by a vote of eight to six, it was decided to postpone further consideration of the matter until November 1st, when the state campaign will be practically over. Under the order by which the committee was created it was to have reported to the City Council on September 20th, but the advocates of municipal lighting were unable to get the committee to report by that date."

Use of Regenerative Primary Cells on a Large Scale.

The use of primary batteries on a large scale is practically prohibited by the expense of the materials consumed and the difficulty of preventing the electrolyte from becoming "dead" or inactive after a comparatively short period of service. To overcome these objections, Baroukh Jonas of Toledo, Ohio, has invented the cell and method of operation here described, for which he has been granted a patent. The construction being all designed with a view of continuous operation for many months at a considerable output, the cells are large cylindrical tanks of cement, into which the pipes, tubes and carbon electrodes are solidly cemented.

In the typical cell (Figs. 1 and 2), the cross-section is divided into six sectiors by horizontal carbon beams projecting radially through the cell wall to about two-thirds the distance to the axis of the tank. An upper and a lower series of these carbon electrodes is supplied. In each of the pockets thus formed, and also in the middle of the tank, there is placed a vertical porous jar resting in the bottom of the cell. A thick bed of iron particles covers the bottom of the tank and surrounds the bases of the jars, which also contain iron particles up to one-half their height. Silver wires lead into each jar and unite to a ring at the top, and, with a leading wire from the iron particles at the bottom, form the terminals of the iron anode. An insulating diaphragm of canvas covers the bed of iron particles and supports a mass of granulated carbon, filling half the remaining volume and forming with

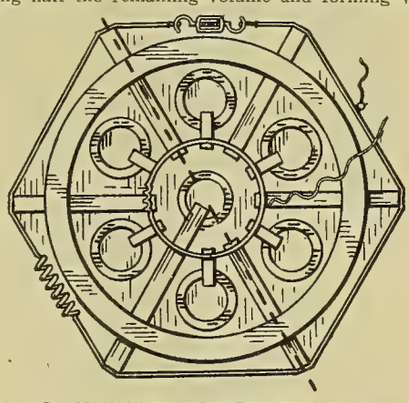


FIG. 1. PLAN OF REGENERATIVE PRIMARY CELL.

the carbon rods before mentioned the cathode of this cell.

Connection is made between the carbons by wrapping a wire around the protruding ends of each series, the binding wires being connected by a contact conducting wire. For an electrolyte Mr. Jonas prefers a solution of the chloride of iron ($FeCl_2$), with which he fills the cell to above the tops of the porous jars. A heating pipe running diametrically across the bottom of the cell supplies the necessary steam, hot air or hot water to raise the temperature to about 150° F. A perforated

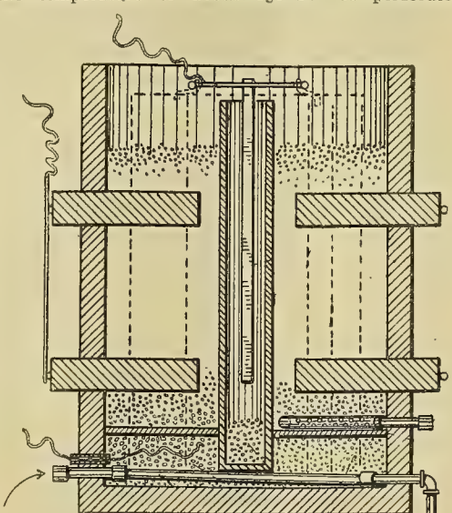


FIG. 2. VERTICAL SECTION OF REGENERATIVE PRIMARY CELL.

syphon hose entering the tank at the height of the canvas diaphragm rests upon the latter and serves to empty and fill the cell.

Such an arrangement as is shown in Fig. 3 is recommended by the inventor for the realization of the essential benefits claimed. The cells are arranged in groups of two, one of which is always empty of electrolyte. Each group has a common drain and pumping-up connection leading to its own centrifugal pump, operated by its own motor. The three motors are fed by a common current taken from the battery itself, or some convenient source of energy, and are controlled by a three-way switch so adjusted that as soon as one group is drained

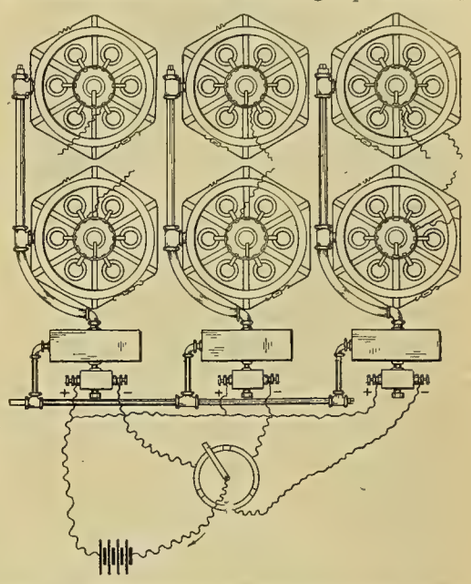


FIG. 3. ARRANGEMENT OF REGENERATIVE CELLS TO PRODUCE CURRENT ON A LARGE SCALE.

and has its contents transferred to another the switch automatically starts the emptying of the third group and the pumping up of the first, continuing the same routine again.

It is said that as each cell is emptied the air rushes in and fills all of the little cavities in and around and among the particles of granulated carbon. Then, again, as it fills with the solution the air is all driven out, except what is imprisoned in the thousands of little cavities, where the minute iron particles come in contact with the air and the electrolytic solution where electricity is liberated and attracted to the carbon plates and the conducting wires. The inventor asserts that by these means the electrolyte is constantly being regenerated and the voltaic efficiency of the cell kept up indefinitely. As the only part to be consumed is the iron, this should constitute an inexpensive energy producer, provided the electrolyte does actually retain its chemical energy by virtue of its periodic regeneration. Practical electrical men will, however, be doubtful of the actual efficiency of the arrangement as a practicable current producer on a large scale under service conditions.

Denver Public-service Companies Win Election Contest.

The count of the votes cast in the May election at Denver, Colo., on the franchises of the street-railway company and the light company was completed in the County Court a few days ago and the companies won. The opening of the ballot boxes showed no fraud to speak of, and the claims of the municipal-ownership organization that directed the contest in the court were not borne out. The contest is ended and the companies will be granted their franchises. The Tramway company on the recount has 119 votes plurality and the lighting company over 500.

This result is especially gratifying to the officers of the Denver Gas and Electric Company, against whom some harsh and evidently unjust accusations were made following the election.

Municipal Ownership Trouble in Columbus.

A news dispatch from Columbus, Ohio, dated September 27th, says that the managers of the Columbus municipal electric-light plant have made a demand for more money. This time $140,000 is asked for, but the council has not acted upon the matter. Within a few years the investment in the Columbus municipal plant is said to have grown from $63,000 to nearly $500,000, and still the promoters of the deal have not money enough to give the service they promised. The present plant, which was supposed to be a model one, is wholly inadequate, the dispatch says.

Adjuncts to the Power Load.[1]

By C. J. Russell.

Part I.

Central-station development of the electric power field has resulted in a marvelous growth in the sales of electrical energy for transformation into mechanical energy. The electric motor has invaded branch after branch of manufacturing industries, and data of actual installations operating almost every known form of machinery are now available for the use of the central-station manager and his prospective customers. The sales of electric current for transformation into luminous and kinetic energy may be said to be proceeding along well defined and satisfactory lines. Progress has called forth progress, in the one case of new illuminants and accessories, in the other of special applications and improved methods. To broaden the field of sales it is but natural that central-station interests should turn to the two remaining transformations of the electric current, namely, into caloric and chemical energy. In the first named of these transformations the central station has met with much encouragement. The introduction of domestic and industrial heating appliances has at least blazed a trail into the undeveloped country. Viewed from the standpoint of comparison with the early experiences in the lighting and power fields, the results are certainly satisfactory.

It has been clearly proven that there is a great opening for sales of current for electric heating in cases where the specific advantages of flexibility, ready control, high temperatures and direct application can be made to count.

For industrial use electric heating may be said to present, over other methods of heating, all the advantages of the electric motor over other forms of motive power. Its use permits individual equipment, the concentration of intense power without the conduction of dangerous or explosive mediums, and without the losses incident to such conduction. The other advantages of cleanliness, absence of vitiation of atmosphere, etc., are too well proven by existing devices to require comment here.

In industrial operations the supply of electric current for heating is intimately related to the supply of power, as its greatest use will be in establishments using power machinery. The hours of its use will be practically the same as those of the industrial motor. These facts entitle this class of business to the same treatment in the matter of rates as the electric power business, and it may properly be classed as an adjunct to the power load.

The development of the electric heating business may be expected to follow the ordinary economical laws of demand and supply. The demand may be separated into two distinct classes: First, created demand, as in those cases where new processes or products may make possible the establishment of new industries; second, existing demand, as in those cases where present methods may be superseded by electric methods with the result of increased and more perfect output. The supply rests with the inventor and electric heating engineer, who must perfect new processes to create demand and devise improved appliances to fill the existing demand.

It may be argued that we have little to do with the first class. As a matter of fact we may do much by offering attractive rates and by giving our encouragement to such pioneer work in every possible way.

In the second class we are undoubtedly a, if not the, potential factor. Just as the central station has been the greatest selling power in the lines of lighting and motor appliances, so can it become the greatest advocate of the use of electric heating for industrial purposes.

Our business brings us into intimate relations with the possible users of such devices. To many of them we stand in the position of consulting engineers, and the power of our suggestions as to anything relating to their product or processes cannot be denied. We serve printing establishments to which the value of electric heating appliances for linotype or monotype machines and all the operations of the stereotype rooms cannot be overestimated. Some of these establishments do binding, and to them the applications of electric heat to press heads, shaping machines, gluing processes, etc., would prove great money savers. We serve laundries to which electrically heated machines would bring the same advantage as the domestic iron has to the residence. The metal industries on our systems may find in the electric welding machine and in the electric furnace just what they need in the way of improved equipment. Textile mills have numerous process requirements, which only need the application of electric heat to produce improved results. Whether it be the humble soldering iron, the glue kettle or the electric furnace, every application of electric heating devices will help to conquer this field for the central station and the placing of the appliance is worthy of earnest effort.

If the central station has proven itself a potent selling agent in other fields, it has done so by campaigns of education, and in the newer fields this experience will undoubtedly be repeated. Proven appliances must form the foundation for attack upon any such proposition, and our equipment in this direction is such as to encourage the central-station manager. The minor appliances are well known, such as soldering irons, glue cookers, special irons for the hat factory, warming pans and stoves for miscellaneous and special uses. The special applications for the binding and stereotype trades may not be so well known, but they have been well tried out, have proven very satisfactory, and data regarding their operation are readily available to those interested. The recent types of laundry applications are also giving very good satisfaction.

The data obtainable upon the operation of the various classes of machinery mentioned would seem to prove that the cost of heating becomes insignificant in the face of the greatly increased and improved output made possible by the use of electricity. In this, as in the power field, the decreased cost per unit of perfect article produced controls the situation and may render the new method preferable at double the cost for energy alone.

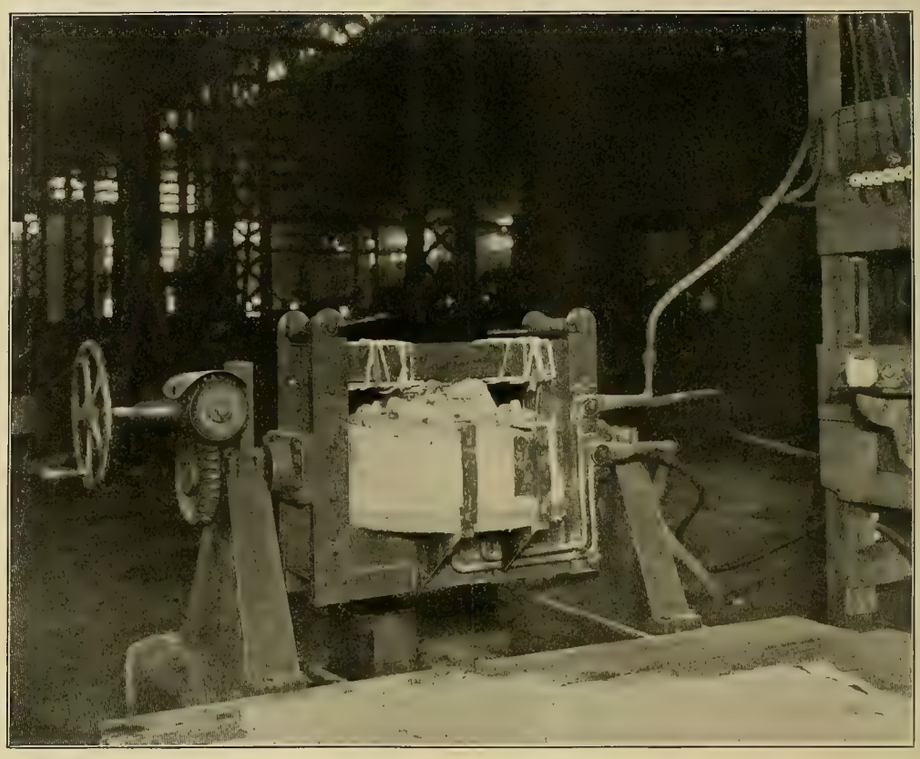


FIG. 1. AN ELECTRIC FURNACE OPERATED BY CENTRAL-STATION CURRENT.

Electric Welding and Tempering.

The field for electric welding and tempering is unquestionably a large one, but machines for this purpose have not been as generally introduced as the publicity given to this class of apparatus and the remarkable results accomplished by its use would lead one to anticipate. It is also to be regretted that the method of installation generally urged and adopted has been in connection with a special generating equipment.

In the sizes up to 30 kilowatts there can certainly be no valid reason presented for the installation of a special generator. We have several outfits on our system ranging from 15 to 30 kilowatts capacity, and their effect is not greater than that of a motor of similar capacity.

The load factor of these outfits is low, averaging three hours. The reason for this is understood when we consider that the longest period of welding in average work will not exceed 40 seconds, whereas the operation of adjusting and removing the work may occupy three to four times this length of time.

Proper presentation of the advantages of these outfits to accomplish specific results in large manufacturing establishments making metal articles of special shape should result in their more general use. There would also appear to be room in each large city for a jobbing shop to handle the work for smaller concerns, which could hardly afford to make individual installations on account of the royalties charged upon the machines of a fixed sum per annum.

Suggestion of the use of a welding machine was made some time ago to one of our large power consumers under the following circumstances: In passing strips of expensive rolled metal between dies it was necessary to rivet succeeding strips together in order to allow continuous operation. When this riveted portion came along it was necessary to open the dies, resulting in quite a loss of the rolled metal. The welder was introduced, and now makes a butt weld on these strips, the fin or bur being removed by an emery wheel on a flexible shaft. The dies can operate continuously, and the saving is from five to eight per cent. of the total length of metal worked.

In another case where thin disks of rolled, spun or hammered metal developed a defect at one portion of the rim, the almost completed article had to be thrown into the scrap pile. A welding machine is now used to weld a piece of metal on at the place of the defect, which is sheared off, and, after completion, it is impossible to detect the place where the joint was made.

In another case, where repairs to costly pieces of large size constantly required careful soldering and refinishing, a welder was installed with such results as to reduce the time consumed in these repairs to one-sixth that formerly necessary. In this case certain articles were also manufactured requiring stamping from large sheets, with much waste, on account of their shape. The suggestion of welding these up from narrow strips was made and a few samples prepared. Within 30 days after these went out to the trade the welding machine had a steady six months' job on the books, and our revenue increased from this source of current sales.

While most of the welding done is of the butt type, some special machines have been developed, one for making wire fencing and another for making longitudinal welds on pieces of large diameter, such as the joints in the shell of hot-water boilers for domestic use.

The electric tempering process by use of the electric welding machine does not appear to have been developed to such an extent as its advantages would seem to merit. The heating of special shaped pieces by the ordinary means is often accompanied by distortion, which is fatal to the article itself. When heated by the passage of an electric current this is not the case, and the tempering of such delicate articles as the rolls used for drawing cotton is successfully done by means of this process. The uniformity of the heat generated in this way in metal of small cross-section and the excellent tempering results obtained have proven eminently satisfactory in such special lines as have come under our observation.

Electric Furnaces.

The importance attained by this class of apparatus entitles it to serious consideration from the central standpoint.

Foreign developments are attracting universal interest on this continent, and the next few years will probably witness extensive applications of the electric furnace in various industries on this side of the water.

The obtaining of commercial data upon the subjects of the electric furnace, its applications and products, is a somewhat difficult matter. The whole subject is surrounded with such mystery by those now using electric furnaces, and the data obtained are so incomplete and vary so widely, that the investigator may conclude that the apparatus is in a purely experimental stage.

The electric furnace has come to be regarded as one of the most important tools of the electrochemist and is generally classified under that branch of science. Strictly speaking, it may be regarded as misplaced, since in itself it is simply a form of apparatus for the utilization of heat transformed from electrical energy. As from present point of view, however, such furnaces will

1. A paper read before the Association of Edison Illuminating Companies at Frontenac, Thousand Islands, N. Y., September 5, 1906. The author is district manager for the Philadelphia Electric Company.

have principal use in industries dependent upon physical and chemical changes in their materials, the classification is probably both correct and proper.

From a commercial standpoint the electric furnace is a piece of apparatus for the generation and utilization of heat. The comparison between various types designed to accomplished specific results must proceed along these lines as far as efficiency and economy are concerned.

The heat may be used to accomplish physical changes alone, or physical and chemical changes. In the latter case a certain proportion of the energy may be absorbed in the chemical reactions necessary, and it may be aided by the chemical reactions occurring during the operations. As the heat units actually utilized to accomplish given results can be readily calculated, the real efficiency of any process can be determined with accuracy.

The transformation of electric energy into heat energy by means of resistance may be utilized in an electric furnace, directly or indirectly, according as the materials to be treated are or are not conducting.

In the direct method the heat is generated within the material itself, which in this case is part of the circuit, current being led to it by suitable electrodes, which are provided with means to prevent their fusion, such as water circulation; and in the direct induction furnaces the heating currents are generated within the materials themselves, they constituting the secondary of a transformer circuit.

In the indirect method the heat is utilized by radiation or conduction. In the arc types, the resistance is gaseous and the arcs are formed between electrodes or between the electrodes and the materials to be treated if they be conducting. These arcs may evidently be formed within or outside of the receptacles containing the materials to be treated, or the latter may be made to pass through the arcs while being fed into the receptacles. In the solid-resistance types the heat may be generated within solid conductors contiguous to the mass to be treated. These conductors may be solid or molten at the temperature at which the furnace is run; may be arranged within the refractory walls of the receptacle, within the mass of the material itself, or may be superimposed upon the mass as in those processes utilizing heat generated within a slag resistance floating upon the bath to be treated.

Division and subdivision of these classes may be elaborated, but as efficiency must become an all important factor in the ultimate development of the electric furnace, it is probable that the classification mentioned will be convenient for purposes of comparison.

The maximum temperatures attained in commercial furnaces range from 2,000° C. to 3,500° C., or from 3,632° F. to 6,332° F. The latter figure may be anticipated, since the latest determinations of the temperature of the arc approach 3,700° C., as given by the United States Bureau of Standards, working with the Wanner, Holborn-Kurlbaum and le Chatelier pyrometers.

An examination of the history of the development of the electric furnace is principally interesting from the early dates of disclosure of the vital principles of existing furnaces, and as showing that it was retarded only by the absence of suitable means for the generation or supply of the necessary amount of electrical energy.

The fundamental principles of existing furnaces were disclosed during the period from 1815 to 1887, and this fact, together with the extensive foreign applications of furnace methods, is worthy of consideration on the part of those having electrical energy for sale.

The tardy developments in this country have been due in a measure to the fact that the electrical furnace man and the central-station man did not get together. The industries require comparatively large quantities of electrical energy, and almost up to the present time it has been assumed that waterpower alone could develop the current at a cost low enough to meet the requirements. Waterpower within available transmission distances of large centers has been in demand for light and power plants, and power sites not so situated may lack the facilities of transportation and of ample supply of raw materials essential to the operation of electric-furnace processes.

In foreign countries the decadence of the calcium-carbide industry caused an active demand for processes to utilize installations completed and under way, with the result that with modified furnaces a large and constantly increasing output of various ferro-alloys has almost completely annihilated the old cupola processes and products. The use of these alloys in the iron and steel industry has called for rapid extensions of existing electric-furnace plants, and it is at this time estimated that fully 100,000 horsepower is being utilized for this purpose alone.

From the production of ferro-alloys it would seem but a step to the production of steel. The step was taken, and electric steel has been on the market in moderate supply for about five years.

Within the last six months considerable electric-furnace work has been done in our city with current supplied from our generating stations. One installation is of especial interest as being the first to produce high-grade crucible steel upon a commercial scale on this side of the water, by heat from electrical energy. The furnace is of the induction type, of 131 kilovolt-ampere capacity, and is supplied with single-phase 60-cycle current at 240 volts. It is in principle a transformer, the secondary of which is constituted by a circular trough-shaped crucible and its contents. The primary consists of 28 turns of copper tube, cooled by internal water circulation and insulated by sectional layers of heat-insulating materials.

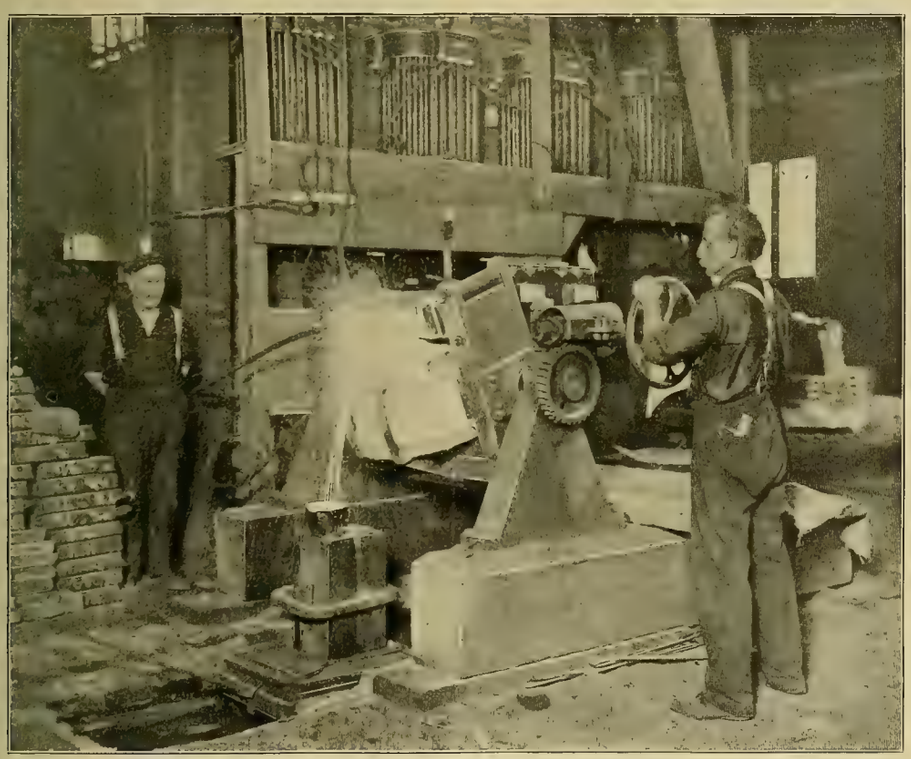


FIG. 3. ELECTRIC FURNACE TILTED IN POURING.

The furnace is shown in Fig. 1, the crucible in Fig. 2 and the furnace tilted as in the operation of making a pour in Fig. 3.

The construction is simple and rugged, as can be readily seen from the cuts. The transformer frame is mounted upon trunnions and fitted with gears and a hand-wheel for convenience in tilting. The top member, which is removable, is provided with cams at each end for the application of pressure to insure good magnetic contact, and the handles operating these cams can be seen in Fig. 1, lying parallel to and just above the top of the transformer frame. Bolted to each side of the lower part of the frame are brackets, upon which rests a circular piece of soapstone which serves as a foundation for the crucible.

The top lid, or covering, of the crucible is made in sections for convenience in introducing materials and for observing the process.

The manipulation of the furnace is very simple. In starting operations, a cast ring may be placed in the crucible or a pot of melted metal poured in from another furnace and the current turned on. When this metal is at the proper temperature, materials are added in the right proportion and the whole brought to the condition desired and an ingot is poured off.

When a pour is made sufficient metal is left in the crucible to maintain the circuit, and new materials are at once introduced. Charging is done gradually, in order to prevent freezing the mass. The fusion of the new charge ordinarily takes about 36 minutes, and the total time between pours is from an hour to 70 minutes, according to the character of steel to be made.

FIG. 2. CRUCIBLE OF ELECTRIC FURNACE.

The secondary current is, at a maximum, 15,148 amperes at 8.57 volts. The current consumption varies with the percentage of carbon in the charge and finished steel, but it will average about 28 kilowatt-hours to melt and a total of 36 kilowatt-hours to a pour per hundred pounds of steel.

The temperature of the cooling water is only raised from 10 to 20 degrees from inlet to outlet, with a very moderate flow. The heat insulation of the crucible is so perfect that the outside of the casing is barely warm to the touch while the furnace is in full operation.

Starting cold, the power factor of the apparatus is rather low, but as soon as the metal in the crucible is heated to such a degree as to lose its magnetic qualities, it improves rapidly. When in full operation the power factor ranges from 93 to 97 per cent.

Careful observations of about 60 heats were taken with standardized instruments, and much valuable data have been obtained.

Several thousand pounds of each kind of high-grade steel of different compositions used for cutting tools have been made in this furnace, and samples submitted to chemical and mechanical tests.

Since the heat is generated in the crucible without external contact or influence, it is obvious that the resultant product will be free from contamination other than that due to the materials themselves and to the lining of the crucible. For this reason the character of the steel can be absolutely predetermined. The high temperatures attainable in the furnace render it possible thoroughly to remove all gases, and the steel is very fluid and still in the mold. The ingots are very dense and homogeneous, and tools made from them present a grain and silvery luster unlike that of the ordinary crucible steel. The metal also has valuable characteristic qualities for the manufacture of high-grade tools requiring uniform temper.

The results obtained have been so satisfactory that it is proposed to install a five-ton furnace calling for about 750 kilowatts current capacity.

The magnetic effect produces some difficulty in charging, but this is not serious when understood and properly avoided.

It is evident that furnaces of this type can be readily designed for use on two or three-phase circuits. While no large furnaces of polyphase type have been manufactured in this country, two different forms have been brought out in France.

We have also on our system a furnace of 100 kilowatts capacity used for the smelting of special ore. This is of the combined direct and indirect type, arcs being used to start the process and the current being subsequently passed through the materials which are conducting when heated. The work with this furnace has not reached such a point as to admit of more than a general reference to it. If as successful as the results abroad indicate, it is hoped that the preliminary work will result in a large installation with central-station supply. There are also two smaller furnace equipments on our system, both used for tests in the smelting of various ores and for experimental purposes.

[*To be concluded next week.*]

WESTERN ELECTRICIAN

EVERY SATURDAY.

PUBLICATION OFFICES:

507 Marquette Building, CHICAGO.

TELEPHONE, MAIN 1746.

Eastern Office, 150 Nassau Street, New York.

Telephone, 5220 Beekman.

Trade Supplied by Western News Co.

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SUBSCRIPTION, in advance, postage prepaid, $3.00 for a full year of 52 numbers; in clubs of four or more, $2.50, with free extra copy for eight subscriptions; foreign countries, $5.00 a year; single copies, 10 cents. When change of address is requested, the **old address** as well as the new should be given.

CORRESPONDENCE relating to electricity or any of its practical applications is cordially invited, and the co-operation of all electrical thinkers and workers earnestly desired. Clear, concise, well written articles are especially welcome; and communications, views, news items, local newspaper clippings, or any information likely to interest electricians, will be thankfully received and cheerfully acknowledged.

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REMITTANCES.—All checks, drafts and other remittances should be made payable to the order of the publishers, the **Electrician Publishing Company,** and addressed to the offices of publication, Suite 507, Marquette Building (204 Dearborn Street), Chicago, Illinois, U. S. A.

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DATES AHEAD.

Old Time Telegraphers and Historical Association, and United States Military Telegraphers (annual meeting), Arlington Hotel, Washington, D. C., October 9th, 10th and 11th.

A RECENT invention by a well-known English engineer, Mr. B. H. Thwaite, is remarkable for the extent to which it is proposed to utilize every detail and by-product to some practical end. The invention relates to the cultivation of plants by the aid of electricity generated by a dynamo driven by a suction or producer gas engine. Ordinary bituminous steam coal, instead of anthracite, is used for power gas-generating purposes, from which the ammonia is recovered in a concentrated solution for fertilizing the soil in the rearing pots. The jacket water of the gas engine is utilized for heating the conservatory or glasshouse, and the carbon dioxide of the gas engine exhaust is used to feed the leaves after it has passed through a purifying process. It would seem that the economy of engineering materials has reached its limit in this invention.

SPEED of operation has a great fascination for the drivers of all kinds of vehicles, but too often a disproportionate price is paid for it in a toll of human life. Thus, excessive speed causing the engine to overturn resulted in the Salisbury (England) railroad disaster of July 1st, in which upward of a score of Americans on their way from Plymouth to London lost their lives. This is the official decision of the Board of Trade inspectors. Major Pringle, the representative of the Board of Trade who had charge of the investigation, says in the report that all the evidence points to the fact that the speed was at least twice as great as was authorized by the company, and possibly it was as much as 70 miles an hour. No doubt if we are willing to slow up a bit, literally as well as figuratively, we shall live longer and, probably, more comfortably.

THE paper on "Adjuncts to the Power Load," by Mr. C. J. Russell of Philadelphia, read before the recent Edison Convention and begun elsewhere in this issue, is, we think, of unusual importance. It is helpful in that it is designed to bring to the attention of the electric-plant managers some new (new, that is, when considered from the central-station point of view) avenues for the sale of electric current. The author makes some pertinent remarks on electric heating, and then passes to consider electric welding and tempering, electric furnaces and electrochemical processes. Now while these methods are all old, as age is reckoned in electrical development, they are all practically virgin territory for the exploitation of central-station power. Mr. Russell cites practical examples, and is confident that many small installations of this character could with advantage buy their current. Not only that, but the alert central-station manager should be conversant with these industries to the end that he may promote them judiciously. The paper is well worth the attentive perusal of all interested in the marketing of electric power.

DATA of considerable interest to capitalists and traction engineers on the cost and profit of electric 'bus traffic are found in the results of a venture of this kind in Berlin, as reported in one of our German contemporaries. Observations cover the period from November 1, 1905, to January 31, 1906. Four old vehicles limited to a speed of 9.3 miles per hour and two new coaches of 15 miles speed were used. The performance of the motors and the storage batteries was satisfactory, it is said. An average run of 37.3 miles a day with vehicles loaded was maintained, the greatest mileage with load being 73 miles. The average income per kilometer (0.62 mile) was 7.37 cents gross, or, after deducting the wages of driver, five cents, corresponding to 8.07 cents per mile. An investment of $9,758 returned $126.85 in 527 operating hours. This corresponds to a yearly income of $536.45, or about five per cent. on the investment. Maintenance of storage batteries cost one cent per mile of running, or $164; rubber tires, $222.77; current for charging batteries at 3.7 cents per kilowatt-hour, $176.59. In a total of 19,262 miles the average cost per mile for maintenance of storage batteries was 0.85 of a cent; for charging current, 1.32 cents; tires, 1.38 cents; repairs, 0.48 cent. At a total cost of 11 cents per mile a profit of 0.67 cent a mile was secured at the usual schedule of charges for coaches.

SAN FRANCISCO, which seems to need skilled labor more than anything else just at present, has not, it appears, given up its project for a great international exposition in 1913. There must be, apparently, an anniversary to serve as a peg on which to hang an international exposition in the United States, and in this case it is the discovery of the Pacific Ocean by Balboa in 1513; therefore, the show is to be known as the Pacific Ocean Exposition. The idea was broached in 1904, and, undeterred by the earthquake and fire of last April, the promoters are going ahead with the project.

The supply of anniversaries is endless, of course; but the exposition idea may be easily overdone. However, three years will have elapsed between the St. Louis and Jamestown expositions, and six more will pass before the date of that at San Francisco, so that, perhaps, sufficient time will intervene to obviate the staleness of repetition. At Jamestown, and probably to a greater degree at San Francisco, electrical applications and electric-lighting effects will play a conspicuous part.

ELECTRICAL ENGINEERING is peculiarly the offspring and handmaid of science, and the fact was brought out, incidentally, at the meeting last week of the American Institute of Electrical Engineers. While it is true of every branch of engineering that progress is based on scientific investigation, it is notably the case with electricity. Faraday did not produce his circuit moving in a magnetic field—the origin of all dynamos and motors—by inspiration or the suggestion of some shop device. The consideration of magnetic action, the conception of lines of force, an understanding of interactions between electric circuits and magnetic poles, preceded the origination of the first generator. The consideration of a subject so intricate as the form of alternating-current-wave distortion, due to hysteresis arising from the introduction of iron into the circuit, as at the Institute meeting, further illustrates this fact. The results of such investigations are of much practical importance, as was shown at this meeting by the case cited by Mr. Torchio. A large electric power company in New York tried to operate all its generators with the transformer neutral grounded and found a large short-circuit on the neutral. This was due to generation of a triple harmonic component, and was fully explained by analysis of the current. Without the aid of mathematical analysis the very conception of a triple harmonic would have been impossible.

PRESIDENT SHELDON of the American Institute of Electrical Engineers, in his inaugural address on "The Work of the Institute," delivered last week, made some interesting observations on the increase of membership. He thought a membership of 25,000, mentioned as possible by Past President Scott, was by no means extraordinary, in view of the enormous and continuous growth of the electrical industries. And yet many men of electrical prominence are not members of the Institute. Dr. Sheldon notes that "one of our foremost and largest universities, with an electrical engineering course in its curriculum, has not a single person connected with it whose name appears upon our rolls, nor does its library subscribe for the Transactions." But, more important than this, is the small number of members in some of the states, to which President Scott called attention. This has not been materially increased. "Perhaps, this is due," says Dr. Sheldon, "to the fact that persons eligible for membership are engaged in the operation of plants of but medium or small size, and that in our papers and discussions sufficient attention has not been given to this kind of work to stimulate their interest and warrant their enrolment." In our judgment this point is very well taken. No doubt the Institute has not devoted sufficient attention to the practical operating conditions of the smaller plants. Now that the president has called attention to the defect, we hope that steps will be taken to remedy it.

League of American Municipalities.

Several hundred mayors, aldermen and other city officials from places in the United States and Canada attended the tenth annual convention of the League of American Municipalities, held at the Auditorium Hotel, Chicago, September 26th to 28th. Many important municipal problems were discussed, and among these municipal ownership probably attracted the most interest. On this question, however, the league refused to go on record as for or against public ownership of public utilities.

R. G. Rhett, president of the league and mayor of Charleston, S. C., opened the meeting. Mayor Dunne of Chicago gave the welcoming address, in which he declared that the "despair of several years ago, when graft and boodle were rife among public officials in this country," was passing, or had passed away. He discussed the question of "private monopolies" generally—traction, gas, electric light and telephone—and said: "We are just now struggling with the telephone question. We intend to dispose of it in a hurry. The present company will come to the city's terms or else there will be a rival company installed which will treat the public fairly. Within three months we will have settled the traction question once and for all."

President Rhett in his address said that just how far it is wise to limit the government by requiring a referendum to the people is an exceedingly interesting problem. But probably the most interesting of the questions under the head is the limitation which policy would dictate as to the ownership of what are vaguely termed "public utilities." "As we have heretofore considered it," he said, "some particular phase or case has been presented and few have found it applicable to their own conditions. The very term 'public utility' is vague, and the first question which needs solution is the precise meaning to be given that term. It seems to me it would be much more satisfactory to consider this question of municipal ownership by taking up each specific utility, such as water, light, transportation, etc., separately. There would then be no confusion; and, inasmuch as it may very well be found wise under given conditions for a municipality to operate some of these utilities and unwise to undertake others, I am sure more practical benefit to our members, if not to mankind, would follow this course than any other we could adopt."

Before adjournment of the first day's session Z. P. Brosseau welcomed the delegates on behalf of the citizens' committee of Chicago, which furnished entertainment for the visitors.

The second day's session was devoted to the reading of papers of importance to municipal officers. Among the papers were: "Franchise Conditions in New York," by Harry P. Nichols, assistant engineer of the Bureau of Franchises, and "The Municipalization of Street Railways in Toronto," by Emerson Coatesworth, mayor of Toronto.

A spirited attack on the terms of many franchises to public-utility corporations was made by James M. Head of Boston, former president of the league. "A perpetual franchise is a crime against humanity," he said. "No municipal franchise should be granted to a public-utility corporation unless the municipality is guaranteed a percentage of the earnings of the company. Neither should any municipality grant a franchise to such a corporation without reserving the right of repurchase. A franchise with the right of repurchase at any time on reasonable notice is vastly superior to a limited franchise."

The last day was taken up in the discussion of municipal ownership and the election of officers. Although Mayor McCaskrin of Rock Island and Alderman William Stearns of Adrian, Mich., had introduced resolutions seeking to obtain an expression from all the delegates on the municipal-ownership question, the committee on resolutions failed to report out either of the measures. The resolutions committee did present a resolution to change the constitution so it would be made clear that the organization holds no official policy as to municipal ownership, but the resolution was tabled because the delegates declared it was sufficiently plain already that the league had no official belief on the subject.

The formal discussion on municipal ownership was opened by Frank Parsons, president of the the Boston Municipal Ownership League, who argued in its favor. He said in part: "Streets and street franchises are public in their nature. If part of the uses of the street can properly be given over to a private corporation, why not the whole? And if the whole of the street or the uses of the streets themseles rightly can be given to a private corporation then our so-called public agents can give the city itself, body and soul, to a bunch of stockholders for their private emolument, for entire possession of the streets would mean control of every life and the use and value of every piece of property. Private ownership is unjust and un-American. It means sovereign power in private hands."

The chief argument against municipal ownership was voiced by Prof. Frank H. H. Roberts of Denver University, Denver. "Some of the objections to municipal ownership," he said, "are these: (1) By the ordinary methods of election it is impossible to choose men qualified to conduct the business of tramways, gas, water, etc.; (2) municipal trading is detrimental to all business interests; (3) labor suffers; (4) it raises taxes; (5) municipal trading lessens the credit of the towns. The advocacy of municipal ownership is distinctly detrimental to the best interests of a city. If the agitation in Chicago should cease, three years would show a transformation in the tramways."

At the closing session Mayor Dunne of Chicago was elected president of the league by a close vote. Norfolk, Va., was selected as the convention place for next year.

The entire list of officers elected is as follows:

President—Edward F. Dunne, Chicago.

Vice-presidents—George M. Hine, Poughkeepsie, N. Y.; J. E. McCafferty, Wilmington, Del.; L. A. La Pointe, Montreal, Can.; Silas Cook, East St. Louis.

Secretary-treasurer—John MacVicar, Des Moines, Iowa.

Trustees—Hugo S. Grosser, Chicago; D. E. Hineman, Detroit; M. A. Brouse, Kokomo, Ind.; Louis Betz, St. Paul; C. O. Lobeck, Omaha; E. F. Brush, Mount Vernon, N. Y., and W. J. Hosey, Fort Wayne, Ind.

The Berlin Space-telegraph Conference.

Writing under date of September 18th the Paris correspondent of the Western Electrician says: "The international space-telegraph conference, which is to be held at Berlin on the third of October and succeeding days, will no doubt settle a number of important questions, and result in establishing a set of international regulations. All countries have been asked to send delegates to the conference. It is desired especially that Great Britain shall adhere to the rules which the conference is to draw up. In the case of most of the nations, the governments have control of aerial telegraph operations. England is the only country in which the monopoly has been conceded to private companies. Some trouble results from this, as, for instance, the English vessels, in most cases, refuse to exchange commercial messages with foreign boats if these latter are not equipped with the same type of apparatus. France will take an active part in the conference. Mr. Barthou, minister of posts and telegraphs, presided at a meeting of the French delegates not long since. The marine, war and colonies departments, besides the former department, have each selected a certain number of delegates for the conference, and at the meeting referred to they took concerted action as to the attitude which they are to observe at the conference."

The London correspondent of the Chicago Daily News adds that England will send eight delegates to the Berlin conference on wireless telegraphy—three from the Admiralty, three from the War Office and two from the Postoffice. At the former wireless conference in 1903 the British delegates refused to support Marconi against the Germans. This time they will take the contrary course on the ground that the German proposal to unify all wireless communication under state control is technically and commercially impracticable.

From Rome comes the statement that complications are likely to follow the forthcoming Berlin conference owing to Italy's independent attitude in supporting Marconi's rights and opposing restrictions upon the liberty of his company. England and France are willing to back Italy, it is said, hence the result of the conference may be a failure. The Chicago Daily News correspondent at Rome is informed that "if the German opposition is not overcome Marconi expects to prove that the German system of wireless telegraphy is plagiarized from his own with the kaiser's knowledge and aid. Italian statesmen fear that this, following the Algeciras conference, will rouse Emperor William's ire and perhaps cause the last link in the triple alliance to be severed."

Delegates from the United States to the Berlin conference are Mr. Tower, the ambassador to Germany, Brigadier-General James Allen, Rear Admiral H. N. Manney and John I. Waterbury of New York. General Allen, Admiral Manney and Mr. Waterbury were nominated, respectively, by the departments of War, the Navy and Commerce.

At last month's meeting of the Institute of International Law, held in Ghent, Belgium, cognizance was taken of new elements introduced into the relations of belligerent and neutral powers by the use of space telegraphy in time of war. A series of rules governing these relations was adopted. Though these rules do not have the force of law until formally enacted by the various nations, they are excellent indications of the legislation which is likely to prevail on this subject, as the powers attach great weight to the conclusions of the Institute.

Rules governing wireless communication in time of peace are made to apply in time of war. A neutral state may be prevented by belligerents from sending wireless messages anywhere within the sphere of military operations. Neutral states are not compelled to stop the transmission over their territory of wireless messages sent to a belligerent. Neutrals may control space-telegraph stations of belligerents operated in their own territory. Notice of any restrictions on Hertzian wave communication imposed by belligerents must be at once sent to neutral governments. Neutral balloons, ships or appliances which have beyond a doubt been used to furnish a belligerent information damaging to his adversary may be removed from the sphere of military operations, and the space-telegraph appliances on board may be confiscated. Persons captured while communicating by space telegraphy with belligerent territory or between the different divisions of a belligerent's forces are to be treated as prisoners of war and not as spies, unless they masked their operations by false pretenses; but carriers of dispatches sent by space telegraphy who use concealment or ruse in their work will be considered as spies.

Prospects of Electric Traction over the Sierra Nevada Mountains.

The San Francisco correspondent of the Western Electrician writes that although the California papers have announced that the Southern Pacific Railroad Company has begun the work of installing an electric traction system on its Ogden line over the Sierra Nevada Mountains from San Francisco, there is no official confirmation of the reports. There is, however, a probability that something may be done within the next two years. Frank J. Sprague, who has been one of the consulting engineers for the New York Central electric installation, recently visited Truckee, Cal., with other engineers and looked over the situation from an electrical standpoint and will make a report. It is understood that if it can be shown that by the assistance of electric motors freight can be transported over the summit of the mountains at a less expense for equipment and operation than would be attained by boring the five-mile tunnel that has been projected through the range to secure easier grades, the company is favorable to electric traction. Engineers of the General Electric Company and other concerns have been figuring with the railroad officials for some years along this line and are still at it. With cheap fuel oil the company could install a steam-power electric plant at a convenient point and transmit the current necessary to operate cars over the heavy grades for 200 miles. Many of the Southern Pacific officials are in favor of an electric system, although some have been considerably impressed by the possibilities of the gasoline motor cars constructed by the Union Pacific. One of these was tried out at Pasadena, Cal., on passenger service and it showed numerous defects as well as good points.

New Italian Tariffs.

The new Italian tariff which went into effect this year provides, among others, the following rates, the first being the conventional, or most favored nation, and the other the general rate. Where there is only one rate it applies to all countries.

Motor cars for ordinary roads, weighing 500 kilograms or less, $40 each; more than 500 up to 1,000 kilos, $80 each; more than 1,000 kilos, $120 each.

Dynamo electric machines, weighing more than 1,000 kilos, $3.20 and $6 per 100 kilos; weighing 1,000 kilos or less, $5 or $6 per 100 kilos.

Electric accumulators, $3.20 per 100 kilos.

Electric transformers, with or without oil, $5 per 100 kilos.

Apparatus for the application of electricity, including regulators, switches and starters, resistances, interrupters, commutators, controllers, speed regulators, cut-offs, etc., weighing 100 kilos or less, $6 per 100 kilos; weighing more than 100 kilos, $5 per 100 kilos.

Electric clocks, $10 per 100 kilos.

Graphite, free.

Electric wires and cables composed of one or more metallic conductors covered with textile materials and varnish, guttapercha or india-rubber, $10 or $12 per 100 kilos.

Electric cables composed of one or more metallic conductors, covered with insulating materials, strengthened and protected with iron or any other metal, including submarine cables, $5.60 or $6 per 100 kilos.

The Work of the American Institute of Electrical Engineers.

President Samuel Sheldon presided at the first regular meeting for the season of the American Institute of Electrical Engineers, which was held at the Edison Auditorium, West Twenty-seventh Street, New York city, on the evening of September 28th.

Secretary R. W. Pope announced that at the meeting of the board of directors held in the afternoon 191 associates were elected, and that George A. Wells, Jr., chief engineer of the Adams Express Company, had been transferred from associate to full membership.

President Sheldon then read his address, which is given in full herewith.

At the last convention, held in Milwaukee, the question of the work of the branches of the Institute and their relations to the executive offices in New York revealed the fact that there was considerable lack of information concerning the scope of the Institute work and the method of carrying it on. The growth of the Institute as a national organization and the extension of its usefulness to its membership is so largely dependent upon the intelligent co-operation of the local organizations that it seems desirable that all should be familiar with its work.

Secretary's Office.—The secretary is the executive officer of the Institute and has charge of all of its routine work. Because of his familiarity with all phases of the work, he is being constantly called into conference with the officers and committee men over questions of policy, ways and means. He receives many calls from members visiting New York, and is often able to assist and give valuable advice and introductions in furtherance of professional purposes. This is especially true in the case of members coming from foreign countries. In carrying on his work, except that which he is, by the constitution, required himself to perform, he has the assistance of a staff of six assistants, besides an editor and a bookkeeper. The character and amount of routine work done during the year ended April 30, 1906, is indicated by the following:

Institute Office Statistics for Year Ended May 1, 1906.—During the year there were 9,802 letters received and more than 4,000 written. There were 2,760 changes of address made in the catalogue, directory, mailing list and card index. This indicates that the addresses of more than 70 per cent. of the members were changed during the year.

The number of bills rendered was 5,928; items of remittances received, 4,858; bills received and checked, 825; checks and warrants drawn, 338.

There were 572 applications for election received, and in connection therewith 1,716 endorsement forms were issued, of which 1,638 were returned. The number of applicants for transfer was 53, involving the forwarding and return of more than 600 inquiry forms for the consideration of the board of examiners.

Seven additions of monthly announcements, aggregating 96 pages, were prepared and distributed.

Numerous notices and circular letters were prepared, printed and distributed to the membership. These related to a variety of subjects such as Institute meetings, convention, proposed revision of the constitution, proposed law regarding the metric system, invitations to visit Europe from our sister societies in England and Italy, and other Institute business.

The number of pages of engineering papers and discussions edited and proofread for publication in the Transactions was 1,138. In connection therewith 91 half-tone, 196 wax, and 68 zinc engravings were made. In addition to the above mentioned engineering papers there were about 250 pages of current Institute news prepared and published in the monthly Proceedings, and not included in the Transactions. More than 54,000 copies of the Institute Proceedings were mailed, 60,250 advance copies of engineering papers were printed and distributed.

The cost of the year's work for the Transactions, salaries, postage, express, stationery, printing, etc., was $40,767.22, or $10.48 per member. The total receipts per member during this period were $12.97, and therefore five-sixths of the receipts were disbursed in the interests of the membership at large, irrespective of location.

The Board of Directors.—The board meets regularly once a month and performs the duties customary with such a body. It makes appropriations, approves bills and recommendations from committees, and determines and outlines broad questions of policy.

The constitution authorizes the appointment of an executive committee of seven members to which the board may delegate certain of its powers. This provision was made to enable the Institute work to go on in case a quorum of the directors could not be obtained. However, the executive committee has had but few meetings in several years, because of the large attendance of the directors and their great interest in the Institute work. The members of the board are as a rule quite familiar with details. Their attendance is probably due not only to their immediate interest in the Institute work, but to the fact that the meetings offer an opportunity for professional intercourse between its members. With a wider geographical distribution of the membership of the board it might in the future seem desirable to make greater use of the executive committee, but one or two meetings per year of the full board being held. Under such circumstances it might seem advisable to furnish free transportation to the members coming from a distance.

As is usual in similar organizations, much work is performed by committees under the immediate direction of their respective chairmen. The general character of the work of these committees and some of the problems which they are endeavoring at present to solve follow:

The Board of Examiners.—This board receives from the secretary all applications for membership, or for transfer, passes upon the qualifications of various applicants, and makes recommendations to be acted upon by the board of directors. The requirements for election as an associate are so easily fulfilled that only about two per cent. of the applicants fail to qualify.

The requirements for transfer to the grade of member are specifically stated in the constitution, and it is desirable that a high standard should be maintained. It seems as though applicants for transfer could readily determine for themselves, from a perusal of the constitution, whether or not they are eligible for transfer to this higher grade. A large portion of the labor of this committee is due to the loose and indefinite manner of filling out the specification papers on the part of the applicant, and the tendency to refer to members of professional eminence, or those prominent in Institute work, rather than to members who are familiar with the applicant's career and who are competent to corroborate the statements made in his application. Careful reading of the constitution and by-laws, definiteness in filling out the application blank and proper selection of references will facilitate the work of this committee and materially reduce the time necessary for transfer.

The Committee on Increase of Membership.—The removal of the executive offices to the new Engineering Building will entail an increased expenditure for carrying on the Institute work. To provide for this the simplest method seems to be to increase the membership. The secretary's staff is able, with slight additional expense, to take care of twice as many members as we have at present. The increase of expenditure incurred by the increase of membership will be due to an increase in the number of Transactions, of printing, and of postage. The enormous annual growth of the electrical industries is accompanied by a similar increase in the material available for membership; and the figure of 25,000 possible members given by President Scott in his inaugural address seems by no means to be extraordinary. While in recent conference with a member concerning the make-up of a committee, of the several names suggested as suitable for appointment, one-half were not to be found in the Institute directory. The small number of members in some of our states, to which President Scott called attention, has not been materially increased. Perhaps this is due to the fact that persons eligible for membership are engaged in the operation of plants of but medium or small size, and that in our papers and discussions sufficient attention has not been given to this kind of work to stimulate their interest and warrant their enrollment. One of our foremost and largest universities, with an electrical engineering course in its curriculum, has not a single person connected with it whose name appears upon our rolls, nor does its library subscribe for our Transactions; on the other hand, another of our large universities has connected with it 22 members and associates. This committee is about to take active measures to bring to the attention of non-members the advantages to be obtained from membership in our organization.

The Committee on Telephony.—Complaints have been received from members engaged in telephone work that not sufficient attention has been given in the past to this subject; and in some cases resignations have been threatened for this reason. It is true that the number of papers presented on this subject has been few, although those presented have been by the most eminent authorities, and some of them have been classic in character. This committee will take measures to increase the usefulness of the Institute to this art, by arranging for meetings on this subject, designed to bring out discussion from members who are too busy to prepare papers, these meetings to be held at various branches instead of at New York. It will also assist the preceding committee in widening our membership in telephone circles.

The Committee on Local Organizations.—A marked increase in the usefulness of the Institute cannot be accomplished except through the co-operation of the executive committees of the branches. It is therefore desirable that the branches should be well organized and that their work should be carried on in a manner as efficient as possible. It seems desirable that in most cases their executive committee should be made up of but five members, and that the time of their election should be shortly after the regular Institute election, to enable them to make preparation for active work when the Institute year starts in September. A larger committee enables the members to shift upon each other's shoulders the responsibilities for good branch work, which results in a lack of co-ordinated effort. The exceedingly attractive programme of the Schenectady branch for the coming season has, however, been arranged by a committee of nine. The branches should be in constant communication with the secretary's office, not simply that the progress of their work may be known, but so that they may give and receive suggestions with a view to attaining a greater efficiency. The branches can be of great assistance in increasing the membership by exerting organized efforts in the localities of which they are centers. They can, without undue loss of dignity, from immediate knowledge suggest to associates in their vicinity the desirability of making application for transfer to the grade of member. The transfer, it is true, means slightly increased dues; but this slight additional cost is more than compensated for by the prestige resulting from the official recognition of the applicant's professional attainments and standing by the Institute's board of examiners.

Furthermore, such slight additional expense is but a small matter to such members; and it is their duty to the organization which represents their profession to enroll themselves in its advanced grade.

Interest in the branch meetings will be hard to sustain if the programme consists chiefly of papers that have been previously read in New York. It is very desirable that original papers should be presented and that local talent should be brought to the front. Efforts should also be made to obtain original papers from men eminent in our society, but who live at a distance. This has been done with marked success in some branches and discussions of great value have been drawn from those in attendance, but from whom formal papers could not be obtained without great difficulty. Arrangements will be made in the future to publish the best of these papers in the Transactions. Experience shows that eminent engineers coming from a distance take great pains to please their audiences, and are rewarded, encouraged and helped by the sympathetic attitude of their listeners. Lectures or instructional papers by local members of expository ability, dealing with prior art and conditions, underlying theory, or present standard practice, are of particular value to younger, rising members, and properly find a place in the branch programme. It is also desirable that an annual calendar, including the dates of future branch meetings, should be made up to enable the secretary's office to co-operate with the executive committees of the branches. All this work of the branches will be co-ordinated and assisted through the efforts of the committee on local organizations.

The Committee on High-tension Transmission.—The results of the work of a committee thus designated, published during 1902-3, proved of such great value that they were reprinted and bound in a single volume under the auspices of a publishing company in co-operation with the Institute and placed upon sale so as to be accessible to the public. In view of the many systems installed since that time and the large number of proposed systems for transmission over much greater distances than ever before, which will use increased voltages, involving many difficulties of insulation, of protection and of construction, the reappointment of a committee for this work has been deemed desirable. The meetings arranged by this committee will be held at interior points in order to insure wide representation, large attendance and full discussion.

The Library Committee.—This committee has a great deal of work in hand. Besides installing and systematizing our present library in its new quarters, some organization for co-operative management in connection with the libraries of the mining and the mechanical engineers should be effected. By the constitution this committee is required to direct the expenditures for the furnishings which will be required in the new executive offices. In the past the library has been but of small use to the members not residing in the vicinity of New York. It is expected that in the near future arrangements will be made by which distant members can obtain lists of publications on desired subjects, abstracts and translations for a nominal fee. This committee will also prepare an author's and subject index of the Transactions, in which will be included the papers presented at the International Electrical Congress held at St. Louis in 1904.

To meet adequately the requirements of the membership represented by the United Engineering Society, extensive additions should be made to the existing three libraries. Competent authorities have considered this question and have concluded that there should be an immediate expenditure of $125,000, and a fund which would provide an annual income of $30,000 to be expended for maintenance and operation.

The Committee on Bibliography.—This committee expects to have in press by next December a chronologically arranged, annotated bibliography of the Wheeler gift. In addition to the main bibliography of books and periodicals there will be appendices covering a great part of the pamphlet literature, including parliamentary papers, patents

and litigation, trade catalogues, prospectuses and reports on projected undertakings in telegraphy, cable and telegraph tariffs and instructions to operators as to the care and use of instruments, and extracts cut from periodicals not devoted exclusively to electrical subjects. The book will contain about 500 pages. Its preparation has entailed a great deal of labor, and the manuscript has been critically examined at the British Museum, in the libraries of several of the European electrical associations and in our own Congressional Library.

The Editing Committee.—This committee, upon which rests the responsibility of the publications of the Institute, has in the past been burdened with a mass of correspondence and critical reading which it is unfair to expect without compensation. There is no valid reason why the responsibility should not be delegated to the editor and the labor be performed in the secretary's office. Furthermore, the services of this committee are needed in other directions. The monthly Proceedings, because of the character of its contents, appears irregularly, and frequently remains unopened or unread upon its receipt. This condition should not be allowed to persist. Every number should contain such fresh, interesting and valuable material as to excite curiosity and command the immediate attention of him who receives it. It should be the official organ of the Institute in fact as well as in name. Its ephemeral portion, besides containing the announcements from the executive offices, should contain news concerning the individual members and the branches.

The editing committee will consider this matter with a view of not only making the Proceedings more attractive but of increasing its value as an advertising medium.

The Committee on Standardization.—Prof. F. B. Crocker and Mr. C. O. Mailloux of this committee represented the Institute at a meeting held recently in England in which 10 nations were represented. An organization of an International Electrotechnical Commission was effected in which the Institute, as representing the United States, will be entitled to one vote. The commission will probably meet during the coming year. This committee also has in hand the rearrangement and reclassification of a report which was presented, in a preliminary form, at the last convention of the Institute.

Committee on National Electrical Code.—This committee will continue to look after the interests of the Institute in the meetings of the National Conference on Standard Electrical Rules and the Underwriters' National Electric Association.

The Committee on Law.—This committee considers the legal aspect of actions about to be taken by the board of directors, interprets the constitution and by-laws and makes recommendations concerning their amendments.

The Committee on Papers.—This committee, besides carrying on the usual work of arranging for meetings and directly soliciting papers, expects the co-operation of the executive committees of the branches and of the committee on local organizations in its work. With this assistance it expects to present an attractive programme.

The Committee on Finance.—The direct supervision of the financial affairs of the Institute is entrusted to this committee, approval of all bills for payment and recommendations as to the investment of funds resting with it. The financial arrangements attending the removal of the Institute offices into the new Engineering Building and the details of the adjustment of our financial relations with the United Engineering Society will be considered by this committee.

The Building Fund Committee.—As a result of the admirably directed efforts of this committee $132,000 has been raised. Of this $94,000 has been paid, and $38,000 is in the form of time pledges. It is hoped and expected that when the new building is formally given over to the United Engineering Society during the coming year the whole amount of $180,000 due from our Institute will have been raised. The architect a few days ago stated that the building will be ready for our occupancy on December 1, 1906.

This building is bound to become a center of activity which will help to shape the destiny of our nation. The present remarkable epoch, which Mr. George S. Morison states is characterized by "the manufacture of power," is due primarily to the professional activities of the members of the three founder societies whose representatives form the holding and administering corporation known as the United Engineering Society. Our work does not end here. Having brought about this condition, it now rests with us to control it. On us, then, rests largely the responsibility for the overcoming of the short-sighted and selfish extravagance in the use of our natural resources so recently commented upon by Mr. James J. Hill. The immediate future, prophetically described by Mr. Hill, with its expensive fuel, its scarcity of iron, and its large population, will demand from these members a more efficient transformation, transmission and utilization of our supplies of stored energy, and a more extensive use of our immediately received energy. The new Engineering Building stands for the fulfilment of this great purpose.

Two technical papers were read at the meeting. The first was on "The Effect of Iron in Distorting Alternating-current Wave Form," by Prof. Frederick Bedell of Cornell University and Elbert B. Tuttle. The discussion was opened by Dr. C. P. Steinmetz of Schenectady, and Prof. W. S. Franklin of Lehigh University and Philip Torchio of New York participated, Professor Bedell closing.

"The Current Transformer" was the subject of the paper prepared by Prof. Kenneth L. Curtis of Stanford University and presented by H. S. McAllister. Louis T. Robinson of Schenectady discussed the paper at some length.

Bedell and Tuttle on Alternating-current Wave Form.

Dr. Frederick Bedell of Cornell University read a paper prepared by him in collaboration with Mr. Elbert B. Tuttle on "The Effect of Iron in Distorting Alternating-current Wave Form" at the meeting of the American Institute of Electrical Engineers in New York on September 28th. Though the paper is theoretical, the results arrived at have important practical application, as was well brought out by Dr. C. P. Steinmetz in his discussion of the deductions.

To investigate the effect of hysteresis on the wave form Dr. Bedell proceeded by superimposing different characteristics of current and by producing from these complex currents a hysteresis loop. From the consideration of the various hysteresis loops he derived relations regarding the relative intensity and phase of the triple harmonic and also the wave of the exciting current.

In case of a sine electromotive force and a complex current wave due to iron, the harmonics in the current wave (being 3, 5, 7, etc., times the frequency of the electromotive force) can represent no power. Any power must accordingly come from that part of the complex current wave which is of the same frequency as the electromotive force. In this investigation the effect of harmonics above the third is not considered. The electromagnetic effect is represented by the complex current curve, and this again considered as made up from the fundamental and the third harmonic; which latter, though wattless, materially effects the form of the resulting curve. When iron is introduced in the circuit the induction is not proportional to the current and magnetizing force, and with induction sinusoidal the current is not sinusoidal but distorted.

Different successive definite relative amplitudes and phase positions are assumed and the corresponding complex current wave is worked out. From this and the sine wave of flux the hysteresis loop which would cause such a current is determined.

These results are given comprehensively in the accompanying table, in which

θ is the phase relation of the third harmonic to the fundamental at the origin.

β is the ratio of the maximum ordinates of the fundamental and third harmonic (critical value).

ψ is the phase difference between the maxima of the distorted and fundamental curves.

$90° - \psi$ is lag of fundamental component of current behind electromotive force.

$90° - \alpha$ is lag of equivalent sine current behind electromotive force.

I and I′ are the maxima of the equivalent sine curve and distorted curve, respectively, the maximum value of the fundamental being unity.

θ	β	α	ψ	I	I′
0°	0.111	0°	0°	1.006	0.8890
2°	0.122	16° 54′	17°	1.007	0.8832
5°	0.135	22° 48′	23°	1.009	0.8833
20°	0.172	29°	29° 30′	1.015	0.9250
30°	0.193	29° 33′	30°	1.019	0.9624
45°	0.220	28° 38′	29° 22′	1.024	0.9868
90°	0.283	19° 36′	20° 30′	1.039	1.1850
135°	0.321	10° 12′	10° 45′	1.050	1.2950
180°	0.333	0°	0°	1.053	1.3330

Vector Representation of Complex Current.

An interesting and novel result of this investigation is the use of three dimensional co-ordinates in the vector representation of these complex currents.

Where the current and the electromotive force are sinusoidal they are vectorially represented by lines in a plane. With the introduction of iron into the circuit the current I becomes complex, being composed of the fundamental F and the third harmonic Q_3 (see cut). The fundamental F may be considered as the resultant of a power component P in phase with E, and a quadrature or wattless component Q_1 at right angles to E, that is, $F = \sqrt{P^2 + Q_1^2}$. As the harmonic Q_3 has no power component in phase with E, it is represented graphically in quadrature to E. Now it may be shown that $I = \sqrt{F^2 + Q_3^2}$, which corresponds to a graphical construction in which Q_3 and F are two sides of a rectangle and I the diagonal. As Q_3 is thus at right angles to both E and F, it is drawn in the third dimension at right angles to the plane of fundamental frequency in which lie E, F, P and Q_1.

In conclusion the authors sum up their results as follows:

We conclude that an alternating current is distorted when iron is present by the introduction of a third harmonic in advance of the fundamental by an angle θ which is greater than 30° and less than 180°.

Taking the fundamental as unity, this harmonic cannot exceed a definite value (see Table I) of about 0.192 for $\theta = 30°$, and 0.333 for $\theta = 180°$.

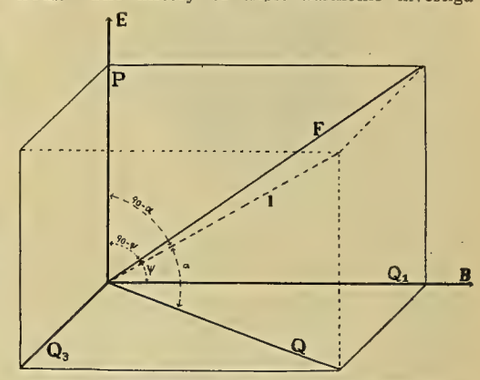
The angle ψ of hysteretic advance due to the third harmonic cannot exceed 30°.

From the shape of the hysteresis loop obtained from the third harmonic only, it is concluded that iron introduces higher harmonics in addition to the third.

Three dimensions (as in cut) are required for the vector representation of the complex current wave.

Discussion.

Dr. Steinmetz opened the discussion. He said that there is today only a very short step between pure scientific investigation and engineering practice. Then he proceeded to show that the phenomenon dealt with in the paper and similar phenomena are of very great practical importance in alternating-current distribution; that is, that wave shape distortion may lead to effects not only very marked and pronounced, but occasionally disastrous. The history of triple harmonic investigation was passed in review and interesting cases of triple harmonic disturbances in transformer practice were cited.



VECTOR REPRESENTATION OF A COMPLEX CURRENT IN THREE DIMENSIONS.

How important these effects may become was shown by consideration of three transformers connected in star in the three-phase system. Here the triple harmonics are 360° apart and cannot flow because they have no circuit. Each transformer has an electromotive force higher than the vector diagram. In case the transformer feeds a long-distance system and the neutral is grounded, there will be triple frequency in series with inductance and capacity. Such a combination may be very serious in certain circuits with destructive voltage, and even if not serious, the rise and fall of the whole system at every frequency means electrostatic induction on neighboring circuits. Various other cases were discussed, showing conclusively that the subject of the paper has a decided practical interest.

The Mathematical Investigation of Alternating Currents.

Prof. W. S. Franklin of Lehigh University in the course of his remarks presented the question of mathematical investigation of alternating currents in a most lucid manner, which should be of value to many students groping in the fog of this intricate subject. He said:

"If you have an alternator which develops an electromotive force of any complicated wave shape whatever, the problem often arises to determine the current produced by the electromotive force. That problem mathematically resolves itself into a series of problems, each one of which is an ordinary simple alternating-current problem. The first thing you must do is to resolve the matter into harmonics and then treat each harmonic electromotive force by itself, and discuss the currents produced, and if the currents are distorted you must analyze them and handle them in an elementary way. That is the theory of alternating currents based on harmonics. It is the only method to pursue, and when you attack the problem of electromotive force, the first thing you must do is to break it up into harmonic numbers and proceed with a series of problems step by step. It simply means if you limit yourself to the fundamental, you have only solved one problem and you must let all the others go."

Philip Torchio of New York brought out the fact that one of the large companies of New York tried at the start to operate all the generators with neutral grounded, and found a large short-circuit current on the neutral which was due to the third harmonic.

The Portland (Pa.) Power Company has been incorporated with a capital of $500,000, the object of which is believed to be to tap the Delaware River a short distance above Belvidere and divert the water for electrical purposes, carrying it through a canal about four miles to Foul Rift, at which point a power house will be erected for trolley, electric-light and power purposes.

THE SMALL CENTRAL STATION.

Practical Hints on Its Construction and Operation.

CHAPTER XIII.

Line Construction.

The immediate need of proper pole-line construction in small central-station work is all too apparent to the casual observer to leave any opening for an argument upon this point. Too much attention cannot be paid to the correct construction and proper maintenance of a distributing system, if good returns upon investment in electric lighting and power properties are expected.

Heretofore elaborate specifications have been drawn stating the requirements of the station equipment, and much time and labor spent upon the proper installation of boilers, engines, generators and switchboards, to the almost absolute exclusion of the requirements of a distribution system. As a result unsightly pole lines are in evidence everywhere and continual expenditures are necessitated to maintain even the poorest possible connection between the customer and the generating station.

Another result of this neglect of transmission systems is seen in the recent numerous instances of local authorities compelling electric-lighting companies to put all distributing lines in conduit underground. The almost prohibitive first cost, together with the high maintenance cost of an underground system, make the net returns of the average central station so small on the investment that managers should be forewarned and see to it that all overhead work is done with the same amount of care that they require on their books.

Available space prohibits an exhaustive discussion of this important subject, but the following hints will be sufficient to give to the reader the important points of a good pole line.

Poles.—The poles commonly employed are chestnut, southern cedar and pine. Of the above, live white chestnut is preferred, being longer lived than pine and possessing much greater mechanical strength than southern cedar. When purchasing poles the following points should be observed:

See that the poles are straight, made of live wood, have bark well removed and have all knots trimmed flush with the surface. The accompanying tables give dimensions and other data on poles suitable for line construction:

Pole Dimensions.

Length.	Circumference at Top, in Inches.	Circumference Five Feet from Base, in Inches.
25	19	39
30	19	40
35	25	42
40	25	44
45	25	50
50	25	57
55	25	63
60	25	69

Average Weight of Poles, with Number of Poles to the Carload.

Length in Feet.	Average Weight of Poles, Pounds.				Length in Feet.	Number of Poles to the Carload.		
	6-in. Top.	7-in. Top.	8-in. Top.	9-in. Top.		6-in. Top.	7-in. Top.	
25	250	300	380	470	25	110	100	1 car
30	330	450	500	625	30	75	66	2 cars
35	440	700	850	1,050	35	70	60	2 cars
40	575	.....	.....	.....	40	.....	60	2 cars
45	725	.....	.....	.....	45	.....	50	2 cars
50	925	.....	.....	.....	50	.....	40	2 cars
55	1,150	.....	.....	.....	55	.....	33	2 cars
60	1,400	.....	.....	.....	60	.....	30	2 cars

Pole-line Construction.—Poles are set in the ground to depths corresponding with their length as follows: Twenty-five-foot poles, 4½ to five feet; 30, 35 and 40-foot poles, five feet; 45 and 50-foot poles, six feet; 55 and 60-foot poles, seven feet. All poles should be roofed at the top to form approximately a right angle. Each pole should be gained to form a flat of five inches or thereabouts for the attachment of cross-arms. Two feet at the least should be allowed between cross-arms and the top arm should be one foot below the top of the pole.

Step all poles on which are located apparatus requiring regular inspection. This will facilitate work and save time for workmen. Standard steps are made of one-half inch galvanized iron threaded three inches and are nine inches long. The first step should be placed six feet above the ground. Steps are placed 14 to 16 inches apart, the distance between two steps on the same side of the pole being 28 to 32 inches.

There is considerable difference of opinion regarding the proper spacing of poles, but a fair average places the distance between poles set in a straight line at from 120 to 140 feet. Poles set on a curve should be brought nearer together, set deeper, and should be given a general lean from the inside of the arc of the curve. All end and corner poles should be guyed with stranded galvanized wire, varying in size from one-fourth to three-eighths inch, depending upon the strain to be taken up. Strain insulators should be provided in all cases, and all guy wires in the business districts should be attached to stubs at a point at least six feet above the sidewalk line.

On long transmission lines some engineers recommend the guying of every tenth pole, the guy wire being strung from the top of one pole to a point about six feet above the ground on the next.

Junction poles should be wired as simply as possible. All branch lines should be attached to reverse arms, and connections to the main circuit made by vertical steps.

Cross-arms.—Cross-arms should be made of selected Norway pine, free from knots and sap, and finished on all four sides. All the upper corners should be chamfered except where the cross-arm is to be fastened to the pole. Cross-arms may be attached to the pole either by lag screws or carriage bolts, although the latter are preferable. Where lag screws are used holes should be bored and the lags screwed in and not driven in. Washers should always be used. Standard practice employs lag screws or bolts five-eighths inch in diameter, the length varying with the diameter of the pole top.

Cross-arms are usually bought unpainted to allow of thorough examination. Before attaching cross-arms to poles they should receive a double coat of linseed oil and lead. Gains in poles should be given a double coat of oil and lead, and the cross-arms placed in position before this coating dries. All cross-arms supporting more than two pins should be properly braced.

Braces, Pins, Insulators.—Braces are made of galvanized iron, 28 inches long, 1¼ inches wide and from three-sixteenths to one-fourth inch thick. The upper end of the brace is attached to the cross-arm by means of a carriage bolt from three-eighths to one-half inch in diameter by four inches long. The lower end of the brace is held firmly to the pole by means of a lag screw of the same dimensions.

Locust pins are preferable to all other wooden pins, and these should be thoroughly boiled in linseed oil before using. An average size pin is 1½ inches in diameter at the shoulder by nine inches long where used on lines carrying current up to 5,000 volts pressure.

Double-petticoat glass insulators are used in many installations up to and including a line pressure of 5,000 volts. Above this pressure triple-petticoat insulators should always be employed if satisfactory insulating results are to be expected. On alternating-current systems the limit for double-petticoat glass insulators is considered in good practice to be 2,000 volts.

Lightning Arresters.—Lightning arresters should be installed on the main line for the protection of transformers and station apparatus. Station arresters should be installed so as to be under continual supervision and should be the best obtainable. All branch lines should be protected by at least one set of arresters and by more where great length of line and numerous transformers are to be protected.

All lightning arresters should be properly grounded. A poor ground on an arrester renders its operation very uncertain, and therefore defeats its purpose.

Arresters should be installed with a suitable means of cutting them out of service for inspection. Whatever means are employed—switches, fuses, copper wire, etc.—care should be taken to have a carrying capacity in the cut-out equal to that of the line.

Regular inspection of all lightning arresters should be made and additional inspection should be required after every heavy electrical storm.

Fuse Boxes.—A satisfactory fuse box for alternating-current circuits of 2,000 to 2,500 volts pressure should fulfill the following requirements if in keeping with the practice of the Association of Edison Illuminating Companies, the rules of which association are given as worthy of adoption.

First—The fuse should be capable of opening the circuit under any and all conditions of overload or short circuit.

Second—The fuse box should be designed to prevent any leakage of current from the metal parts in circuit to the case of the box, under any and all conditions of weather. In other words, the insulation must be such as to allow of mounting the box on an iron cross-arm.

Third—The break distance should be such as to allow of the opening of the box under an inductive load of at least 30 amperes without causing trouble.

Fourth—The box should be so designed as to make attachment to standard cross-arms easy and certain, and be so placed as to be easily opened for inspection and replacing of fuses.

Fifth—The introduction of wires should be such as to render contact with them unnecessary when opening the box.

Sixth—The design should be such as to put a lineman in no danger from an arc or from hot metal on the replacement of a fuse.

The above requirements are, perhaps, entirely met by no box on the market at present, although a number of designs fill several of them. Fuses in boxes on branch circuits should be of such a capacity as to blow readily on a current far below that at which the station breakers operate. Transformer cut-outs should be so placed as to be easy of access and capable of being reached with safety.

[*To be continued.*]

QUESTIONS AND ANSWERS.

Extent of Electric Sign Business.

R. R. W., St. Catherines, Ont.: If possible, will you kindly give me figures or estimates in regard to the amount of sales in the electric-sign business in the last few years?

Answer.

An estimate of the electric-sign business of the United States or Canada is difficult to make, owing to the large number of small sign makers and sign painters in the different cities and towns who do something with electric signs. Individually, these sign people do only a small business in the electric line, but collectively it amounts to a very respectable figure, as there are usually one or two such men in the smaller places and a comparatively large number in the large cities. There are also, of course, the concerns devoting themselves exclusively to the manufacture and sale of electric signs. However, taking the year 1905 alone, it may be estimated that the value of electric signs produced in the United States was about $1,500,000.

Do Telephone Condensers Wear Out?

B. H. S., Belleville, Pa.: Do condensers in bridging telephones ever wear out? If so, how long do they last, and how may one tell when they are worn out?

Answer.

There is no such thing as a condenser wearing out in the ordinary sense of the term, unless it is knocked about or damaged in service. The electrical stress due to there being a charge upon the conductors of the condenser causes a certain leakage of current through the paraffine paper insulation, which is very small if the condenser is manufactured of good material and of high insulation resistance. But the leakage can only be increased by some change in the insulative material. Such a change may be carbonization, due to lightning or some other high potential accidentally breaking down the condenser, or by some other chemical change due to impure paraffine being used in manufacture or other cause. A test of insulation resistance will show whether the condenser is defective.

Diameter of Cable and Conduit.

T. W. P., Winnipeg: I would like to know the diameter of a 400,000-circular-mil cable and how big a conduit pipe would be needed to let three such cables be pulled through without trouble. The distance is 120 feet. The cable is to have proper insulation for conduit work.

Answer.

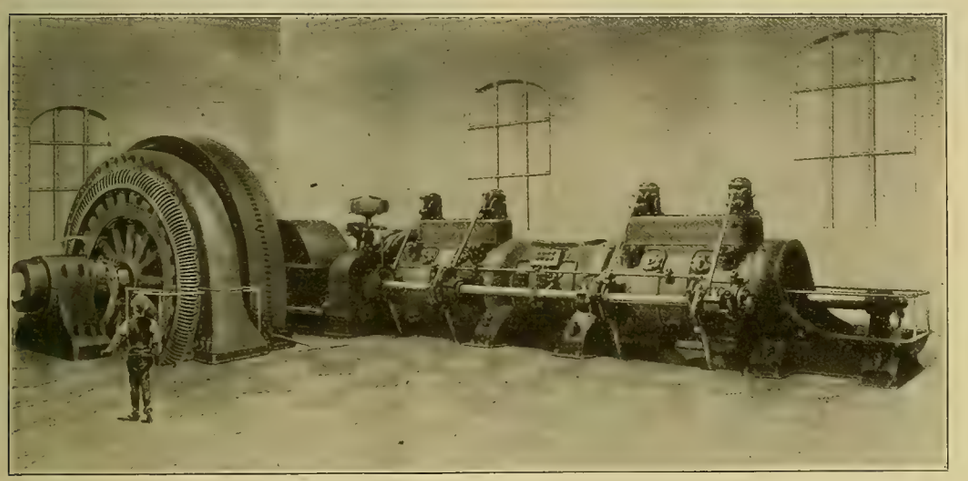
The diameter of a 400,000-circular-mil cable, bare, is 0.734 of an inch. With proper insulation for inside installation the diameter over all is about 0.92 inch, varying some, according to the manufacturer. Three such cables could be pulled satisfactorily through a conduit having an inside diameter of two inches. But they would better be pulled through a 2½-inch conduit. The allowance for play depends upon the number and angles of the bends in the conduit.

A New Wisconsin Electric Railway with Large Gas Engines.

Milwaukee, Wis., is being made the southern terminal of a new electric interurban line, known as the Milwaukee Northern Railway, whose contracts for gas-engine-driven electric power equipment were recently placed with the Allis-Chalmers Company of Milwaukee. The Comstock-Haigh-Walker Company of Detroit is the engineer and contractor for the new road, and through that company the contracts were let, covering what is said to be the largest installation of gas-engine-driven electrical generating units for traction purposes in America.

The equipment ordered comprises three horizontal twin tandem Allis-Chalmers gas engines, each with a rated capacity of 1,500 horsepower, direct connected to three 1,000-kilowatt three-phase 25-cycle Allis-Chalmers alternators, together with gas-driven exciter sets and complete equipments for eight sub-stations.

Port Washington, Wis., will be the present northern terminal of the system, over which cars are expected to be in operation by June, 1907. Grading for the roadbed was practically completed from a point four miles south of Port Washington



LARGE GAS ENGINE DIRECTLY COUPLED TO GENERATOR.

to the Milwaukee County line, some time ago, and grading for the remainder of the route is being rushed to completion.

The main power house is at Port Washington and sites for sub-stations have been provided at the following points: Burleigh, Cedarburg, Georgia Avenue, Marblehead, Brown Deer, Cedar Grove, West Bend and Campbellsport. As soon as the grading and construction work between Milwaukee and Port Washington is completed, work will be begun on the extensions from Port Washington to Sheboygan and from Cedarburg to Fond du Lac.

The route from Port Washington to Milwaukee is over private right-of-way for practically the entire distance and in almost a straight line. Between Port Washington and Grafton, there is only one curve—of two degrees. There will be no grade crossings. At the points where the new right-of-way intersects the Chicago, Milwaukee and St. Paul and the Northwestern railroads, in four different places, the new company has made preparation to trestle over or tunnel under. Trestles will be built over the St. Paul tracks at Grafton and in the town of Mequon, and tunnels under the Northwestern will be built at Port Washington and in the city of Milwaukee.

The physical aspect of the country which the Milwaukee Northern will penetrate, the absence of curves and the elimination of grade crossings insure the proposed schedule of high-speed trains.

The location of the main power house at Port Washington on the harbor front provides for economical handling of coal, which can be unloaded directly from the boats at the company's docks, convenient to the gas producer plant.

Power Equipment.

The power equipment will be of standard Allis-Chalmers design, both for gas engines and alternators. The electrical features of the equipment may be briefly described as follows: Three-phase alternating current will be generated in the power house, at 405 volts and 25 cycles, by the three direct-connected alternators, each of 1,000 kilowatts normal capacity, driven at 107 revolutions per minute by twin tandem gas engines. The power house is designed for a future installation of an additional 1,000-kilowatt unit to complete the plant.

The current generated will be delivered to a six-panel switchboard, having three generator panels, one exciter panel and two transformer panels, which will contain all the necessary switches, circuit-breakers, instruments, etc., for properly handling and regulating the equipment.

From the switchboard the current will be carried to the step-up transformers and also to the rotary transformer switchboard. There will be seven oil-filled water-cooled step-up transformers of 500 kilowatts each, arranged in two banks of three each, with one transformer as a reserve. These transformers will raise the voltage from 405 to a maximum of 22,000, with intermediate taps to allow the voltage to be varied if desired. The current will be carried from each bank of transformers to the high-tension bus through three oil switches, of 40 amperes capacity each, in each circuit, and in addition to plug switches at each transformer to allow for speedily cutting out any transformer in case of breakdown. From the high-tension bus, three transmission lines will be led away, each with automatic oil circuit-breakers of 40 amperes capacity in circuit. The station apparatus will be protected from lightning by means of an equipment of low-equivalent lightning arresters and oil-immersed choke coils connected to the high-tension bus.

There will also be installed in the main power house two compound-wound rotary converters of 300 kilowatts normal capacity, at 650 volts direct current, connected to a six-panel switchboard, having two alternating-current rotary panels, two direct-current rotary panels and two direct-current feeder panles with two feeder circuits, which will contain all the necessary switches, circuit-breakers, instruments, etc., for handling and regulating the current and apparatus.

The rotary converters will be protected from lightning by means of arresters on each feeder circuit, and a 50-kilowatt oil-cooled three-phase choke coil will be placed in the alternating-current circuit of each rotary in the sub-station installed at the power house only.

Sub-stations.

There will be eight sub-stations, two of which will have, each, two 400-kilowatt compound-wound 650-volt rotary converters and six 125-kilowatt 22,000-405-volt step-down oil-filled self-cooled transformers. The remaining six sub-stations will each have two 300-kilowatt compound-wound 650-volt rotary converters and six 100-kilowatt 22,000-405-volt step-down oil-filled self-cooled transformers.

Each sub-station will be protected against lightning by means of three 22,000-volt low-equivalent lightning arresters and three 22,000-volt oil-immersed choke coils; each sub-station will have an eight-panel switchboard having two alternating-current rotary panels, two alternating-current starting panels, two direct-current rotary panels and two feeder panels, except in the Cedarburg sub-station, where there will be three feeder panels.

All sub-stations will have 22,000-volt 20-ampere automatic oil circuit-breakers on outgoing transmission lines and on the transformer circuits, except at Cedarburg, which will have 40-ampere breakers on outgoing transmission lines.

The Cedarburg sub-station will also have 22,000-volt, 40-ampere oil switches on the incoming transmission lines and three 22,000-volt 20-ampere automatic oil circuit-breakers on the high-tension equalizing bus.

The low-tension cables are to be triple-braided, weather-proof wire supported on insulators, the insulated covering being relied upon only for protection from accidental contact and as a spacer. All high-tension wires will be bare mounted on proper insulators.

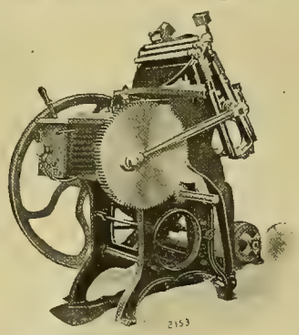
Taken throughout, the equipment will be of the most approved character, and in its design it represents the best engineering practice.

Single-phase Constant and Variable-speed Motors.

To meet the increasing demand for single-phase motors, the Wagner Electric Manufacturing Company of St. Louis has brought out some interesting

VERTICAL CONSTANT-SPEED SINGLE-PHASE MOTOR.

types. The accompanying illustration shows this company's vertical single-phase constant-speed motor, and the single-phase variable-speed motor is shown driving a job printing press. The vertical constant-speed motors are especially adapted to the driving of centrifugal pumps. They are built in sizes from ½ horsepower to 15 horsepower. For driving the machine tools, printing presses and similar machinery subject to frequent stopping and starting and running at different rates the motors must have an economical variable-speed feature. The motor here shown driving the printing press is used in connection with the Wagner auto-transformer speed regulator. It is said that with this control these motors are susceptible of a speed



PRINTING PRESS DRIVEN BY SINGLE-PHASE MOTOR WITH AUTO-TRANSFORMER FOR VARIABLE SPEED.

variation of from one-eighth speed to full speed in eight or 10 steps. A great advantage of the auto-transformer control over a straight resistance control is said to be in its economy of current, as with the straight resistance control there is a constant source of loss occasioned by the rheostat interposed to affect speed regulation.

A New Shade Holder.

The wire shade holder here represented, known as the Jem, is the product of the Jem Shade Holder Company of 13 East Thirtieth Street, New York. It has four points of support, making it rigid and

JEM SHADE HOLDER.

self-centering at any angle. The holder can be applied in a second, no tools being required, and there are no screws to wear out or become lost. Vibration will not loosen the holder, a symmetrical appearance being maintained from any point of view. To apply, the free ends are pressed together and the clamp is fastened.

SELLING ELECTRICITY.

Under this heading will appear, from time to time, articles, suggestions and examples which will be of assistance in the constant effort to increase the existing demand for electric current and to create new demands.

New-business Departments for the Smaller Central Stations.[1]

By W. Randolph Sweany.

The foundation of a new-business department, like everything else, depends upon its setting. The public expects to have its patronage appreciated, therefore it is necessary to be in a position to handle in a business-like manner any request coming from the consumer; complaints should receive the same polite attention as orders for service. The greatest advertisement is a satisfied consumer. Except in rare cases the operating man of the central-station company is not qualified to treat with the consumer. In some instances he feels antagonistic owing to frequent reflections on the quality of service furnished.

For companies of the size this paper concerns, it is not always found practicable for the head of the new-business department, generally known as the contract agent, to devote his time to the office, in which case, for the convenience of the consumer and the public, an office presided over by one with a thorough knowledge of the business, together with keen commercial instincts, should be established for handling orders, complaints, etc. It is not advisable to associate the title complaint department with this office, as it is too suggestively inviting. As the business grows this office should be brought under the control of the person in charge of the new-business department, as it is necessary that this officer should be thoroughly in touch with the established business in order intelligently to prosecute a successful business-getting campaign.

The sale of electricity should be conducted along the same lines as that of any other staple manufactured product. The number of solicitors employed in the new-business department, theoretically, should be governed by the greatest number that can individually earn a profit on themselves. This can be readily figured out. Ordinarily the organization should be composed of eight men. The contract agent is responsible for the growth of the business; he is assisted by seven others, one general-office and publicity man, two special and four district solicitors. In cities with a population of 40,000, drop out two district solicitors from the number. Where the population is 30,000, drop out two district solicitors and the contract agent, the manager or superintendent assuming the contract agent's duties. With a population of 20,000, drop out two district solicitors and the contract agent, and combine the duties of the power and new-building agent with that of the sign and heating agent. For cities with a population less than 20,000 the manager or superintendent can assume the duties of the contract agent and office man, the soliciting force to be composed of special power and sign agent and two district solicitors. If found necessary further to reduce the force, owing to limited territory, one or both district solicitors can be dropped.

The entire contract department should assemble at least two evenings a month to bring out talking points, review business secured, and talk over new plans; interest must not be allowed to lag.

A space in the general office and the show windows should be devoted to display, demonstrating the different applications of lighting, small motors, and heating and cooking appliances. This will greatly assist in making popular the devices that improve the day load. The central station, to enjoy the business that belongs to it, should advertise. This is frequently done ineffectually and much money wasted. At a moderate expense a very effective, productive publicity department can be maintained. A follow-up system of letters, interspersed with attractive folders with cuts and descriptions, will reach people not seen by the solicitors. Such things are bound to create a desire, and when this is accomplished the consummation of the deal is left to the solicitors. These letters and folders can be bought from advertising concerns engaged in this line of business at less cost than if designed by the central-station company and turned out by local engravers and printers; such of these that go to consumers can be enclosed with the monthly bill, saving postage. It is best not to be too general in advertising; drive one thing at a time. The consumer using electricity for lighting only presents a good opportunity for the advertising department; signs, small motors, heating and cooking devices can be constantly brought to his attention, their application and usefulness being shown.

In connection with the display part of the business, the central-station company should be able to demonstrate the uses of each device it exploits. Although the sign business presents many difficulties, a business arrangement with one or a number of electric-sign manufacturers is preferable. It pays to sell signs, heating and cooking appliances, sewing-machine motors, etc., from samples shown in the display room.

Only by sticking to system can the best results be obtained. For the convenience of solicitors, loose-leaf books that can be carried in the pocket should be provided. These books should contain rules, formulas and data on all subjects pertaining to the business, such as the average consumption of lamps, motors, etc., percentage of average load to connected load in different businesses, cost of all current-consuming devices, cuts showing the proper distribution of light, etc.

It is not meant in this paper to refer to rates other than to say that they are the largest factor concerned in regulating the amount of new business secured. They should be as simple as possible, published, not concealed, and, with the exception of signs and show lighting, which can be placed on a switching circuit under control of the company, should be entirely on a meter basis.

Electricity is a mysterious force, and, as the steady-going public dislikes unknown quantities, a campaign of education is necessary, which, if properly and systematically carried out, will surely bring the desired results. The public is simply waiting to be taught the advantages the use of electricity offers. With it can be supplied light, power and heat in innumerable ways; this the general public understands only in a vague manner. At least one of the three commodities is indispensable to every human being. The desire being created, owing to the necessity, the advantages can readily be shown. Believe in it yourself and you will inspire confidence; present it properly and business must follow. Advertise! Solicit!

1. Extracts from a paper which received honorable mention in the Co-operative Electrical Development Association contest on the subject of organization and conduct of a new-business department suitable for central stations in cities of 50,000 inhabitants and under. Mr. Sweany is contract agent for the Minneapolis General Electric Company, Minneapolis, Minn.

Methods of Getting Business in Small Cities.

Elaborate and expensive business-getting systems are out of the question in the smaller places, but the manager can have lists prepared of every class of possible customers, and call their attention by letter at intervals to his product. Newspaper advertising can also be used to advantage. Personal solicitation must be relied upon to do the actual work of business getting, but the assistance of the letters and advertising will be felt.

Good service is the principal factor in getting and retaining business. Good service consists of furnishing a continuous supply of electricity at uniform voltage to the premises of every customer, together with such supervision of each customer's installation as will result in his greatest satisfaction. In every case care should be taken to give the consumer the most useful light possible for his money. If a 16-candlepower lamp with a prismatic-glass reflector will give the customer more useful light than a 32-candlepower lamp without a shade, the customer should be advised to that effect.

The central-station manager must not only obtain the order for lighting, but fill it in such a manner that the customer will feel that he is getting his money's worth, and repeat his order from month to month indefinitely. One well-lighted store is the best canvasser for the neighboring stores, and too great pains cannot be taken to give the store lighted the most handsome effect.

When a residence is wired, see that the stable is wired also, and that the lamps are of such candlepower as will give the best results without waste. Prompt and courteous attention should be given to all complaints, and causes thereof remedied promptly.

A recording voltmeter should be in continuous service at every plant, and a chart should be taken at the end of each main at intervals to see that the proper voltage is being obtained. Every plant that does not keep a switchboard attendant on that work exclusively should have an automatic voltage regulator, as nothing causes dissatisfaction so readily as to have the lights bright at one period and dim during another.—From a paper by W. C. Anderson of Canton, Ohio, at the convention of the Ohio Electric Light Association, Put-in-Bay, August 22, 1906.

Central-station Bulletins in England.

[From the London correspondent of the Western Electrician.]

The electric-supply companies of London have come within the fashion in regard to issuing a bulletin relating to the supply of electricity. A combination of the companies has been effected and a publication issued under the editorship of one of Mr. Robert Hammond's staff. Mr. Hammond, of course, is noted for his municipal leanings, he having championed the London County Council electric-power bill last year against the companies, besides being a municipal consulting engineer; so it seems a little curious that one of his staff should be editing the publication in question.

The issue of these periodical bulletins has now become so general—and their style almost stereotyped—that a doubt seems to be gaining ground as to whether they will be as efficacious as was at first anticipated. When the first one was issued by the Newcastle company the idea was original—at any rate, over here—but everyone else seems to have blindly followed in its wake and no departure has yet been made.

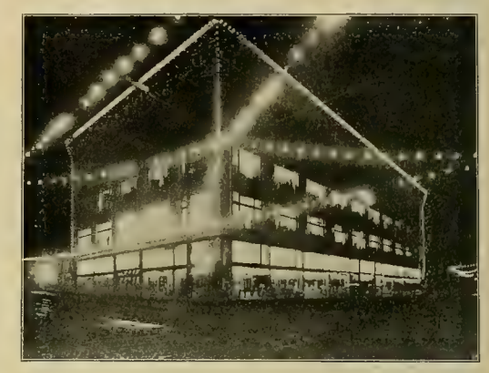
Electricity and Commercial Prosperity.

The following is taken from a recent article in Mertz's Magazine—an advertising publication of Los Angeles—by Bury Irwin Dasent, advertising agent for the Portland (Oregon) General Electric Company:

Universal effort shows a universal want; and the utilization of electricity is no more a luxury in a civilized state of society than warmth and clothing are a luxury to any state; the mind, as does the body, makes everything necessary that it is capable of permanently enjoying.

Because of its wide utility and its pliant beauty of effect, electricity has become a necessity of the mind, which it gratifies by means of the eye; and, in its æsthetic sense it has a perfect analogy, say with music, which similarly gratifies the mind but by the means of a different organ—the ear.

So electricity has been discovered to be today



AN EXAMPLE OF EFFECTIVE EXTERIOR STORE LIGHTING IN PORTLAND, OREGON.

an essential element in our commercial prosperity, i. e., it is a want of the public mind. This was not so at first, because in a less cultivated state we are quite satisfied with the gratification of our merely physical wants. But in an advanced state still more extensive wants of the mind demand still more pressingly to be satisfied. And these demands of the popular mind evoke always immediate and ample response in the expression of our commercial activities.

There is sound reason for this condition of the popular mind. For example:

The most beautiful decorative effects in illumination are possible only with electricity, and when the extraordinary crisis arises, that demands expression in equally impressive manner, the natural trend of the popular mind suggests electricity as the medium. So, for instance, when the great Butterick Company desired to achieve the greatest advertising feat of the time it promptly called for the assistance of the electrical people, and erected in New York the largest electrical sign in the world for the advertising of its business.

This sign consists of the single word "Butterick" on the building of the Butterick Publishing Company, facing the North River, and located at Spring and McDougal streets, New York city. The building is 17 stories high, and near the top is the sign, which is 225 feet long. The letter "B" is 68 feet high, while the other letters are 50 feet high.

The advertising effect of this gigantic sign is incalculable, for it is seen by millions each day, being visible many miles. Maintenance of this huge electric symbol affords striking testimony to the belief of a great and conservative corporation in the advertising value of the electric sign.

The Butterick sign has been operated nightly for nearly two years, and it is the testimony of the company that it forms one of the greatest advertising features of its large business as well as one of the cheapest.

As proving the statement that electricity has become a fixed necessity of the public mind, it is perhaps sufficient to state that within the last year the number of electric signs used for purposes of advertising in the city of Portland has increased more than 200 per cent.

That the impelling demand for a product used by the people must come from the people is a sound conclusion is shown by the progress made in the supplying of electric light in any city. No merchant whose business it is to cater to the wants of the public can afford to disregard the plainly expressed desire of even a minority of his patrons.

There is significance in the fact that Portland uses more electric light per capita of population than any other city of the Pacific Northwest.

The thoughtful observer of economic conditions must inevitably reach the conclusion that in a community where the per capita use of electric light is so great under normal conditions of competition with other means of artificial illumina-

tion there exists the true spirit of advancement, the uplift that makes for the highest attainment in commercial progress, the highest standard in refinement, the broadest culture, and that widening desire for the conveniences, comforts and luxuries of twentieth-century civilization which is inseparable from such conditions.

At this epoch when widespread publicity for the advertising of city and state is looked upon as the greatest factor in the making of commercial progress and civic development, it is of utmost importance to include the consideration of existent economic advantages, such as electric light and cheap electric power for manufacturing, as among the valuable features of the advertising propaganda of any section or community.

Co-operation with Contractors.

Display in a prominent place in your central-station office a wall directory of all the electric contractors in your territory.

Arrange to send them immediately any tips coming to your notice concerning wiring work, etc.

Keep in touch with your contractors, establish friendly relations with them and consider their criticisms and suggestions.

Their co-operation is a valuable means of extending your business, and is well worth your strenuous efforts to secure and hold.

Keep informed of the local work your architects have in hand and arrange for regular reports from the building inspector's office.

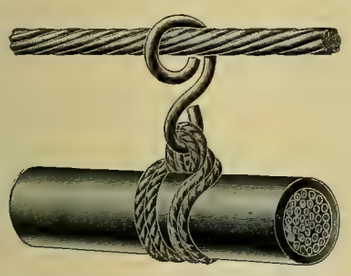
Knowing in advance of projected new buildings or remodeling work, you can furnish advance information to your friends, the contractors, and their self-interest in securing the work will make them effective solicitors for you.—From prize paper by J. M. Robb on "Organization and Conduct of a New-business Department Suitable for Central Stations in Cities of 50,000 Population and Under."

Free Wiring of Small Residences.

President Norman G. Kenan of the Union Gas and Electric Company of Cincinnati, Ohio, has announced that the company will wire small residences free in order that their occupants may use electric light. Mr. Kenan is said to have had this in mind for some time, believing that it will be a good thing for the company as well as those who live in small houses.

A New Marline Cable Hanger.

The Yonkers Specialty Company of Yonkers, N. Y., manufacturer of the well-known Metropolitan metallic cable hanger, is manufacturing a marline hanger with a peculiarly shaped hook, known as the "pigtail" type, from its resemblance to the form of that well-known appendage. There is a growing demand in these days of careful



A NEW MARLINE CABLE HANGER.

construction work for the kind of marline hanger which will not easily come off the supporting strand and which does not have to be pinched on to the supporting strand by the lineman. This new hanger is designed to supply this demand. It is as easy to apply as the ordinary marline hanger, and when in place is held by the marline loop so that the plane of the hook is perpendicular to the strand. In this position it is impossible to detach, and at the same time the point of the hook is so located that it will not catch wires from the running board and snarl everything up—an accident which often occurs when an attempt is made to add new line wires to a pole line carrying cable.

The factor of safety is said to be greater with this form of hook than for any S-shaped hook of similar size wire, and under test the device hangs on to the supporting wire until the curl of the hook is completely straightened out. The hook is carefully galvanized after being bent, and finished with a fine grade of houseline. The Yonkers Specialty Company says that its "pigtail" hangers have been in service experimentally for several years and have proved so successful that it feels justified in putting them actively on the market.

The president of a concern consuming over 60,000,000 pounds of copper a year is quoted as saying that he would be glad to have a guaranty that his requirements of copper for the first nine months of 1907 could be secured at an average of not over 20 cents a pound.

Central Electric Railway Association.

The first fall meeting of the Central Electric Railway Association was held in Robinson Park, Fort Wayne, Ind., on September 27th. The meeting was intended to be more of an outing than a convention, and for this reason, both as to the number in attendance, character of the proceedings, entertainments and amusements, it was the best and most enjoyable ever held by the association.

The Master Mechanics' branch of the association held its meeting the evening before, and the committee on lightning arresters met early in the morning, the regular session of convention being held at 11 o'clock. There was no effort to prolong the business of the convention but rather to devote the day to pleasure. In the gathering 201 electric roads in Ohio, Indiana and Michigan were represented.

The meeting was called to order by E. C. Spring, president of the association, and after the reading of the minutes of the previous meeting the report of the committee on standardization was presented by W. H. Evans of Indianapolis, chairman of the Master Mechanics' branch. Mr. Evans stated that the subject of standardization was a very important one and that the committee had considered the matter very carefully and had arrived at the conclusion that it is best to follow, in so far as is possible, the plans of the steam lines, and to conform as near as possible to the rules of the Master Car Builders' Association. The work of the committee, he said, had provoked a hearty discussion, resulting in the adoption of a report recommending a wheel tread three inches wide, flange 7/8 inch high and 1 3-16 inches thick. The committee recommended the T-rail as being best for all purposes, and also the M. B. C. form of brake-shoe. Three sizes of journals with the M. C. B. form of bearings, or the steam railroad box, which is now in general use on electric cars, were recommended as steps toward standardization. The report of the committee was adopted by the convention and will be presented to the national association meeting in Columbus, Ohio, next month as the recommendation of the Central association on the subject of standardization.

The committee on lightning arresters reported progress in the matter of forms for gathering data, which, it is to be hoped, will enable the experts to produce a remedy. Following this report and the discussion of the forms a paper on "Lightning Arresters" was read by C. R. McKay of the General Electric Company. Mr. McKay said he had spent considerable time traveling over the country obtaining data upon which to base plans for a lightning arrester for interurban cars. Operators alone can provide the necessary data. It is impossible for any one man to get all the data necessary to determine the best arrester. Mr. McKay said experts are now at work and in a short time manufacturers hope to further develop the apparatus calculated to lessen damage from lightning.

Following the business session the members of the association, supply men and their ladies enjoyed a sumptuous country dinner in the park pavilion, served by the chefs of the Fort Wayne and Wabash Valley Traction Company. A vote of thanks was extended to C. F. Shelton and Harry Vandermark of the traction company for the enjoyable entertainment. At the conclusion of the banquet, games, bowling and boating were indulged in, closing with a vaudeville performance which was put on at the Summer Theater for the sole benefit of the visitors. Special cars took the entire party to the new power house, and to the brass works and the electric works. The meeting was declared to have been by far the most enjoyable ever held by the association.

Death of Philip F. Kobbe.

Philip Ferdinand Kobbe, director and assistant secretary of the Westinghouse Electric and Manufacturing Company, died at his summer home at Stockbridge, Mass., on September 21st, aged 64 years. Mr. Kobbe was one of the pioneers in the electrical business, his efforts always having been devoted to the financial end. In 1883 he was elected treasurer of the United States Electric Lighting Company, which position he held until 1890, when that company was absorbed by the Westinghouse company, at which time Mr. Kobbe was made treasurer of the latter company. In 1896 Mr. Kobbe was made vice-president in addition to his duties as treasurer, and in 1902 he became a director of the company.

It was in the year 1900, when Mr. Kobbe was on his way to Europe to undertake important work in connection with Mr. Westinghouse's foreign interest, that he was stricken by an attack of paralysis, from which it is believed he never fully recovered. Continued ill health recently compelled Mr. Kobbe to be relieved of the duties devolving upon him as treasurer and vice-president, but up to the time of his death he remained on the board of directors and held the office of assistant secretary. Mr. Kobbe always showed great ability as a financier.

Mr. Kobbe was born in New York, October 24, 1842, and received his education in Germany. He was a man of broad culture, and of a charming personality that endeared him to all of his associates, so that they were always glad to consider him their friend. He served in the Civil War, as a member of the Seventh Regiment. He was a member of the Calumet and Richmond Country clubs and the Society of Colonial Wars. Surviving him are a widow, three daughters and two sons. Two brothers, Gen. William A. Kobbe, U. S. A., and Gustave Kobbe, author and journalist, of New York city, also survive.

In the passing away of Mr. Kobbe the interests with which he was so long associated lose one of the stalwarts in their early organiation, and one who throughout his career has been the embodiment of industry and honor.

Single-phase Railways Hamper Telephone Lines.

Trouble has broken out in Indiana between telephone companies and the electric railways operated by the single-phase alternating-current system. The cause of contention between the traction and telephone men lies in the fact that the single-phase system carries a current so powerful that it affects nearby telephone wires by induction, thereby making conversation impossible and jeopardizing telephone equipment.

The Central Union and Home telephone companies of Fort Wayne have found it necessary to remove their wires which parallel the newly completed Fort Wayne branch of the Toledo and Chicago traction line, and it is announced that the courts will be asked to place the burden of expense on the traction company, which is responsible for the change.

Single-phase alternating current is regarded in Indiana as the coming system of interurban motive power, inasmuch as it permits the trolley to carry a current so strong that sub-stations for power are not needed. This effects a notable economy for the traction companies, but it is said to be death to the efficiency of paralleling telephone wires.

With the completion of the new traction line in Allen County, telephone service between Garrett, Auburn, Huntertown and other places has been ruined, it is said. The manufacturer of the single-phase apparatus has had a number of experts along the line for weeks trying to find some method of preventing the induction of current from the traction to the telephone wires, but the conclusion seems to be that the only reliable prevention is the complete separation of the two sets of wires. Consequently, the telephone wires between Garrett and Auburn have been removed half a mile west. Inasmuch as the tendency in traction development is toward the single-phase system, because of economy, the question as to supremacy of location and the cost of separation will probably have to be determined by the courts or the legislature.

New Members of the National Electric Light Association.

A large number of applications for membership in the National Electric Light Association were passed upon and approved at a recent meeting of the executive committee. The following-named were admitted:

Class A.—North Georgia Electric Company, Gainesville, Ga.; Millville Electric Light Company, Millville, N. J.; McCall Ferry Power Company, New York; Miami Light, Heat and Power Company, Piqua, Ohio; Laramie Light and Power Company, Laramie, Wyo.; Albany Power and Manufacturing Company, Albany, Ga.; Toledo Gas, Electric and Heating Company, Toledo, Ohio; Escambia County Electric Light and Power Company, Pensacola, Fla.

Class B.—E. J. Fowler, Chicago Edison Company, Chicago; J. W. Murray, Allegheny County Light Company, Pittsburg; A. S. Allen, Tonawanda Power Company, Tonawanda, N. Y.; C. H. Patten, Chattanooga Electric Company, Chattanooga, Tenn.; Arthur L. Linn, Rochester Railway and Light Company, Rochester, N. Y.; E. A. Phinney, Ouray Electric Power and Light Company, Ouray, Ohio; Henry Stephenson, H. M. Edwards, Charles S. Shepard, New York Edison Company, New York, N. Y.; J. W. Young, McCall Ferry Power Company, New York, N. Y.; William S. Dupont, Newark, James T. Whittlesey, Montclair, J. Kennedy, Weehawken Heights, Public Service Corporation of New Jersey; Edward J. O'Beirne, Gainesville Electric Railway and Light Company, Gainesville, Texas.

Class D.—Michaelis & Ellsworth, New York, N. Y.; Roderick J. Parke, Toronto, Canada; the Lundin Electric and Machine Company, Boston, Mass.; Condit Electrical Manufacturing Company, Boston, Mass.; the Shelby Electric Company, Philadelphia, Pa.

Class E.—James D. Ellsworth, Michaelis & Ellsworth, New York, N. Y.

Lax Methods of a Municipal Lighting Plant.

In response to a request from the electric-light investigating committee of the town of Peabody, Mass., the Electrical Auditing Company has inspected the municipal electric lighting plant of that town with a view of making suggestions which would improve the financial conditions of the plant. The auditing company found that the methods of keeping accounts and records were very lax, and it was obliged to make a number of tests in order to get at the capabilities of the plant.

The report says: "The method of not charging the proper cost of production and distribution of the electric plant in identically the same manner as though they were a private corporation is neither in line of good business judgment nor fairness to the taxpayer of the town, although by so doing it often makes an apparently low cost for the production but is not a true cost, only a mass of figures given to satisfy a few unthinking people, who, if they stopped to reason would realize that it is not possible to obtain something for nothing. * * * The costs are so concealed, unintentionally it may be, that every taxpayer in town, whether or no he uses electric light or power, is paying for the cost of operation of the electric plant, and should in return derive a proportionate benefit therefrom."

There is a demand for electric power in Peabody which cannot be satisfactorily furnished because the municipal station generates a single-phase, high-frequency current. The report calls attention to the fact that, as a rule, municipalities consider it entirely unnecessary to canvass or otherwise attempt to obtain new business or add to the connected load of their existing customers, and it recommends a steady and systematic canvass for prospective customers. The company believes that the means employed for street lighting, namely, "variable inductive resistances operated from constant potential transformers, is inefficient and unsatisfactory as a power factor and in other respects," and recommends the tub system as most economical.

The report recommends, among other things, "an investigation as to the desirability and possibility of purchasing electrical energy, doing away with the generating plant and following the plans that have been already adopted by other towns, for purchasing the current per meter at the switchboard of the town plant and the distribution of the same by the usual methods to the town's customers, not, however, allowing the company supplying the current to obtain any rights for location or otherwise within the limits of the town."

Columbus Street-railway Convention.

The annual convention of the American Street and Interurban Railway Association and its affiliated societies will be held in Columbus, Ohio, on October 15th to 19th, inclusive. The convention and exhibit halls are located at the state fair grounds at the north end of the city. A large attendance is expected, and hotel arrangements should be attended to as early as possible. In case of difficulty in securing accommodations, the matter should be taken up with Mr. Henry C. Pirrung, chairman of the convention committee of the Columbus Board of Trade. A special fast train will be run from New York over the New York Central and Big Four railroads, leaving New York city at 2:04 p. m. on October 14th, and arriving in Columbus at 6:58 a. m. on October 15th. A rate of a fare and a third is granted. Fuller details of the convention arrangements will appear in the Western Electrician of next week.

Chicago Street-lighting Statistics.

Statistics of street lighting of the city of Chicago for the first six months of 1906 show a decrease in the number of gas and gasoline lights operated, compared with the corresponding period of 1905, and an increase in the number of electric lights used. For the period mentioned 29,164 gas and gasoline lamps were burned in 1906 and 30,997 in 1905. The number of electric lights burned during the six months increased from 6,178 in 1905 to 7,331 in 1906. The lights were divided up as follows: 1906—Gas lights, 23,587; gasoline lights, 5,577; electric lights operated by the city, 6,606; rented electric lights, 725. In 1905 the figures were 24,865, 6,132, 5,490 and 688, respectively.

The Sarnia Tunnel.

According to the original plans, the electric power house for the St. Clair Tunnel Company was to have been built over the tunnel shaft on Military Street, Port Huron. Manager Hays of the Grand Trunk Railway, however, ordered the building to be erected as far north from the tunnel shaft as possible. He says that in a year or two it will be necessary for the railway company to construct another tunnel under St. Clair River, on the south side of the present tunnel. The approaches were built with this end in view, and with the introduction of electricity the Grand Trunk expects that a single tunnel will not accommodate the traffic.

Direct-connected versus Belt-driven Units.

In a recent bulletin the Allis-Chalmers Company makes the following comment on a subject that is often debated: "The question is frequently asked by intending purchasers whether it is better to use direct-connected or belt-driven units. To this no definite reply can be given without considering fully the conditions governing each case. The direct-connected unit has the advantage of requiring less floor space, and is ordinarily a trifle more efficient, as it does away with the friction of belts and extra bearings. On the other hand, the belt-driven unit is, under normal conditions, somewhat lower in first cost, and, where there is available floor space, it is much to be preferred to a cheap high-speed direct-connected machine. Notwithstanding the many advantages of our direct-connected units, there are numerous cases where belt-driven machines can be used to good advantage." It is added that the selection of apparatus should be made only after careful consideration of the service required and the conditions under which it is to be performed. Requests for information should state:

1. Character of load; whether lighting, power, or lighting and power combined.
2. Whether steady or variable load, normal capacity required, and minimum and maximum loads.
3. Whether a direct or alternating-current machine is desired. If direct current, what terminal voltage and output in kilowatts at full load is wanted; and if the generator is to be compound wound, state voltage required at no load and full load. If alternating current, give terminal voltage and output in kilowatts, with unity power factor, at full load, and state number of phases and frequency, or number of cycles. Also state whether an exciter is to be furnished, and how it is to be driven.
4. Whether the generator is to be operated in parallel with others, and, if so, give as full and complete information as possible regarding speed, voltage and method of driving, etc., of the other machines.
5. Steam pressure at throttle.
6. Whether engine is to run condensing or non-condensing. If condensing, state vacuum in inches of mercury (referred to barometer at 30 inches). If non-condensing, state back pressure, if any, against which the engine must operate.
7. Whether right or left-hand machine is wanted.

BOOK TABLE.

Catechism on Producer Gas. By Samuel S. Wyer, M. E. New York: McGraw Publishing Company. 1906. With four illustrations. Price, $1.00.

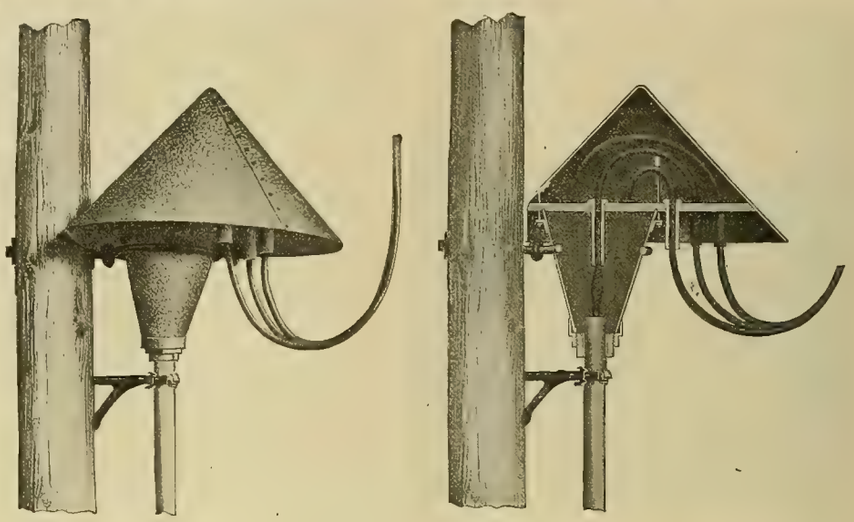
A compendium of useful information presented in the form of a catechism covering fundamental principles of gas production and the operation and maintenance of gas plants.

Technical Dictionary. In six languages. Vol I. The Elements of Machinery. By P. Stülpnagel. New York: McGraw Publishing Company. 1906. Pages (4½ by 7¼), 403, with 823 illustrations and numerous formulas. Price, $2.

This is the first volume of a series of technical dictionaries which are intended to assist the engineer in the reading and study of technical articles and books written in any of the principal modern languages. The matter is treated in separate branches by the introduction of sketches or diagrams, and is referred to by a table of classified subjects as well as a combined alphabetical index containing all the words which occur in the book of each language. The languages represented are English, German, French, Russian, Italian and Spanish.

Protected Terminals for High-tension Cables.

The Security protected terminal for high-tension cables is illustrated herewith. This terminal does not need wiped lead joints, but constitutes a thoroughly substantial joint permanently protected. The flaring receptacle of the terminal is soldered to the cable sheath by an ordinary workman. The cable conductors are soldered to the distributing wires, and the joints are protected in the usual manner. The distributing wires are carried upward and again downward through the wooden table, which has been boiled in paraffin, and are further protected by porcelain tubes. The pothead is then filled full of melted compound, pouring it through a hole in the wooden table. A brass tube is sometimes used, which carries the hot liquid to the bottom without cooling it, thus filling the pothead from the bottom up.



PROTECTED TERMINAL FOR HIGH TENSION CABLES.

On the receptacle are riveted lugs. The hood has riveted bolts, which pass down through the table and through the lugs just mentioned, and these hold the hood firmly in place; it cannot be disturbed by wind or ordinary accident. The completed terminal is held to the pole by the encircling ring. The receptacle and the hood are of sheet iron, heavy galvanized, and, with a coat of paint at intervals, will last a long time. The F. Bissell Company of Toledo is the manufacturer of this terminal.

Indiana Telephone Items.

Both the local telephone companies operating in Irvington, a college suburb of Indianapolis, disclaim responsibility for the recent destruction of fine shade trees in the college campus. General Manager Hirst of the Central Union Telephone Company and General Manager Tetu of the Indianapolis Telephone Company state that the men had no authority to mutilate the trees and both disclaim having men at work in that vicinity at the time the trouble arose. Notwithstanding these denials the grand jury has indicted the linemen alleged to be implicated, and the extent of their authority and their connection with the telephone companies will be brought out in the trial of their case.

The complaint of poor telephone service in Indianapolis, Columbus and some other points in the state continue, and the question is being asked if the companies are doing their best to remedy the trouble. The public criticism is to the effect that good telephone service can be rendered if the affairs of the telephone companies are properly administered and the equipment not too cheaply constructed. People insist that they are buying and paying in advance for good service, which they do not get. S. S.

Ohio Telephone Notes.

At a meeting of the directors of the Bellevue Home Telephone Company, in Bellevue a few days ago a committee was appointed to superintend the rebuilding of the exchange. F. A. Knapp, B. F. Bell and Frank L. Beam will serve on this committee.

The telephone companies of Franklin County paid taxes amounting to $20,340 the last year. Other public-service companies also paid large amounts into the treasury.

A meeting of the Bell managers of Northern Ohio was recently held at the Courtland Hotel, Canton, presided over by F. G. McConnell, superintendent of the district. Thirty-two managers were present. Charles Norris, manager of the Canton district, read a paper on "Blue Days, Cause and Antidote."

The Dean Electric Company has installed a new switchboard for the Citizens' Independent Telephone Company at New Lexington. The central-energy multiple system is used. The dynamos and storage batteries will be put in place at once. C.

Detroit Home Telephone Company's New Plant.

The Home Telephone Company of Detroit, Mich., has purchased the site for its central exchange at the corner of Madison Avenue and John R. Street. The detailed plans and specifications contemplate a building to cover the entire lot, 105 by 100 feet, three stories, and devoted entirely to local and long-distance telephony. It is expected to have this building ready for occupancy by May 15, 1907. The first floor, containing 10,000 square feet, is devoted to public and executive offices of the company. The accounting and contract departments open across from each other at the entrance to the building. The offices of general manager and engineer and the board room are also on this floor. The second floor is devoted to long-distance board, hospital, rest room and lockers for the operators, terminals, battery room and office of the long-distance wire chief. The third floor is for the switchboard exclusively. Under the building is a large basement for shops, storage purposes, etc. The exterior is very attractive in cut stone and ornamental brick. Construction work has been actively under way since July 16th, and nearly a million feet of the subway is already in the ground and a great many of the terminal poles in the Central exchange district are set.

The company has purchased property for its East Exchange at Field and Sylvester streets and for the Delray office at Artillery and Lafayette streets. The work on modern branch offices on these sites will commence shortly.

The plant of the company is being built by the Electric Construction Company of St. Louis, Mo., controlled by the same interests as control the telephone company. The officers of the Electric Construction Company are: President, Max Koehler of St. Louis; treasurer, Sam. B. Jeffries of St. Louis; general manager, W. B. Woodbury of Detroit; chief engineer, W. C. Polk of Birmingham, Ala. Charles H. Ledlie of St. Louis is consulting engineer for the telephone company. The Commonwealth Trust Company of St. Louis is financing the proposition, and its representative on the ground is W. W. Grayson, formerly of the Kinloch Telephone Company.

Back of the Detroit proposition are Adolphus Busch, Edward Faust, Henry Koehler, Arthur W. Lambert, Max Koehler, Hugo A. Koehler, Herman C. Stiefel, Ben Altheimer, C. Marquard Forster and many others. It is expected that the plant will be ready for operation some time during the summer of 1907. The plant is being built underground and for 30,000 telephones.

Wireless Telephony Said to be Practicable.

Dr. Shunkichi Kimura, professor in the imperial Japanese navy, now in Europe to attend the Berlin Wireless Telegraphic Congress, interviewed by a representative of the Scientific American, made the statement that a wireless telephone system had been so far perfected as to be of practical utility. It is to be observed, however, that the author of this statement is the inventor of the system. In making practical experiments in space telegraphy by means of temporary balloon stations Dr. Kimura quite unexpectedly discovered that there was a decided telephonic effect in certain phases of the wireless telegraphic phenomena. It was this discovery which led to the invention of his telephone system, which is said to have been formally adopted by the Japanese Navy, which will shortly install it upon the various war vessels.

No disclosure of the details and method of operation of this system was made, as these are government secrets. Presumably that is why this invention, as well as Dr. Kimura's wireless telegraph system, has not been patented.

Showing the success with which Dr. Kimura's wireless telegraph system has been used, an occurrence during the late war may be mentioned. At the time of the battle of the Sea of Japan, the weather was foggy and hazy to such an extent that it was impossible to see for a distance greater than five miles. A Japanese scout cruiser while searching for the Russian fleet suddenly found herself, when the fog had lifted unexpectedly for a moment, practically in the midst of the numerous vessels of the enemy. A wireless message was at once transmitted giving notice of the discovery, and this message was simultaneously received by all the vessels of the Japanese squadrons, notwithstanding that these were some 150 miles distant. Admiral Togo immediately dispatched a squadron of scouts, which kept in touch with the enemy and informed him at five-minute intervals of the course, speed, position and location of the Russians with such accuracy that Admiral Togo was able to forecast with absolute precision the actions of the enemy. It was through wireless communication alone that it was possible for the Japanese commander to maneuver and place his fleet to enable him to strike the enemy in the most favorable position and under the most advantageous circumstances.

The Wisconsin Telephone Company has closed the contract for connection between Milwaukee, Baraboo and Reedsburg, Wis.

COMMUNICATION.

Unnecessary Noises in Telephone Service.

To the Editor of the Western Electrician:

I wish to enter a protest against a very common and often serious annoyance of the telephone service in the noises that frequently strike the ear, due to imperfect operating conditions at the exchange. Just before conversation is commenced, the telephone subscriber often has his ear so strained by a report like that of a pistol that he is forced to change the telephone receiver to his other ear to carry on conversation at all. Sometimes in the middle of a conversation the operator in listening-in makes very disturbing noises. These noises are not only painful, but often provoke anger, and since they are entirely unnecessary, immediate steps should be taken to suppress them.

Some ingenuity in rearranging operator service at the switchboard may be required to prevent these too-frequent noises. The fact that some telephones are much more noisy than others is sufficient proof that the noises are not necessary. The old trick that children have of pretending to whisper in your ear and then shouting very loud is invariably followed by immediate punishment. It seems to me that the telephone company that permits unseemly noises to continue ought to be subject to arrest and fine fully as much as the owners of chimneys that produce black smoke. I believe that little or no attention has been given to this matter, and telephone experts who produce a switchboard from which unnecessary sounds cannot be produced will confer a lasting benefit on the public.

MORGAN BROOKS.

Urbana, Ill., September 24, 1906.

GENERAL TELEPHONE NEWS.

W. P. Records and others have asked the city of Lawton, Okla., for a telephone franchise.

The Beaver Bend Telephone Company has filed articles of incorporation at Valley Springs, S. D.

The Star Mutual Telephone Company of Eureka, Kan., has been incorporated with a capital stock of $10,000.

The Valleyview Mutual Telephone Company of Arapahoe, Okla., has been incorporated by George Kroth and others.

W. R. Wallace and others of Holland, Tex., have incorporated as the Holland Independent Telephone Company, with a capital stock of $7,000.

The Wilzetta Telephone Company of Wilzetta, Okla., has been incorporated. Incorporators are J. F. Thompson, W. S. Cooper, Jackson Clark of Wilzetta, and others.

S. S. Lichty and others of Vinton, Iowa, have purchased the controlling interests in the Benton County and Vinton Telephone Company. They will improve the property.

The Carolina Telephone Company of Wilson, N. C., will install a new central-energy telephone system at a cost of $25,000. A new franchise has been obtained from the city.

C. A. Hollis of Hudson, Iowa, manager of the Farmers' Mutual Telephone Company, is trying to organize an association of mutual and Independent telephone lines in the vicinity of Des Moines.

The Southwestern Telegraph and Telephone Company has been making extensive additions to the local system at Orange, Texas. It is the intention of the company early in the coming year to install a new and much larger switchboard with the common-battery system.

The following-named telephone companies are among those recently incorporated: Peckham Central Mutual Telephone Company, Peckham, Okla.; Federal Telephone Company, Brock, Neb.; Montgomery County Telephone Company, Coffeyville, Kan.; Center Telephone Company, Salem, S. D.

The president of the International Independent Telephone Association has appointed the following-named members to serve as a committee on standard forms of accounting: Charles West, Allentown, Pa. (chairman); George T. Hewes, Des Moines, Iowa; W. H. Spooner, Minneapolis, Minn.; J. B. Ware, Grand Rapids, Mich.; R. E. Mattison, Lincoln, Neb. All telephone companies are requested to send samples of the blank forms used in their various departments to the Cleveland office for the use of the committee.

The Chicago Telephone Company will establish an extensive division headquarters at the northeast corner of Fillmore Street and South Forty-first Avenue. The site embraces a tract 318.9 by 126.7 feet. The headquarters will include a barn and large warehouse for storage purposes. The company is also arranging to add two new exchanges, one of which will be in Edgewater and the other in the western section of the city, and the buildings, which are now being planned, will be opened next spring. This improvement is made necessary because of the large number of telephones now being cared for by the Lake View exchange and the present West District.

CORRESPONDENCE.

Continental Europe.

Paris, September 18.—Experiments are now being carried out with the hope of sending wireless signals between the vessels of the French war fleet in the Mediterranean and Paris, using the Eiffel Tower as the station at this end. A detachment of operators taken from the Mediterranean coast stations left Toulon on the 19th of September under Lieutenant Lapointe on the cruiser Jeanne d'Arc. The cruiser will cross the Mediterranean and make experiments in signaling to the Eiffel Tower while en route. There are good hopes of doing this, seeing that messages were exchanged between Porquerolles and Paris during the last naval maneuvers. Should this be successful, it is proposed to set up stations on the African coast.

A hydro-electric plant which is used for carbide production is now working very successfully at Freyung, Bavaria. Two rivers give the power, the Saussbach and Rechbach, which come together shortly above Freyung. The total water head is 440 feet. The plant is located midway upon the canal, however, as ground could not be had elsewhere. With a 240-foot head are run three turbine-dynamo sets of 800 horsepower each. To utilize the rest of the head a well is sunk in the rock, and two turbines of 1,100 horsepower are placed at the bottom. Long shafts run up from the wheels to the power house, where they run two machines erected by the Allgemeine company. When in full running order the plant is to turn out 4,000 tons of carbide annually.

The electric lighting and electrical exhibits were among the interesting features of the General Exposition of Hygiene held at Vienna. Buildings and grounds used a great number of arcs and incandescent lamps. Model operating rooms formed part of the exhibit, and these were lighted by a new form of arc lamp carrying a special opal glass shade. It gave a very good diffusion of light for carrying on the operations. Some of the new tantalum and osmium filaments were used in the shape of small lamps combined with reflectors and portable storage battery.

The Industrial Society of Mulhouse, Alsace, is to hold an exhibition of different appliances next year. Among the devices for which prizes are to be awarded I may mention a smoke-consuming device which is to be used with boilers burning various kinds of coal. Motor-driven machines such as printing presses, sewing machines, etc., form another class. Three-phase motors are to be used, at a constant voltage and frequency. Cotton-spinning and weaving mills, motor-operated, are also to be considered.

A carborundum composition has been used in some of the new subway stations of Paris for the flooring of the passenger platforms and the staircases, in order to form a hard and durable surface. To carry this out, the flooring is laid with cement in the usual way, but the top layer which comes on the cement is now formed of a mortar containing a good proportion of carborundum in rather fine grains. This gives a surface which has a brilliant sparkle, and it is claimed that it will wear much better than an ordinary flooring. Besides, it has a great advantage, at least for the staircases, in giving a grained and polished surface, so that slipping is avoided.

The new Mouterde storage-battery cell, which has lately appeared in France, differs from most others from the fact that it uses an active cylinder instead of a plate. The cylinder is made of rather thick lead, into which are cut a set of dovetail grooves, either in screw-thread or ring form. Active matter is forced into the grooves and lies flush with the surface, being well held in place. It is asserted that such a cylinder cannot buckle like an ordinary flat plate and keeps its shape, and the matter will never fall out. One form of cell is made by using the outer cylinder with a bottom to form the cell itself, and having a second cylinder inside it whose grooves are on the outside. This gives an all-metal cell. Concentric cylinders can be easily used. I had occasion to see some of the new cells at Lyons some time ago, before they were brought out, and the system seemed to have many good points.

Iron and steel working by the electric furnace is among the leading questions in Italy, where fuel is scarce and waterpower abundant. Mr. Stassano is foremost in promoting these processes, and he has already set up several furnace plants. His latest furnace is a revolving chamber of refractory material into which project three heavy carbons so as to form the arcs above the material. To move the carbons in and out he uses a hydraulic piston, mounted upon each carbon and fixed against the outside of the furnace. The whole furnace is mounted at a slight angle upon a pivot base, so that by turning it around the material will be mixed up. A fixed furnace of the same type is also used.

The latest electric cooking apparatus is brought out at Paris by the Société Electro-Culinaire. Instead of resistance wire it employs a specially made incandescent lamp, in tube shape, and a number of such tubes fitted into a rack gives a good heater. The tubes are easily handled, cleaned

or replaced, and are inexpensive, and it is claimed that the device gives less trouble than the usual forms. A. de C.

Great Britain.

London, September 18.—A development of electric supply in London seems to have taken place in quite an unexpected direction. It appears that some of the large West End business houses have been approached by enterprising individuals who are offering to erect suction gas plants or similar installations, and to supply electrical energy upon terms more advantageous than those offered by the central-station companies themselves. In addition, the installation would at the end of a definite period become the property of the business houses. To what extent the central-station companies will meet this with a counter stroke remains to be seen.

An innovation in connection with the next tube railway to be opened, of which control was secured by the late Mr. Yerkes and his party—the Great Northern, Piccadilly and Brompton Railway—is that at one of the stations there is to be, in place of lifts, a Reno moving stairway. By an ingenious arrangement of the gear, the stairway will be continuously running in both directions, and it is probable that this method will meet with public approval. Speaking on this point, too, reminds me that the District company has reverted to the old system of flag signaling between the drivers and the guards, having discarded the use of the bell which was, when the electric trains were first used, rung from the rear car to the front, from car to car. No one seems to have heard why this has been done, and I do not remember that any complaints have been made concerning a nuisance caused by the bells. The raising of the fares on the District line has created an agitation which will die hard. Mass meetings are being held in all parts urging people to boycott the line, while a deputation will wait upon the Board of Trade.

The electric fountain at the machinery exhibition in London is an ingenious piece of apparatus. The structure is 33 feet high and eight feet six inches hexagonal at the base. Surrounding the fountain 12 feet from the floor is a large shell 15 feet in diameter, and immediately above this are the fountain arrangements, including an internal tank capable of holding 400 gallons of water. By the aid of an electrically driven pump in the base, the water is circulated to the top of the fountain and through the domes at the rate of 1,500 gallons per minute and drops in a solid cylinder of water four feet in diameter and some 12 or 14 feet in length. Immediately behind this cylinder of water, in screens, are a series of colored electric lights of some 3,000 candles, which continually change color and give a brilliant effect. The lamps can also be rotated in order to heighten this effect. In the pedestal of the fountain are six electric fans, which draw in the air near the floor through grids and afterward throw it out at the top to the extent of some 20,000 to 22,000 cubic feet per minute. In this way and with the aid of the falling column of water the fountain also acts as a ventilator.

In connection with the sale of the Brighton corporation telephone undertaking to the state, the postmaster-general refuses to be precluded from making any arrangements with the National Telephone Company which he may deem advisable, either in the way of intercommunication or combination. It is well that the view of the corporation be not regarded in this matter, for very probably some duplication of plant may be avoided by agreement in some shape or form with the National company. The Brighton corporation now urges the postmaster-general to retain the working of the system in his own hands. The official transfer of the Glasgow municipal telephone system has taken place and a check for $1,540,330 was handed to the chairman of the telephone committee. The system is now designated the Glasgow postoffice telephone service and a rearrangement of charges is looked for. Glasgow still contends that the $25 subscription was sufficient to meet all expenditure, and threatens to "have something to say" should the rates be unduly increased. Opinions differ considerably as to that $25 rate being sufficient to meet expenses; very little had been set aside for depreciation.

A successor to Mr. J. F. C. Snell as city electrical engineer at Sunderland has been appointed in the person of Mr. A. A. Day, who at present holds a similar position at Bolton. Mr. Snell was retained last year in connection with the London County Council electric power bill and is coming to London to practice as a consulting engineer, having, I believe, been again retained by the council for the next parliamentary session.

The Manchester corporation electricity department has three generating stations, two of which are quite modern. The original one, at Dickinson Street, however, somewhat impairs the efficiency of the whole system, and plans are being formulated by the city electrical engineer, Mr. S. L. Pearce, for an extension of the undertaking in order to eliminate the Dickinson Street plant at certain periods of the year except for particular purposes. The details of the proposal have not yet been laid before the corporation, but the increasing demand in Manchester renders extension of the plant necessary, and the opportunity is being sought to dispense as far as possible with the more or less obsolete plant at the Dickinson Street station.

The transporter bridge which has been erected by the Newport corporation across the River Usk in Monmouthshire is novel, in that the traveling car is hauled across by an endless rope off an electrically driven drum.

Tramway managers in this country are dealing in a very firm manner with the strikes of motormen and conductors, which seem just now to be growing popular with the men, so to speak. At Dundee, Halifax and Mansfield the operating employes have recently ceased work, ostensibly on a question relating to the management, and then have attempted to extort all manner of concessions. Without the slightest hesitation new men have been imported and the strike ignored. Thanks to a very good system of police supervision, there has been practically no interference with the new employes, and not more than a day's interference with the service in any case. In all these instances the men's demands have been unreasonable, seeing that they were working under the recognized conditions appertaining to tramway service. G.

Dominion of Canada.

Ottawa, September 29.—The Ontario government has leased Fountain Falls, on the Montreal River, Ontario, to Beach Bros. of Haileybury, who intend to use the power developed there for running an electric railway connecting New Liskeard, Haileybury and Cobalt. The capitalists who are behind the project also intend to use the power for the operation of the silver mines.

H. S. Holt, president of the Montreal Light, Heat and Power Company, is also president of the Kakabeka Falls Power Company, which will supply electric energy to Fort William, Ont. The capital required to carry through the construction work of the company was supplied entirely by Messrs. C. R. Hosmer, H. S. Holt and F. W. Thompson of Montreal, but it was intended that shortly after the date on which power is delivered regularly into Fort William, a regular share company be formed by the Montreal capitalists with a capital of about $5,000,000.

The Ontario Power Company has decided to proceed at once with the completion of the first section of its development plant. Three more generators, with turbines, have been ordered and will be installed as soon as received. They are capable of producing 12,000 horsepower each, being duplicates of generator No. 4, now installed in the power house. When the company desires to further increase the capacity of its plant, it will have to build another section of the power house and another conduit. Rumor says this will be undertaken within a year.

The report of the engineer in charge of the Georgian Bay canal survey will show the feasibility of a hydro-electric development of 1,250,000 horsepower along the route. It is now claimed that an expenditure of $100,000,000 would be justified by the increased facilities afforded transportation of the products of the West to the seaboard by this great waterway, and if so great an electric development can be realized, there would be a greater incentive to construct the works as a national undertaking. W.

New York.

New York, September 29.—The first electric locomotive driven over the tracks of the New York Central Railroad will move into the Grand Central Station from High Bridge tomorrow, the purpose being to try the new motive power. The engine will draw eight steel cars, and the passengers will be officials of the road. As now planned, the change of motive power from steam to electricity over part of the New York Central system will go into effect before November 10th. The authority of the State Legislature to substitute electricity for steam was granted to the company in May, 1903. It was conditioned that the electrification in the Manhattan terminal and the Park Avenue Tunnel should be finished before July, 1908. The change has been made in three years, and without interfering with the regular traffic. The new motive power has been installed from the Grand Central Station to Wakefield, including 56 miles of track; from Mott Haven to Kingsbridge, a distance of 17 miles, and on 12 miles of yard track, making a total of 85 miles. The actual territory covered is 17 miles.

The 35 electric locomotives acquired for hauling through trains are each of 2,200 horsepower and weigh 100 tons. There are 125 motor cars for suburban service, each of 400 horsepower and weighing 53 tons; 55 all-steel multiple-unit cars, weighing 41 tons, and six multiple-unit motor combined baggage and express cars, each of 400 horsepower, making 221 cars and locomotives. The approximate cost of the change of motive power from steam to electricity was $5,000,000, and the average number of workers employed during the progress of the work was 10,000. The suburban station will cover 22 acres and the express level 39 acres, making a total of 61 acres. There will be 25 miles of tracks within the station and accommodations for 1,200 cars.

It is possible that Bayonne, N. J., will erect and operate its own electric-light plant. It is conjectured that by doing so the city can save something like $50 a year on each lamp. Councilmen Bannon, Meyer, Donohoe, Stinson and Cassidy have been named as a committee to inquire into the cost of building a plant.

Following the refusal of the company to meet certain demands made by the motormen on the elevated lines of the Brooklyn Rapid Transit system, the men were in an angry mood last night, and there was much talk among them of a possible strike. In the afternoon representatives of the dissatisfied employes called on President Winter of the road with a number of grievances affecting working conditions and with demands for a higher rate of pay. Whether or not there will be a strike depends upon the action taken by the employes' union when the representatives of the men have made their report.

In readiness for the annual meeting of the stockholders next month, President Charles S. Mellen of the New York, New Haven and Hartford Railroad has given out advance information contained in his general statement of the affairs of the company for the year ended June 30th last. The report of the Consolidated Railway Company, which holds the electric properties, shows earnings of $1,952,449; income from other sources, $64,073, from the total of which the deduction of $1,496,222 represents taxes, rentals, interest, etc., leaving the net income at $520,300.

Work of removing all portable materials from the abandoned United States government's space-telegraph station at Montauk, L. I., to the new station at Fire Island, was completed on Monday. The Fire Island site is one-eighth of a mile from the lighthouse. It is much superior to the Montauk plant, as the largest vessels pass within 10 miles of the shore. The new station will be completed before the cold weather.

The New York City Railway Company has begun to advertise for conductors and motormen, to whom it offers the higher rates of wages recently instituted. Men wanted are those between the ages of 21 and 40. Motormen are offered $2.25 to $2.60 a day and conductors from $2.15 to $2.45. Motormen will receive $1.10 a day during the period of instruction. C. I. C.

Southeastern States.

Charlotte, N. C., September 29.—W. J. Payne, controlling the electric lines on the peninsula about Newport News, Va., has asked the city to permit the Hampton Roads Traction Company to abandon its franchise, tear up its tracks and restore the streets. This is the result of the failure of plans of the Traction Company to consolidate all of the local lines.

Motion has been refused in the case of Schenectady Trust Company against the Cape Fear Power Company for another decree of foreclosure of mortgage. A motion in the same case, held at Raleigh, N. C., by defendant's counsel, to rescind the decree of sale and dissolve the receivership recently granted, was denied by the Federal Court.

The large dam across Saluda River, near Greenville, S. C., is all but complete, and electrical power will be available soon. The Greenville-Carolina Power Company has disposed of most of the power to be generated, leaving a small portion available for the lesser enterprises about the city.

The last of the old cable slot of the United Railways and Electric Company in Baltimore, Md., has been removed, and heavy electrical construction will take its place. During three years the United has rebuilt all of its old cable lines; heavy 60-pound rails are used, and about 300 semi-convertible cars have been put in commission, taking the place of a like number of the older ones. With the addition of two 7,500-horsepower engines and generators on Pratt Street, and the installing of a 7,500-horsepower generator to be ready for use by December 1st, the company is adding greatly to its equipment. New car barns are to be built, and many other improvements made.

Richmond, Va., seems to be in proper shape to get a municipal lighting plant, the committee on electricity having recommended to the council the establishment of a plant on the site of the Old Pump House, and it is believed that the proposition will become a law in a short time. The ordinance under consideration was offered by Mr. Don Leavy. The vote in committee in favor of the plant was eight to one.

About 300 men and many teams are now engaged in the electrical development of the waterpower at Gaston Shoals, near Gaffney, S. C., and a town of some proportions has already risen about the site of the proposed dam.

The Corinth (Miss.) and Shiloh Electric Railway has sold $500,000 in bonds to W. W. Williams & Co., of Nashville, who have successfully floated the bonds, buying the entire issue. The proceeds will be used for building 22 miles of additional road between Corinth and National Shiloh Park in Tennessee. The company will by special act of Congress run the line into the confines of the park, also having secured a privilege to build a 10-story hotel near the terminus. Both freight and passengers will be handled over the new line.

A committee, with J. B. Johnson chairman, Rock

Hill, S. C., is working on a proposition to build a lighting plant or make a new contract. The committee will present to the council estimates of cost of new plant, and also bids from the local light, water and power company for lighting the city for a term of years.

The Cabarrus cotton mill at Concord, N. C., has been equipped for operating by electricity. All of the six or eight mills of Concord will resort to electricity for power.

A movement is on foot at Statesville, N. C., in which the Commercial Club is interested, to organize a new cotton mill in order to increase the amount of electric power to be used as motive power so that the Southern Power Company will bring its wires into that town.

Prospects are good for a large waterpower electric development near Hickory, N. C., where Col. M. E. Thornton, with outside capital, has secured access to the Catawba River, where it is said 80,000 horsepower will be available for Hickory, Newton, Maiden and other manufacturing points. It is proposed to unite two waterfalls, several miles apart, into one plant, and thereby get a larger amount of energy than would be gotten from the aggregate of the two powers developed separately with a power plant located at each. L.

Ohio.

Cleveland, September 29.—Philadelphia men will in a short time incorporate the Columbus, Magnetic Springs and Northern Traction Company, to take over the property of the Delaware and Magnetic Springs Traction Company, which was purchased a short time ago. The capital stock of the company will be $400,000.

President John W. Herron of the board of trustees of Miami University at Oxford has asked Governor Harris that the institution be allowed $6,000 for an electric plant. The current has heretofore been furnished by the village plant, but it seems that the demands for the town have become so great that it can no longer take care of the university.

It is said that Toledo has been offered street-lighting service for $52 per lamp in place of $83, as now paid. The Toledo Railways and Light Company has had the contract for some years.

The Marion and Western Railway, Light and Power Company has been incorporated with a capital stock of $200,000 by John G. Webb, George H. Holzbog, H. B. Harris, James S. Webb and George Whysall to construct an electric railway from Prospect to Richwood, Union County, a distance of about seven miles. The interests of the new company are identical with those of the Columbus, Delaware and Marion. The same men have also incorporated the Marion and Suburban Railway Company, with a capital stock of $250,000, to operate lines in Marion and to other towns in Marion County.

The Cleveland Electric Railway Company has asked the city to bring suit at once to forfeit all the grants made to the Forest City Railway Company on the ground that Mayor Johnson is financially interested in the company, in violation of the law. The city attorney replied that such suit would be brought and asked that the evidence be furnished to substantiate it. This action will complicate matters and probably hinder a settlement of the street-railway controversy. The Cleveland Electric Railway Company says that its best proposition is contained in an ordinance now pending before the council and asks that it be submitted to a vote of the people at the next election.

The State Railroad Commission has made arrangements to inspect electric roads in the same way as steam roads.

Public-service corporations have paid into the treasury of Franklin County this year $218,284. Of this, street and interurban roads paid $57,055; telegraph companies, $1,362, and gas, ice and electric-light companies, $31,024.

A two-track electric railway will be built at the state fair grounds at Columbus, and cars will be operated there for demonstrating the use of different apparatus and mechanical appliances during the convention of the American Street and Interurban Railway Association.

The consolidation of the Canton-Akron Consolidated Railway Company with the Northern Ohio Traction and Light Company of Akron was completed at a meeting of the board of directors of the latter on Friday. The Akron Consolidated was made up of the Canton-Akron Railway Company, the Canton-New Philadelphia Traction Company and the Tuscarawas Traction Company. The value of the acquired properties is placed at $4,000,000. It is said that Charles Currie will now be the manager of the entire system. P. L. Saltonstall and Mr. Tucker of the Tucker-Anthony syndicate were added to the board of directors of the Northern Ohio Traction and Light Company. To some extent this company will be a holding company, as the stock of the Canton-Akron Consolidated goes into its treasury, and it assumes the interest on $4,155,000 bonds.

The Barney & Smith Car Company of Dayton is extending its electric railway from Naylor to Valdosta, Ga., in order to take care of a new piece of timber land that is being opened up. This line transports the lumber to the trunk-line railroads for shipment to the factory at Dayton.

The Ohio Electrical Supply Company of Columbus has purchased a building from the Morgan Engineering Company at Alliance and will install machinery in it as soon as possible. Otto C. Rayman will be the manager. O. M. C.

Indiana.

Indianapolis, September 29.—William H. Ogan of Indianapolis and associates of Kenton, Ohio, are promoting a new traction company to construct a line from Marion, Ind., to Lima, Ohio. The company will soon be incorporated with a capital stock of $1,500. The promoters say that the line will be the first in the country to use the new Strang gasoline electric cars.

The increasing express and freight business of the interurban lines centering at Indianapolis has reached a point which necessitates the operation of additional cars on nearly every line.

George A. Saylor, who has been superintendent of the Indianapolis, Columbus and Southern Traction Company from the beginning of operation on the road, has tendered his resignation to accept a position as salesman for a Milwaukee electric firm.

The Indiana Car and Equipment Company of Logansport has been incorporated with a capital stock of $50,000. The company proposes to manufacture and repair all kinds of cars and manufacture equipments. L. J. Smith, F. J. Lewis and C. H. Pennington are the directors.

A recent break in a large water main in Ohio Street, Indianapolis, was the means of making the discovery that electrolysis has affected the water mains to an alarming extent. The officials of the water company are emphatic in their demand for some sort of protection against the ravages of the electric current.

The city of Indianapolis is preparing to enter into a contract for such improvement in the Gamewell police telegraph system as will safeguard the lives of the operator. This precaution has been prompted by the loss of life and serious injury to a number of officers and firemen who are compelled to operate the system.

The Indianapolis City Council has passed an ordinance compelling all railroad companies entering the city to provide and maintain electric street lights at street crossings. The operation of the ordinance, if it can be enforced, will save the city at least $10,000 per year. The ordinance includes interurban and steam railroads using their own tracks.

The gas and naptha street-lighting service in the outlying districts of Indianapolis has been discontinued by expiration of contract. The city authorities will immediately advertise for bids for such service in accordance with the city charter.

The City Council of Rushville has decided to improve the electric-light plant by enlarging the building and installing a 160-kilowatt direct-connected alternating-current unit, with the necessary switchboard and equipment; also transformers for additional street lamps and arc lights for both public and commercial use.

The Richmond Electric Sign Company, recently incorporated, will establish a plant in the city of Richmond for the manufacture and installation of electric signs of all kinds.

Articles of incorporation have been filed by the Winona and Maxinkuckee Electric Railway Company with an initial capital stock of $10,000. The company's home office will be in South Bend, and the object is to construct an electric railway connecting Culver, Warsaw and Argos. The directors are headed by Edwin P. Taylor.

The one needed electric railway to complete the plan of making Goshen an electric-railway center is to be supplied by a north-and-south road projected by the Plymouth, Goshen and White Pigeon Railway Company. The new line will be 48 miles long.

The Indiana Central Traction Company is said to have been financed, and the work of building from Wabash to Warsaw will begin at once. The new line will give direct trolley communication from Indianapolis to Winona, and will also connect the Indiana Union Traction system and the Indiana Interurban with the Northern Indiana systems.

Ground was broken during the last week for the construction of a large power plant near Newcastle for the Indianapolis, Newcastle and Toledo Electric Railway Company, which is to build an electric railway between the cities named. It is the purpose of the company to finish the power plant and the first section of the line between Indianapolis and Newcastle as speedily as possible.

Indiana traction men have taken steps to bring the electric roads under complete jurisdiction of the Indiana Railroad Commission for the purpose of obtaining the benefits of the provisions of the law requiring railroad companies to make through-traffic arrangements, and also to exchange freight matter in bulk or carload lots. Up to the present time the steam lines, with a few exceptions, have ignored the interurban lines and refused to make through passenger rates or receive or transfer freight in bulk. Traction men believe that the time is coming when their roads will be built sufficiently strong to carry freight from the steam lines in carload lots for short distances, and thus save the transfer thereof.

The school commissioners in the principal cities of Indiana have ordered maps of the traction lines of Indiana from the American Engineering Company for use in the graded schools, in connection with the study of Indiana geography.

The Beck Light, Heat and Power Company has been incorporated to construct and operate a water, light, heat and power plant in the city of Carthage, Ind. The capital stock is $10,000. S. S.

Illinois.

Peoria, September 29.—Joseph S. Dailey of Chillicothe has sold the water and light plant in that city to a syndicate headed by F. A. Sharpe of Chicago and F. H. Earl of Plano, Ill. The price is said to have been between $90,000 and $100,000. A new company has been incorporated with a capital of $50,000. The company has the use of the streets for nearly 20 years, according to the franchise. The plant was erected in 1891 and Mr. Dailey took it over in 1897. Mr. Dailey is heavily interested in the Independent telephone business, to which he will devote his time in the future.

The Chicago and Alton has given notice to its telegraphers that, commencing October 1st, they will be given an advance in pay.

Claiming that the right-of-way is too expensive, the proposed electric road between St. David and Lewistown will not be built. The Illinois Central Electric Railway Company will not build beyond St. David, as the owners of the land are asking too much for their property.

John Finley, who retires from the managership of the Peoria Railway Company, has been presented a gold watch by the employes of the company in token of their good will.

The City Council of Springfield will take control of the municipal lighting plant. An ordinance to that effect will be introduced, ratifying the contract submitted by General Manager Emil G. Schmidt of the Public Utilities Company. The Utilities company has been operating the plant for the city, and the new contract is very fair and is drawn pending the controversy now before the Circuit Court.

Track laying has begun on the new interurban electric road between Kewanee and Galva. V.

Northwestern States.

Minneapolis, September 29.—F. H. Joslin and other Oshkosh (Wis.) men have closed a $50,000 deal for the purchase of power rights on the Peshtigo River at High Falls and Joslin Falls. Both powers will be developed and power transmitted to Marinette and Green Bay.

A movement is on foot at Jefferson, Iowa, looking to the construction of a trolley line to Perry, where it would connect with the Interurban Railway Company's line.

The Brainerd Hydro-electric Power Company will put in a power plant at Brainerd, Minn., and has submitted a proposition to the City Council looking to the furnishing of the city with lighting for the streets.

Construction work has been started on the new electric-light plant at Hevelock, Neb.

Plans will be prepared shortly for a city electric-light plant at Fairmont, Minn.

The contracts have been let at Kelliher, Minn., for the new water and light plant. R.

Pacific Slope.

San Francisco, September 27.—The Portland Railway, Light and Power Company's new hydro-electric plant at Cazadero, Ore., which has been under construction for more than a year, is to be started up about December 1st. A permanent concrete dam will be put in, not later than 1908, at a cost of about $100,000. The plant practically picks up the entire flow of the Clackamas River. From the dam it is conveyed in a flume to the power station. The electricity will be transmitted to Portland on a pole line about 28 miles in length, now in course of erection. A sub-station is being constructed at the Waverly Golf Links.

Mayor Schmitz of San Francisco recommends that the city take possession of the Geary Street Railroad, of which the franchise has expired, and reconstruct the street-car system as an overhead-trolley line. It is being operated at present by the original owners as a cable road, a monthly rental being paid to the city. Before the fire the Board of Supervisors entered into a contract with C. E. Loss to reconstruct this road as an underground-conduit electric line, to be operated by the municipality. The contractor has since been released from his obligation, as the mayor has become convinced that the underground-conduit system is not the best for San Francisco under the changed conditions.

The United Railroads of San Francisco has shown great activity in resuming the reconstruction of its street-railroad lines ever since the striking employes returned to work, pending the arbitration of their differences, which is about to begin.

The westbound track of the United Railroads on Sutter Street has been opened to electric cars as far as Devisadero Street. The reopening of the

Polk and Larkin street line will be taken up before very long. The construction of a new electric road out Fulton Street from Twenty-fourth Avenue westward through the sandhills north of Golden Gate Park, toward the Ocean Beach, has been resumed. The construction of large repair shops near the Geneva Street car-barns will be rushed. A great many new electric cars will be set up and equipped. A lot of the company's old cable cars will be sold for use as temporary houses, by burned-out citizens, who are looking for shelter from the fall rains.

A proposition has been made by the Hood River Electric Light and Power Company of Hood River, Ore., to extend its wires to Mosier for the purpose of lighting that city. The distance to be traversed is between five and six miles. It is also proposed to supply power for the box factory at Mosier from the same source.

The Western Union Telegraph Company will shortly begin the construction of a railroad telegraph line on the Weed Road in Oregon from its junction with the Southern Pacific in the Sacramento Canyon, at Weed, Ore. The Weed railroad heretofore has only had a telephone-wire service.

An electric-lighting plant owned by the city of Echo, Ore., is soon to be established at that place. The engine and dynamo have been ordered, and the poles of the system are already in place. Under the franchise of the Bitter Creek Telephone Company its poles can be used by the city.

The Pacific States Telephone and Telegraph Company has decided to spend $300,000 on toll lines in the state of California. Two new wires will be strung between Stockton and San Francisco, and an underground system will be constructed in Stockton.

The Sunset Telephone Company is preparing to build a long-distance line from Wadsworth to Lovelock, Nev. These cities will be connected with all the intervening points of interest.

Great Northern engineers are working out a proposition to "harness" Chelan Falls in Washington and generate enough electric power to operate all the Great Northern trains, on a line yet to be built between Wenatchee and Chelan, between Wenatchee and Seattle, and the line between Seattle and Vancouver, B. C. Electrical engineers have estimated that the falls can be made to produce as high as 100,000 horsepower, and it is declared entirely feasible to transmit this power the 100 miles to Seattle to electrify the Hill line. The immediate construction of an electric line between Wenatchee and Chelan Falls by the Hill system is planned as the beginning of the changed system.

A.

PERSONAL.

H. F. Whitcomb, Jr., has been elected secretary of the Eastern Wisconsin Railway and Light Company of Fond du Lac, Wis., succeeding F. B. Huntington, who resigned several months ago.

E. C. Morse has resigned his position as instructor in electrical engineering at the Worcester (Mass.) Polytechnic Institute to accept a position with the Westinghouse company in Boston.

Alfred S. Brown, for a long time head of the electrical engineering department of the Western Union Telegraph Company, died at New York on September 25th, aged 71 years. He leaves a widow and two daughters.

L. D. Mathes, general manager of the Union Electric Company of Dubuque, Iowa, was in Chicago last week. He says that business is particularly good in Dubuque, there being a notable revival of interest in the lead-mining industry in and near Dubuque, for which considerable electric power is required.

Henry J. Clark has been chosen manager of the Fort Dodge Light and Power Company of Fort Dodge, Iowa, filling the vacancy caused by the resignation of H. E. Morton. Mr. Clark has been with the Fort Dodge company for two years, and his experience in the electrical field extends over a period of 15 years.

Mr. C. W. Whitney, formerly associate editor of the Western Electrician and now manager of the publicity department of the Abner Doble Company of San Francisco, was in Chicago last week on an eastern visit. Mr. Whitney reports that the work of rebuilding the metropolis of the Pacific Coast is proceeding rapidly.

W. H. Hurlburt, general manager of the Oregon Power and Railway Company's lines at Portland, Ore., will retire from the service. He does not expect to return to railroading, as he has been 36 years in the service. Mr. Hurlburt was president of the Oregon Waterpower and Railway Company prior to its consolidation with the other electrical interests into the Portland Railway, Light and Power Company.

Robert W. Hunt & Co., Chicago, announce that they have engaged the services of Mr. Edward H. Lynde, who for years was connected with the Lackawanna Steel Company, in charge of its Bessemer steel-rail department at Scranton, Pa. Mr. Lynde will assume direct charge of the departments of the Hunt business which were under the immediate direction of the lately deceased partner, Mr. Albert W. Fiero. It may be of interest to Mr. Fiero's many personal friends to know that under the terms of the partnership, his widow and children will continue to enjoy his interests in the business for three years following his death.

ELECTRIC LIGHTING.

T. H. Slover will erect a new electric-light plant in Davis, I. T.

The City Council of Jonesville, La., proposes to establish a light plant in the near future.

The Plymouth Gypsum Company of Fort Dodge, Iowa, has let the contract for an electric-light plant in its mill.

The Frisco railroad will install an electric plant in its shops at Monett, Mo., for light and power purposes.

The city of Brookhaven, Miss., will issue $15,000 bonds for the improvement of the waterworks and electric-light plant.

The Louisiana (Mo.) Gas and Electric Light Company has changed its name to the Louisiana Power and Traction Company.

An engine and generator are being installed and poles set preparatory to lighting the village of Owen, Wis., with electricity.

James L. Key is chairman of a committee appointed to investigate the cost of installing an electric-light and gas plant for Atlanta, Ga.

The Wapello (Iowa) Electric Light and Power Company proposes to receive bids for the construction of a water and light plant to cost $15,000.

The Standard Electric Company of Jacksonville, Fla., is said to have contracted to construct the proposed waterworks and electric-light plant in Dunnellon, Fla.

Henry Floyd, consulting engineer of East Orange, N. J., has been engaged to estimate the cost of a combined municipal lighting and incinerating plant proposed for East Orange.

Richmond, Va., is considering the installation of an electric-light plant. It is estimated that about $300,000 will be required for the complete equipment. W. E. Cutshaw is city engineer.

An engineer has been engaged by the city of De Funiak Springs, Fla., to prepare plans and specifications for an electric-light plant, water-works and sewerage system. About $50,000 will be expended in improvements.

The Fairbanks Company has made a proposition to the town of La Porte, Tex., to install waterworks and electric-light plant. A 500-light electric plant with 50-horsepower gas engine will be installed. A. N. McKay is mayor.

The Mauch Chunk Heat, Power and Electric Light Company of Mauch Chunk, Pa., is a recent purchaser of a 20 by 36-inch Reynolds Reliance Corliss engine of the belted type, built by the Allis-Chalmers Company of Milwaukee. The new unit will drive electric generating apparatus.

The Sapulpa (I. T.) Light and Power Company has been organized with E. C. Reynolds and J. A. Boyd at the head. The company will operate an electric-light plant for which Mr. Boyd has received a franchise. It is proposed to equip for a capacity of 135 kilowatts. About $20,000 will be invested.

On October 8th the city of Greenville, Mich., will vote on the proposition to install a municipal electric-light plant. The city is to be bonded for only $28,000, and this is not considered sufficient for a plant to supply a city of 4,000 inhabitants. The Greenville Gas, Electric Light, Power and Fuel Company now furnishes 45 arc lights at the reasonable rate of $50 each a year, burning until 1 a. m. Current is furnished at 10 cents a kilowatt-hour. It is quite likely that the municipal plan will be defeated.

The Detroit Edison Company is said to have obtained valuable waterpower concessions on the Huron River, which it will proceed to develop. This company controls practically all the commercial electric lighting and power business of Detroit. It does no street lighting, as the city has a municipal plant for this purpose. As soon as the company has completed its new waterpower plant it is expected, says a correspondent to the Milwaukee Journal, that it will put in a strong bid for the public lighting. The municipal plant is old, and though it is managed efficiently its operation is not as economical as that of a modern plant. With its new and cheap means of producing electricity the company is expected to underbid the city for this work.

ELECTRIC RAILWAYS.

The Milwaukee Heat, Light and Traction Company has petitioned for a franchise to extend its lines through the streets of Burlington, Wis.

The Snohomish Valley Railway Company has petitioned the council of Everett, Wash., for a franchise permitting entrance of an electric railway. The company has arranged to place $2,500,000 bonds, and proposes to begin the construction of the line at once.

M. Buckmaster has petitioned the council of Redlands, Cal., for a franchise to construct an electric railway in the eastern section of the city. The franchise would permit the carrying of mail.

Traction lines from Covington, Ky., to Spring Lake and Independence have been planned, it is said. Engineers are now at work on them, and an eastern syndicate is said to be interested.

Promoters of the Du Quoin Rapid Transit Company propose to build an interurban railway from Benton to Dellville, through Du Quoin, Ill. They have completed arrangements and will at once begin the construction of the road.

According to the London Times it has been determined to construct an underground electric railway at Buenos Aires, the estimated first contract to be $240,000. It is expected that bids will be called for shortly. Señores Guesada y Gallo, Buenos Aires, Argentina, may be addressed.

The Dallas Traction Company of Dallas, Tex., has been incorporated with a capital stock of $3,000,000 for the purpose of constructing and operating an electric railway between Dallas and Sherman. The incorporators are Frank S. Procter, Walter G. Clark, J. F. Strickland and a number of others.

POWER TRANSMISSION.

The Electric Manufacturing and Power Company of Spartanburg, S. C., will develop the waterpower of the Broad River and transmit electricity to Gaffney, Spartanburg and otner towns.

The Great Northern Railway Company is interested in a project to develop waterpower in the Chelan River for the purpose of operating an electric railway from Wenatchee to Seattle, Wash.

The Everett (Wash.) Railway, Light and Power Company has plans under way to develop the waterpower at Granite Falls, 14 miles from Everett, and transmit current to Everett for the use of the street cars, lighting system and for commercial purposes.

The Light, Power and Water Company of Elgin, Utah, on Green River, has filed articles of incorporation. The capital stock of the company is $24,000. The officers are L. P. Hill, W. G. English and C. E. Whistler. The company will divert water from Green River for power and irrigation purposes.

C. C. Field of Shepherd, Mich., has real estate options on 22 miles of Michigan rivers, with site privilege for five dams having an average of from 20 to 25 feet head each and 300 cubic feet of water per second. He says that the first cost of development will be low and a ready sale for all power can be found at reasonable distances.

The ameer of Afghanistan is deeply interesting himself in the development of the new town of Jabl-us-Siraj. He has determined to employ electric power in his factories, but the cost of fuel is so high that the driving of dynamos by steam would involve heavy expenditure. There is, however, an enormous amount of waterpower running to waste in the Khoistan, and this is now to be utilized. At Jabl-us-Siraj, apparently, the Panjshehr has a sufficient fall to give all the power that is needed, and the necessary works are being undertaken to utilize this.

The Rio de Janeiro Tramway, Light and Power Company is pushing forward the construction work on its new power plant as rapidly as possible. A temporary power plant has been completed, and as soon as the pole line into the city of Rio de Janeiro is finished the company will have 3,560 horsepower ready to be delivered into the city. This will be used in operating one tramway line which has already been electrified, in filling electric-light contracts and in supplying power to some of the industrial concerns. There is said to be every indication that the big power plant will be completed within the next 15 months, and the company will then have 48,000 horsepower available for distribution in the city.

The Central Colorado Power Company is planning to utilize the waterpower of the Grand River to generate electricity for light and power for use in Denver, Colorado Springs, Leadville, Cripple Creek and many other places. Ex-Governor Myron T. Herrick of Ohio, it is said, will be the president of the company when the organization is completed. Engineers estimate that current to an aggregate of 75,000 horsepower may be developed, but it is the intention of the promoters to start with a plant that will develop 30,000 horsepower. The capitalization will be $22,250,000, with an authorized bond issue of $20,000,000. For the initiatory development, $9,000,000 bonds will be sold. The largest part of the securities has been taken by London capitalists, it is said.

PUBLICATIONS.

Ajax arc-light specialties are given special attention in the October bulletin of the Ajax Line Material Company, 12 and 14 South Jefferson Street, Chicago. Twenty-nine convenient and serviceable specialties are enumerated, including pole tops, rope, chains, insulators, tools, pulleys, cleats, break-arms, fixtures, mast-arms, etc.

The 300 words recommended by the Simplified Spelling Board and adopted by President Roosevelt for use in all executive documents have been printed conveniently for reference on a large wall card by the Crocker-Wheeler Company, Ampere, N. J. The company is sending the card to its friends and patrons, with its compliments.

The P & S folders, which arrive regularly from Pass & Seymour, Solvay, N. Y., are well designed for the purpose of attracting attenion to the company's big line of electrical specialties. Attached to the last one is a card calling attention to a socket, No. 417, designed for temporary decorative work, by the use of which it is not necessary to strip the insulation from the wire to make contact.

The latest publication from the Wagner Electric Manufacturing Company, St. Louis, is a neat illustrated booklet treating briefly of lighting and power transformers, single-phase constant-speed motors, vertical motors, elevator motors, single-phase printing-press drive with auto-transformer control, polyphase motors, switchboard instruments and portable instruments. Further and more detailed information of the company's high-grade lines mentioned above can be found in bulletins Nos. 67, 71, 72, 75, 77 and 78.

"A System of Engines" is the title of a handsome library edition of a book treating of the products of the Harrisburg Foundry and Machine Works, Harrisburg, Pa. It is presented by Mr. A. M. Morse, manager of the Chicago office. The book has 57 pages, artistically printed, and the cover is an attractive and durable imitation of burnt-leather work. There are a large number of excellent half-tone illustrations and several colored plates. The text is largely devoted to Fleming reciprocating engines, but also goes into Fleming steam turbines and superheaters and Fleming steam power plants.

The Crocker-Wheeler Company, Ampere, N. J., has just published Bulletin 69, describing a specially arranged generator for direct connection to steam or gas engines. The form I machine, known as a motor, has received some modifications in the present design, which bring the machine into the market as a dynamo. These generators are built in sizes to give outputs of 1½ to 19 kilowatts, and meet the demand for small direct-connected units for isolated plants and residences. The commutator end of the shaft is carried in a bearing supported by a rigid bracket which is bolted to the side of the frame, and the inner end of the shaft is finished to receive the engine coupling.

SOCIETIES AND SCHOOLS.

The Massachusetts Institute of Technology began its fifty-first year on September 27th, with large gains in all the classes. The curriculum is practically the same as that of last year, with the exception of changes in the sanitary and civil-engineering courses. During the summer a sub-cellar has been built under Rogers Museum, the Rogers Building corridors have been renovated, and a drinking fountain, presented by the class of 1906, has been placed in the main corridor of the latter building. Definite plans for the Walker Memorial Building will soon be made. Among the new appointments are those of Raymond Haskell as instructor in theoretical electricity, Edward B. Rowe, S. H. Granten and Charles D. Richardson as assistant instructors in electrical engineering, and Burton W. Kendall as assistant instructor in electrochemistry.

The new building for the engineering departments of the University of Pennsylvania, Philadelphia, will be dedicated on October 19th. The building, which is at Locust and Thirty-third streets, will be open for private view from 9 a. m. to 5 p. m. The dedicatory exercises will be at 2 o'clock.

The Proceedings of the annual meeting of the Association of Railway Telegraph Superintendents at Denver June 20 and 21, 1906, have appeared in pamphlet form. This association was formed in Chicago in 1882, and its object is the improvement of the railway telegraph service. E. A. Chenery of St. Louis is president and P. W. Drew of Milwaukee is secretary.

The applications for admission to the fall term of the Lowell Textile School, Lowell, Mass., which began on September 25th, indicate an increase in the entering class of about 20 per cent. The popular department of engineering has been further strengthened by the addition to the instruction staff of Herbert J. Ball, Louis F. Blume, Robert R. Sleeper, Frederick A. Wood and Henry H. Crompton.

At a recent meeting of the executive committee of the National Electric Light Association the matter of offices in the United Engineering Building, New York city, was finally decided, and the association will therefore change its headquarters as soon as practicable after the new building is ready for occupancy. There was an unusually full attendance at the meeting, and several very important measures for the benefit of the association were set in motion.

Thirteen miles of electric railway, a part of the system planned to connect Lafayette, Ind., and Chicago, will be built by the students of Purdue University, the promoters of the road having made arrangements with the university authorities whereby the Purdue students will have entire charge of the work of building the first section of the road out of Lafayette. The surveys are now being made by Purdue men, under guidance of the members of the faculty.

TELEGRAPH.

The Western Union Telegraph Company is constructing an additional circuit from Little Rock to Hot Springs, Ark., a distance of 60 miles. Copper wire running 210 pounds to the mile is being used.

The Postal Telegraph-cable Company is preparing to construct a transmountain branch with the main office at Reno, Nev. Wires will be strung from Salt Lake to San Francisco with lines to Tonopah and the southern mining country.

MISCELLANEOUS.

The Eastman Kodak Company of Rochester, N. Y., in making extensions to the present power equipment has contracted for a new 22 by 42-inch Reynolds Reliance Corliss engine for direct connection to a 300-kilowatt direct-current generator. The new engine will be furnished by the Allis-Chalmers Company of Milwaukee.

TRADE NEWS.

A. B. Dempsey has sold his electrical supply business in Sedalia, Mo.

E. A. Frantz of Weatherford, Tex., has purchased the electric-supply business of C. J. Clark.

The Van Buren Electrical Supply Company of Van Buren, Ark., has been organized by C. B. Williams, Arthur Todd and Harry Todd to deal in electrical supplies and fixtures.

The French Battery Company of Madison, Wis., manufacturer of dry batteries, has appointed as its general agent for Chicago the firm of A. J. Cox & Co., which enjoys a large acquaintance in the telephone field.

The firm of Keough Bros. & Co., Boston, has been dissolved by mutual consent. All outstanding accounts and contracts have been assumed by Augustus Keough and James E. Keough, who will carry on the business of electrical contractors at 41 North Street, Boston, Mass., under the firm name of Keough Electric Company.

Sealed proposals will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until 3 o'clock p. m. on October 22d, for the installation of a conduit and electric wiring system for the United States postoffice and court house at Sherman, Texas, in accordance with drawings and specifications, copies of which may be had at the above office, or at the office of the superintendent of construction, Sherman. Bids will also be received until October 17th for the installation of an electric passenger elevator in the postoffice and court house at Fargo, N. D.

Thomas T. Richards of the Wagner Electric Manufacturing Company, St. Louis, informs the Western Electrician that on September 19th Judge Hazel, sitting in the United States Circuit Court for the Southern District of New York, handed down a decision favorable to the Wagner company in a suit in equity of the Arnold Monophase Electric Company, complainant, against the Wagner Electric Manufacturing Company and Herbert A. Wagner, defendants, involving the title to United States letters patent Nos. 543,836 and 562,365. This litigation has been going through the courts for some time. Judge Hazel's decision sustains the Wagner company fully and completely in the title to the patents. The patents in question are those of Prof. E. Arnold, and constitute a part of the chain of patents involved in the single-phase power motors manufactured by the Wagner company.

The London Times of September 12th says: "The Société Westinghouse Électrique de Russie is the title of the new company, formed in Paris, to acquire the Westinghouse patents for Russia relating to electrical apparatus, turbines, gas engines, etc. Its president is Mr. George Westinghouse and the vice-presidents M. E. Déjardin-Verkinder, of the Société Générale of Paris, and Mr. J. H. Lukach, of the Traction and Power Securities Company. It also acquires the Compagnie Centrale d'Electricité's electrical works at Moscow. The company has a share capital of 20,000,000 francs, of which 7,000,000 francs has been subscribed in cash and the balance has been issued to pay for the assets acquired. A debenture issue has been arranged with the Société Générale. The company will begin operations with the electrification of the municipal tramways of St. Petersburg, and the profits of its production of electrical apparatus should be assisted by the almost prohibitive duty recently imposed."

BUSINESS.

Kohler Bros., contracting electrical engineers, Chicago, have given the name "The Kohler System" to their systematic way of handling a job. They say: "We can do any electrical work if the architect and owner are particular. If they are not, we don't care for the work."

ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued (United States Patent Office) September 25, 1906.

831,530. Trolley-pole Controller. James F. Boggs, Needles, Cal. Application filed September 21, 1905.

A spring-pressed piston working in a hydraulic cylinder operates the trolley pole, being itself controlled by the fluid supply.

831,548. Joint for Electric Conductors and Other Wires. Austin Fleeger, Chicora, Pa. Application filed August 18, 1905.

The two wire ends to be joined are gripped in the conical-shaped ends of a metal sleeve by the wedge action of a number of gripping pieces, each too large to pass through the wire holes of the sleeve.

831,561. Antimagnetic Watch. Henry S. Montgomery, Topeka, Kan. Application filed May 9, 1905.

The main spring barrel of the watch is permanently magnetized, and its effect is balanced by a permanent magnetized disk located on the arbor and likewise on the opposite side of the driving wheel.

831,562. Insulated Track System. Andrew Morrison, Pittsburg, Pa. Application filed June 9, 1905.

Insulated clips hold down the rails, which rest on chafing plates separated from the supporting metallic ties by layers of insulating material. The clips abutt against shoulders on the chafing plates and engage the base flanges of the rails, being held down by insulated throughbolts, so that it is claimed the two lines of rails are wholly insulated from the ties and from each other.

831,599. Inductive System. Ralph C. Browne, Salem, Mass. Application filed August 19, 1904.

An apparatus for providing suitable charges for therapeutic electrodes, comprising a condenser automatically charged by the self-induction and secondary induction of a main circuit. (See cut on next page.)

831,609. Electrical Measuring Instrument. Carl Hering, Philadelphia, Pa. Application filed August 3, 1905.

Current strength is measured by the magnetic interactions between a fixed and a movable coil.

831,624. Electric Railroad. Jeremiah Murphy, Chicago, Ill. Application filed February 9, 1906.

Feed current is taken from the under side of a "third rail," insulated from its supporting standards and shrouded in by an overarching shield insulated from the rail. The object is the prevention of injury to the public and of loss of current.

831,625. Ventilated Armature. James F. McElroy, Albany, N. Y., assignor to the Consolidated Car Heating Company, Albany, N. Y. Application filed April 18, 1905.

Ventilating channels are provided by interposing between ordinary laminated core sections spacing disks keyed to the shaft and having stiff thrust-resisting pocket-shaped projections on one side only, abutting an opposite disk and located in the same angular and radial positions in successive spacing disks, the other sides of these disks being plane and seating solidly against the core sections.

831,634. Alarm-system Apparatus. Richard F. Spamer, Chicago, Ill., assignor to the Consolidated Fire Alarm Company, New York, N. Y. Application filed September 23, 1905.

In this fire-alarm apparatus a signal wheel controlled by an electromagnetic device makes and breaks the main circuit, the arrangement allowing the signal wheel to be rotated to send in a trouble alarm and to be stopped when the trouble alarm is completed, also to start the wheel to send in an O. K. signal when the normal condition of the local circuit is restored, while leaving the signal wheel in a position to repeat the process upon a second interference with the normal condition of the local circuit.

831,666. Electric Panel Board. Montgomery H. Johnson, Utica, N. Y. Application filed July 8, 1905.

This panel has three parallel bus-bars spaced apart, and a series of fuse-plug sockets supported directly over and spaced apart from the middle bar and from each other, while lateral distributing conductors from

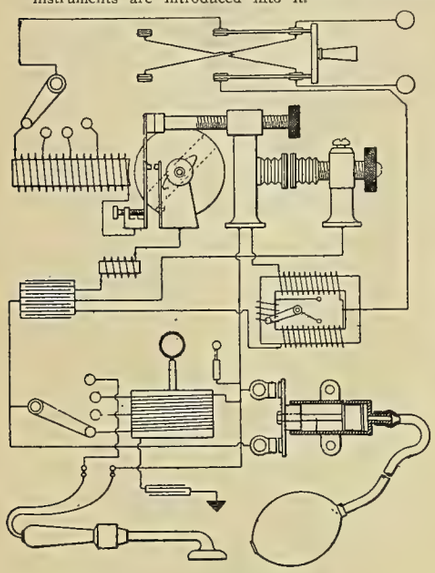
the sockets pass over and are spaced apart from the other bus-bars respectively. Other fuse-plug sockets are supported over the outer bus-bars and have distributing conductors connected with them.

831,678. Device for Nourishing and Strengthening the Growth of Trees. Anna Osborne, Santa Ana, Cal. Application filed April 25, 1906.

A combination of iron and copper wires with a zinc cup is used to stimulate plant life.

831,687. Selecting and Signaling System. Robert J. Sheehy, New York, N. Y. Application filed October 9, 1902.

In a line connecting a central station with a number of sub-stations there is a pole changer at the central station for sending alternating currents to line and adapted to be brought to rest, after the transmission of any given number of impulses with a given pole of the battery to line. Apparatus at each station responds step by step to such impulses. When the apparatus at any station has been advanced a particular number of predetermined steps the main-line circuit is directed through telegraphic instruments at the station. A resistance in the normal line circuit at each station is provided equal to the resistance of the telegraphic instruments introduced into the line, and may be eliminated from the direct-line circuit when the telegraphic instruments are introduced into it.



NO. 831,599.—INDUCTIVE SYSTEM FOR THERAPEUTICS.

831,685. Variable-speed Device. Grant B. Rossman, New York, N. Y. Application filed September 29, 1903.

A horseshoe electromagnet is used to increase the friction between the driving and the driven member, while a movable idler interposcd between them enables the speed to be varied by contacting with the driving member at a variable distance from its axis. (See cut.)

831,724. Method of Fixing Incandescent Lamps. Josef Levin, Munich, Germany. Application filed November 16, 1905.

A structurally novel socket piece and connecting device are described.

831,740. Armature-winding Machine. Paul E. Oswald, Los Angeles, Cal. Application filed October 23, 1905.

A guard frame having staggered arms engages the armature drum at its opposite ends at different core channels. The armature holding frame is rotated by a shaft, the exact turns of which are registered by the marked disk of a worm wheel actuated by a worm on the shaft.

831,779. Magnetic Sound Record. Victor H. Emerson, Newark, N. J., assignor to the American Graphophone Company, Washington, D. C. Application filed January 14, 1904. Renewed March 2, 1906.

This patent covers both the instrument and the art by means of which sound records are traced on a non-magnetic tablet by the crumbling action of a magnetic needle actuated in accordance with sound waves.

831,792. Trolley Wheel. William Livingstone, New York, N. Y., assignor of three-eighths to himself and five-eighths to the Empire State Engineering Company, New York, N. Y. Application filed March 27, 1905.

A trolley wheel made of sheet-metal parts united in a structurally novel way.

831,815. Connector for Electrical Conductors. Paul F. Williams, Chicago, Ill. Application filed May 23, 1905.

A pair of oppositely open sockets, in connection with a plug fitting into one of these sockets, connect the cable ends electrically and mechanically, while they are protected by an insulating casing and screwed cap, the intervening space being filled with insulating cement.

831,819. Telephone System. Francis G. Bell, London, England, assignor of one-half to Isidore Bernard Birnbaum, London, England. Application filed October 9, 1905.

The characteristic features are a split impedance coil in the operator's set, with split indicator coils in connection with each subscriber's lines, and means for connections of the battery between the impedance and indicator coils of the operator's and subscriber's sets which are in communication in such a way that the pulsations of current allowed to pass by the vibrator through one circuit are able to produce, in the impedance and indicator coils, induced current impulses in the other circuit capable of operating the subscriber's signaling apparatus.

831,821. Illuminating Device. Alfred W. Beuttell, London, England. Application filed October 17, 1902.

A support for double-ended incandescent lamps and a trough-shaped reflector are described.

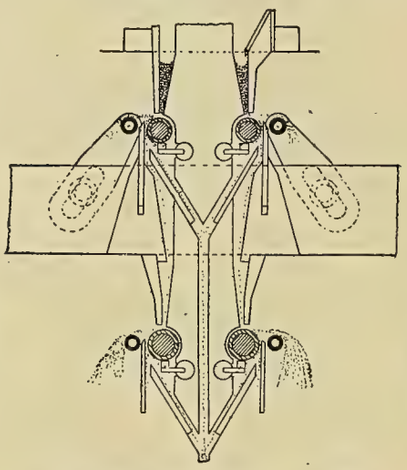
831,843. Process for the Electrolytic Production of Zinc. Victor Engelhardt, Vienna, Austria-Hungary, assignor to Siemens & Halske Aktiengesellschaft, Berlin, Germany. Application filed September 14, 1904.

Zinc is electrically deposited from sulphate solutions by employing an anode of platinum or platinum alloy and a current density at the anode of from 20 to 50 times that of the current density at the cathode.

831,846. Automatic Telephone System. John Erickson, Chicago, Ill., assignor to the Automatic Electric Company, Chicago, Ill. Application filed December 30, 1904.

A number of lines lead from an automatic subscriber-controlled switch mechanism which has a local operating circuit closed by a differential relay under subscriber control.

831,847. Electrothermal Switch. John Erickson, Chicago, Ill., assignor to the Automatic Electric Company, Chicago, Ill. Application filed December 31, 1904.



NO. 831,916.—ELECTROSTATIC SEPARATOR.

A resistance connected in series with normally closed switch contacts is in connection with a thermal member normally subject to a tensile strain but subject to an endwise-compressive strain when the switch is operated, whereby the circuit of the resistance is broken when the contacts are separated by the expansion of this thermal member in response to the heat generated by the resistance.

831,848. Adjustable Harmonic Ringer for Selective Signaling Systems. John Erickson, Chicago, Ill., assignor to the Automatic Electric Company, Chicago, Ill. Application filed September 18, 1905.

A number of polarized ringers or electric bells are connected in parallel and each is provided with an armature and a striker and a striker arm adapted to vary or change its length, without disturbing the armature and striker.

831,855. Telephone Transmitter Arm. Harry J. Guttman, Chicago, Ill., assignor to the Automatic Electric Company, Chicago, Ill. Application filed November 25, 1905.

Two longitudinal members support the transmitter, being connected with the base by clamping pieces held together by screws.

831,875. Interrupter for Automatic Telephone or Other Switches. Alexander E. Keith, Chicago, Ill., assignor to the Automatic Electric Company, Chicago, Ill. Application filed February 17, 1905.

A subscriber-operated apparatus for automatically making a step-by-step search for an idle connection. The switch springs bear upon a switch shaft, to which a ratchet wheel is attached, which is operated by a pawl worked by the armature of an electromagnet, to which is connected an interrupter arm so mounted as to separate the switch springs when the magnet circuit is closed and to keep them separated until the armature is restored to its normal position. Thus while the step-by-step search for a connection is going on, the normally open magnet circuit remains closed.

831,876. Switching or Telephone System. Alexander E. Keith, Chicago, Ill., assignor to the Automatic Electric Company, Chicago, Ill. Application filed March 9, 1905.

A current interrupter individual to the first idle line, and used to select this first line by the step-by-step method, and adapted for vibrating or pulsating the operating current until the first idle line is selected, is characteristic of this invention.

831,889. Telephone Attachment. William A. Patterson, Pittsburg, Pa. Application filed October 20, 1905.

A disk fitted into the flaring end of the transmitter mouthpiece is provided with a hole smaller in diameter than the opening in the smaller end of the trumpet-mouth, and is closed by a pivoted shutter.

831,916. Electrostatic Apparatus. Millard Woodsome, Boston, Mass., assignor to the Huff Electrostatic Separator Company of Maine. Application filed August 2, 1904.

An electrostatic separator having a pair of opposed electrodes, to one of which material is fed. The arrangement of fenders, one between, the other below, the electrodes, is to facilitate the separation. (See cut.)

831,930. Motor or Engine. Charles C. Clark, Corning, N. Y. Application filed September 13, 1905.

A motor car driven by electricity and by compressed air, in which the current is supplied by a storage battery recharged by a dynamo, which latter is provided with a motor wheel operated by air pressure from the pneumatic driving mechanism. There are also means for supplying air to the driving mechanism to compensate for the loss of that employed to operate the motor wheel.

831,947. Priming Device. Joseph W. Graeme and Robert W. McNeely, U. S. Navy. Application filed April 15, 1905.

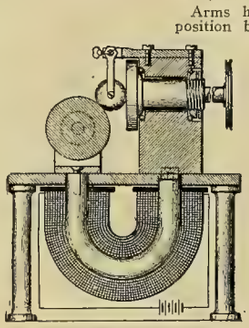
A movable indicating device for showing whether or not the electrically ignited primer has fired, is operated by the explosion of the primer charge and is retained in the indicating position by the distortion of a portion of the primer in case of explosion.

831,959. Automatic Electric Switch, Particularly for Use in Charging Electric Accumulators. Henry Leitner, Woking, Richard N. Lucas, Byfleet, and Harry Hill, Woking, England; said Hill assignor to said Leitner and Lucas. Application filed February 10, 1905.

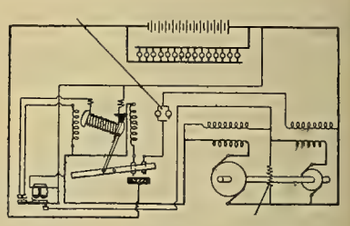
The switch is controlled by a movable electromagnetic armature and a field magnet with fine and coarse wire windings, in combination with an electromagnet and a connection for energizing it from the generator when it develops a low electromotive force, and for then causing the electromagnet to make contacts which cause the armature of the automatic switch to be energized from the battery of accumulators and the fine wire field winding of the same to be put in series between the generator and the battery. (See cut.)

831,996. Lamp Support. Adolph Rydquist, Rochester, N. Y. Application filed September 14, 1905.

Arms hinged to a base and secured in any desired position by clamps support the lamp.



NO. 831,685.—VARIABLE-SPEED DEVICE.



NO. 831,959.—STORAGE-BATTERY CHARGING SWITCH.

832,024. Process for the Electrodeposition of Metals. Josef I. Nussbaum, Charlottenburg, Germany, assignor to Siemens & Halske Aktiengesellschaft, Berlin, Germany. Application filed November 28, 1905.

To correct the tendency some electro-depositing metals have to deposit in crystals a colloidal substance is added to the solution, which has the property of traveling to the cathode. The colloidal layer acts as a diaphragm at those places on the cathode where the current density tends to increase beyond that at other places on the cathode.

PATENTS THAT HAVE EXPIRED

Following is a list of electrical patents (issued by the United States Patent Office) that expired on October 1, 1906:

411,772. Hotel Electrical-annunciator Circuit. C. G. Armstrong, Englewood, Ill.
411, 782, 411,783. Governor for Electro-dynamic Machines. G. F. Card, Covington, Ky.
411,786. Method of Forming Plates for Secondary Batteries. S. C. C. Currie, Philadelphia, Pa.
411,787. Apparatus for Forming Secondary Battery Plates. S. C. C. Currie, Philadelphia, Pa.
411,801. Wire Holder and Insulator. J. R. Fletcher, Dayton, Ohio.
411,805. Booth for Signaling Purposes. T. F. Gaynor, Louisville, Ky.
411,831. Electric-firing Mechanism for Breech-loading Guns. T. Nordenfelt, Westminster, England.
411,833. Electric Motor. C. C. Peck, Middlebury, Vt.
411,840. Automatic-synchronizing Commutator. R. S. Taylor and M. M. M. Slattery, Fort Wayne, Ind.
411,899. Electro-magnetic Separator. R. F. Moffatt, New York, N. Y.
411,908. Electric-valve Device. F. Stevens, Philadelphia, Pa.
411,930. Station Switchboard and Connections. E. W. Rice, Jr., and A. L. Rohrer, Lynn, Mass.
411,935. Cut-out. A. P. Seymour, Syracuse, N. Y.
411,947. Rheostat. M. J. Wightman, Lynn, Mass.
411,970. System of Electrical Distribution for Street Lighting. O. B. Shallenberger, Rochester, N. Y.
411,982, 411,983. Electric Motor. P. Diehl, Elizabeth, N. J.
411,989. System of Electric Conductors for Electric Cars. C. A. Jackson, Billerica, Mass.
412,013. Temperature Regulator. E. W. Beebe, Milwaukee, Wis.
412,089. Globe and Reflector for Incandescent Lamps. T. G. Hawkes, Corning, N. Y.
412,095. Electric Subway. I. La R. Johnson, Washington, D. C.
412,115. Thermostat. J. L. Nix, Homer City, Pa.
412,141. Arc Light. F. Von Hefner-Alteneck, Berlin, Germany.
412,140. Galvanometer. W. Thomson, Glasgow, Scotland.
412,157. Trolley Attachment for Electric-railway Cars. J. M. Anderson, Boston, Mass.
412,158. Governor. G. G. Annable, Syracuse, N. Y.
412,159. Electric Switch. F. M. Bennett, New York, N. Y.
412,165. Electrode for Medical Batteries. F. B. Cox, New Haven, Conn.
412,185. Coupling Alternate-current Generators. J. Hopkinson, Westminster, County of Middlesex, England.
412,186. Method of Synchronizing Alternate-current Generators. J. Hopkinson, Westminster, Eng., and E. Hopkinson, Manchester, England.
412,196. Electrotherapeutic Appliance. J. S. Mellon, St. Louis, Mo.

WESTERN ELECTRICIAN

EVERY SATURDAY

Vol. XXXIX. CHICAGO, OCTOBER 13, 1906 No. 15

The Electric Interurban Railways of Ohio.

By O. M. Carter.

DEVELOPMENT in electric-railway matters in Ohio for the last year or two has been in the way of consolidation and connecting of systems by filling in gaps rather than in the execution of entirely new work, although plans have been made for several roads that may be built in the immediate future. While Ohio is considered well supplied with electric lines, there is considerable fairly good territory that yet has no service, and it would not be surprising to see new activity within the next year or two. The southeastern and southern portions of the state have hardly been touched yet. While they are rather rough and the soil is not any too fertile, except in the valleys, the hills are full of coal in many sections, and gas and oil abounds in others. These things will bring about conditions, if the truth of recent investigations is verified, that will make Southern Ohio worth while, even though the cost of railroad construction is rather high. From Marietta to New Richmond, along the Ohio River, there are but one or two short stretches of electric railway, and all that territory lying north to Logan, Lancaster, Chillicothe and Washington Court House is without service. Steam railroads are not any too plentiful, although the country is crossed here and there by good lines.

There has been great activity in the development of the northern, eastern, western and southwestern portions of the state within the last two years, so far as consolidation and the completion of large systems is concerned. It is possible now to travel long distances in almost any direction in these sections, and within another twelvemonth it is believed that managers will be at work on interstate tariffs both for the east and west. While the short-haul business still yields the greatest revenue to the traction companies, so much is being done in preparation for rapid transit and through lines that it is believed the electric roads will secure a good portion of the long-distance business later on.

Most of the roads are well built and equipped with plants and cars that are up-to-date in every particular. All the later lines have been built on private right-of-way, so that speed may be attained without trespassing upon the rights of those who use the public roads. Where lines have been lately rebuilt, the owners have endeavored to place them on private property for the same reason. Thus, it will not be long until the electrics will be in the same position, so far as this is concerned, as the steam roads.

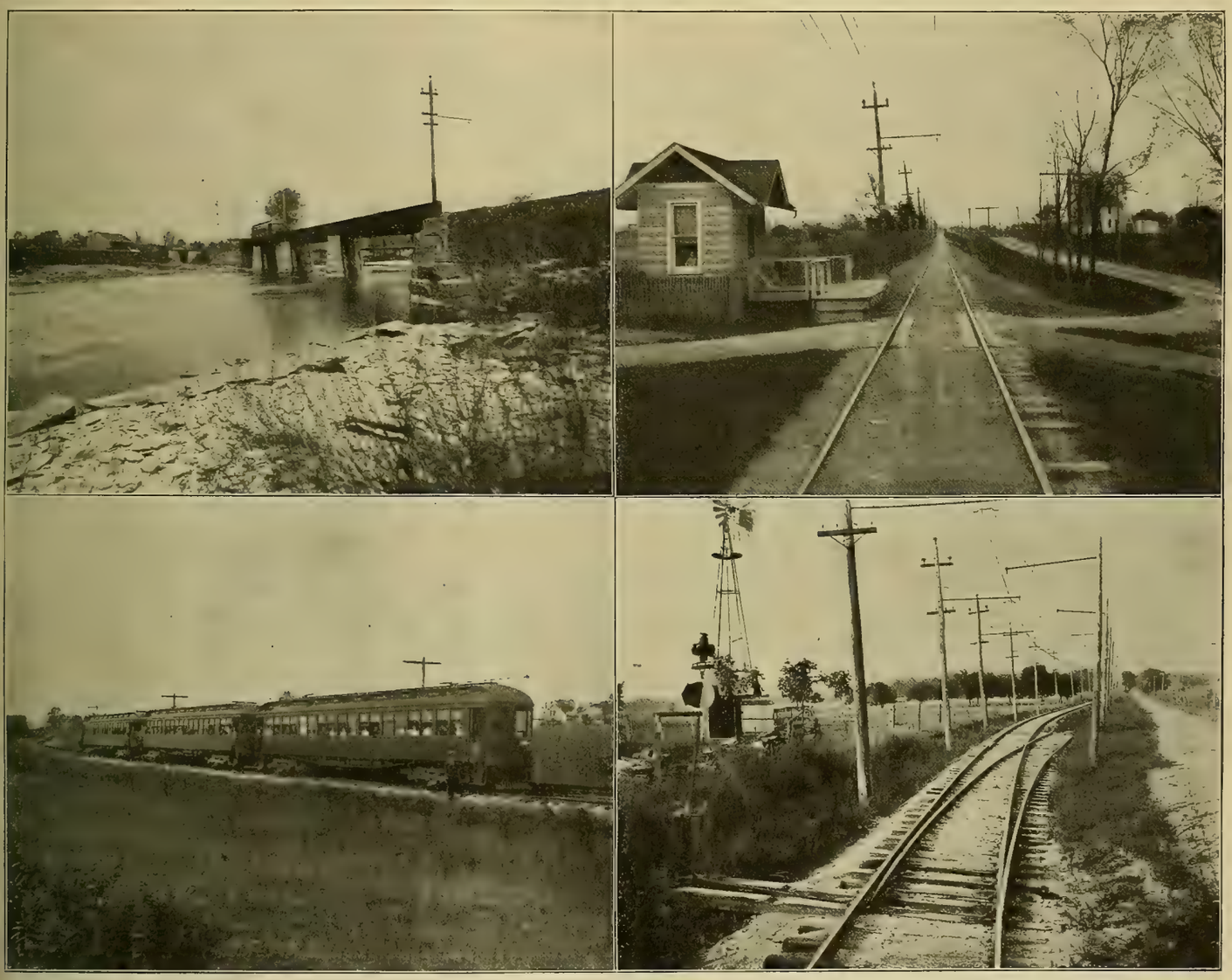
Ohio railway men are shy of new things until they are certain they will be successful. Hence, investigation discloses the fact that the single-phase idea has not yet gained much of a foothold in the state. As far as can be ascertained, not one road is operated on that system, and but one now under construction will use it, that being the Indianapolis and Cincinnati. All of the track yet constructed by the latter company lies within the state of Indiana.

The Consolidation in Western Ohio with Indiana Connections.

The most recent and probably most important consolidation of electric roads in Ohio is that formed by W. Kelsey Schoepf and his associates. With the Indiana connections, the system comprises lines from Zanesville across the state to Richmond, Ind., and from Cincinnati to Bellefontaine, with plans for through lines to Toledo and Defiance within the next year. The Indiana, Columbus and Eastern Traction Company was formed with a capital stock of $1,000,000, afterward increased to $12,000,000, to handle these properties. The company now owns the Columbus, London and Springfield; the Dayton, Springfield and Urbana; the Springfield and Western; the Urbana, Bellefontaine and Northern; the Columbus, Grove City and Southwestern; the Dayton and Northern; the Columbus and Lake Michigan, and that portion of the Dayton and Muncie lying within Ohio. All but the last two of these were acquired by purchase from the receivers of the Appleyard properties.

The Dayton and Western and the Columbus, Newark and Zanesville Electric Railway companies (which recently purchased the Columbus, Buckeye Lake and Newark line and the properties of the Zanesville Railway, Light and Power Company) are operated by the company under a lease.

These properties are all being placed in first-class



Steel Bridge over Olentangy River on Columbus, Delaware and Marion.
A Three-car Train on the Scioto Valley Third-rail Route.
Salmons Station on the Columbus, Delaware and Marion.
A Turnout on the Columbus, Delaware and Marion.

VIEWS ON SOME OF THE ELECTRIC INTERURBAN RAILWAYS IN THE VICINITY OF COLUMBUS, OHIO.

1. Indiana, Columbus and Eastern.
2. Cincinnati Northern.
3. Cincinnati Interurban.
4. Interurban Railway and Terminal.
5. Lebanon and Franklin.
6. Cincinnati, Milford and Loveland.
7. Cincinnati and Columbus.
8. Cincinnati, Georgetown and Portsmouth.
10. Springfield, Troy and Piqua.
11. Dayton and Troy.
12. Springfield and Xenia.
13. Washington Traction.
14. Dayton, Covington and Piqua.
15. Scioto Valley.
16. Columbus, Delaware and Marion.
17. Columbus, New Albany and Johnstown.
18. Columbus, Urbana and Western.
19. Western Ohio.
20. Fort Wayne, Van Wert and Lima.
21. Columbus and Lake Michigan (Schoepf interest).
22. Lima and Toledo (Schoepf interest).
23. Toledo and Western.
24. Toledo and Indiana.
25. Toledo, Bowling Green and Southern.
26. Tiffin, Fostoria and Eastern.
27. Lake Erie, Bowling Green and Napoleon.
28. Toledo, Fostoria and Findlay.
29. Columbus, Marion and Bucyrus.
30. Lake Shore Electric.
31. Cleveland and Southwestern.
32. Sandusky, Norwalk and Mansfield.
33. Ohio Central Traction.
34. Northern Ohio Traction.
35. Cleveland, Painesville and Eastern.
36. Pennsylvania and Ohio.
37. Conneaut and Erie.
38. Eastern Ohio.
39. Cleveland and Sharon.
40. Warren, Cortland and Jefferson.
41. Mahoning and Shenango.
42. Stark Electric Railway.
43. Youngstown and Southern and Youngstown and Ohio River.
44. East Liverpool Traction (Ohio Valley Finance Company).
45. Steubenville Light and Power (Ohio Valley Finance Company).
46. Wheeling Traction.
47. Parkersburg, Marietta and Interurban.
48. Ohio River Electric Railway.
49. Camden Interstate.
50. Portsmouth Street Railroad.
51. Marion-Bucyrus Railway.
52. Cambridge Traction.
53. Columbus Railway.
54. Felicity and Bethel.
55. Kenton and Southern.
56. Miami Transit.
57. Delaware and Magnetic Springs.
58. Mansfield Railway.
59. Sandusky, Monroeville, Bellevue and Norwalk.
60. Tiffin and Port Clinton.
61. Maumee Valley Railways.
62. Toledo, Port Clinton and Lakeside.
63. Cincinnati, Lawrenceburg and Aurora.
64. Lima Eastern.

MAP OF OHIO, SHOWING EXISTING AND PROPOSED ELECTRIC RAILWAYS.

condition. The lines are all gravel-ballasted, with the exception of the Dayton and Western, where broken stone is used. New ties and ballast are being furnished in some places, and the roadbeds will all be in excellent shape when this is completed. Additional boilers are being placed in the Hebron power station of the Columbus, Newark and Zanesville, and two Westinghouse-Parsons turbines, one of 1,500 kilowatts and one of 750 kilowatts, are being installed in the Medway plant of the Dayton, Springfield and Urbana line. A few new cars may be purchased within the next year, although the rolling stock now seems to be ample.

Next year it is expected that a line will be completed from Bellefontaine to Lima, and the line from Springfield to Dayton will be double-tracked. The Lima extension would give the company a through line from Cincinnati to Toledo, when the Lima and Toledo is completed. The latter is now in operation from Lima to Ottawa, and the intention is to complete the construction to Toledo as soon as possible. The old Columbus and Lake Michigan steam road will be "electrified." It now extends from Lima to Defiance, and reports have been current for some time that it may be extended on up into Michigan for quite a distance.

At Lima the Fort Wayne, Van Wert and Lima, controlled by the syndicate, joins the other roads, and the portion in Ohio will form part of the system. The other lines join the Indiana roads at Junction City and Richmond. They are connected with Cincinnati by the Cincinnati Northern, which operates the Cincinnati, Dayton and Toledo Traction line, between Dayton and Cincinnati, with a branch to Germantown.

The lines between Cincinnati and Dayton and Springfield and Dayton have half-hour service, the former employing 20 cars and the latter 12. Between Columbus and Springfield seven cars are used, and between Springfield and Urbana five. The eastern division from Columbus to Zanesville makes use of 21 motor cars. Freight and express cars sufficient to take care of the rapidly growing business are used on all the lines.

Limited cars are now operated between Indianapolis and Richmond and Dayton and Springfield. Plans have been made to put limiteds between Richmond and Dayton and Columbus and Springfield, giving through service between Columbus and Indianapolis. Many interline tickets are now sold over these lines, and the business will increase with the introduction of the new service.

New stations will probably be built at Columbus, Springfield, Dayton and London within the next year or two. Negotiations have been pending for locations in some of these places for some time. The company is making a specialty of parks, both for picnics and vaudeville purposes, and each line has or will have one in the near future. Buckeye Lake, containing 6,000 acres of water, is located on the Columbus-Zanesville line, not far from Newark, while Idlewild Park is still nearer that place. Dillon's Falls, near Zanesville, will be improved next summer. On the Dayton-Springfield line Tecumseh Park is located on the banks of Mad River, and Big Darby Park, a picnic ground, is located midway between Columbus and Springfield. The northern division gets the benefit of Silver Lake traffic, while the Dayton-Richmond line has Glen Miller Park, just out of Richmond.

The officers of the Indiana, Columbus and Eastern are as follows: President, W. Kelsey Schoepf; vice-presidents, D. G. Edwards, J. B. Foraker, Jr., and N. McD. Crawford; secretary, F. A. Deverell; acting general passenger agent, A. W. Jordon.

Northern Ohio Traction System.

Perhaps the next most important consolidation is that of the Canton-Akron Railway Company, the Canton-New Philadelphia Railway Company and the Tuscarawas Traction Company, with the Northern Ohio Traction and Light Company. Recently the Akron Consolidated Railway Company was organized for the purpose of taking over these three properties, and it will be merged with the Northern Ohio Traction and Light Company under the latter name. Its lines extend from Cleveland to Akron, with a branch from Cuyahoga Falls to Ravenna, and it owns and operates the lighting plant at Akron. The section known as the Akron, Bedford and Cleveland line has been double-tracked.

The Canton-Akron property consists of the line from East Akron to Canton and the city lines in Massillon and Canton. The Canton-New Philadelphia line extends from Navarre to New Philadelphia, while the Tuscarawas Traction Company operates a line from Canal Dover through New Philadelphia to Uhrichsville.

The main power house of the Canton-Akron Railway Company is at Canton, where, among other units, there is a 2,000-kilowatt turbo-generator. There are two sub-stations on the line, with a 300-kilowatt rotary in each, the voltage of transmission being 13,200, three-phase, alternating, and of distribution 650 direct current. Cars, some of them 56 feet long, are in use to the number of 29. Tracks consist of 70-pound T-rail and 73-pound girder rail. The company does a freight business, having two cars for that purpose.

Turning to the Canton-New Philadelphia line (completed in 1904), it is to be observed that the type of construction is much the same as that of the Canton-Akron. However, this company uses aluminum cable for transmission, has some track rail running 80 pounds to the yard, and of its seven cars two are 57 feet long. Two-thirds of

MAIN POWER HOUSE OF THE SCIOTO VALLEY TRACTION COMPANY AT REESE'S STATION, OHIO.

the roadbed is on private right-of-way, with the remainder on highways. Freight is also carried on this road.

Dating back to 1890 for the earliest of its origins (for it is itself a consolidation), the Tuscarawas Traction Company has some old equipment. It has a power house four miles northeast of New Philadelphia, and is exclusively a direct-current road. It has six cars, the longest 42 feet long, and the track is on public roads. The heaviest rail weighs 70 pounds. This line likewise carries freight, having one car for the purpose

The three roads taken over were Tucker-Anthony properties. They are well located and built and have proved successful in the matter of making money for their owners. The Northern Ohio Traction and Light Company, which now controls them, is itself a consolidation, being made up of the Akron Traction and Electric Company, the Akron, Bedford and Cleveland Railway Company and the Akron and Cuyahoga Falls Rapid Transit Company. Henry A. Everett is the president of the company and it is owned by him, E. W. Moore and their associates. This important company has four generating plants at Akron, Cuyahoga Falls, Bedford and Barberton, and two sub-stations, one in Barberton and another in Bedford. In all it has 12 generating units, with a storage battery at Bedford and a line battery at Ravenna. Alternating-current transmission is used, and 163 cars, some 50 feet long, are operated. Three of these are freight cars. Improvements contemplated include a 2,000-horsepower turbo-alternator and three new rotaries, one of 1,000 horsepower.

A contract has been awarded the Cleveland Construction Company for a line between Barberton and Seville, the work being done under the name of the Barberton, Wadsworth and Western. This will connect the Northern Ohio system with the Cleveland and Southwestern, and, through the line now being built from Seville to Mansfield by the Cleveland, Ashland and Mansfield, will give connection with Mansfield, Crestline and Bucyrus. With the completion of the proposed line between Marion and Bucyrus, which will be constructed by John G. Webb and associates, Columbus, Springfield, Dayton and Cincinnati may be reached.

Cleveland and Southwestern.

The Cleveland and Southwestern Traction Company is now building an extension from Seville, on the Wooster branch, to Mansfield, under the name of the Cleveland, Ashland and Mansfield. This extension will connect the system with Columbus when the Marion-Bucyrus line is completed, and will also make it possible to transfer business from the Northern Ohio Traction and Light lines to southern points without going by way of Cleveland, when the extension of the latter is completed from Barberton to Seville. Another short link between Shelby Junction and Plymouth will connect most of the roads in the central part of the state with the Lake Shore Electric at Norwalk.

The beginning of the Cleveland and Southwestern was the Cleveland and Berea, and it is declared that this is the first interurban road in the state. It was built in 1892, F. T. Pomeroy being the leading spirit. It extended from the Cleveland city lines to Berea. Shortly afterward an extension was built to Elyria, and in 1897 the track reached Oberlin. Since then other extensions have made the terminal points of the road Lorain, Wooster, Grafton, North Amherst, Wellington and Norwalk. The Wooster branch leaves the main line just west of Cleveland and extends south through Medina and several other prosperous towns. A short branch reaches Lindale and Puritas Springs. The power plant is located at Elyria and contains two Westinghouse turbo-generators and three direct-current generators. The small machines are driven by Slater compound engines.

In all 63 cars, from 45 to 51 feet long, are used on this system. The Electric Package Company operates over the lines, and probably the largest milk business is done on this system of any electric road in the Middle West. From 900 to 1,000 cans a day are carried. The passenger business is very satisfactory and growing rapidly. Elegant cars are used, and from their color the road is known as the "Green Line."

As the tracks are well ballasted, some sections with gravel and others with broken stone, good speed can be made by the cars. Limited cars are run to the end of all the main branches. Within the last nine months 30 new cars have been put in service. Twenty-three of these are three-compartment cars, the smoking rooms being provided with leather upholstered seats and the passenger compartment with plush. The woodwork of some of them is mahogany and the remainder Flemish oak. The addition of these cars has brought the passenger service up to the top notch.

Lake Shore Electric.

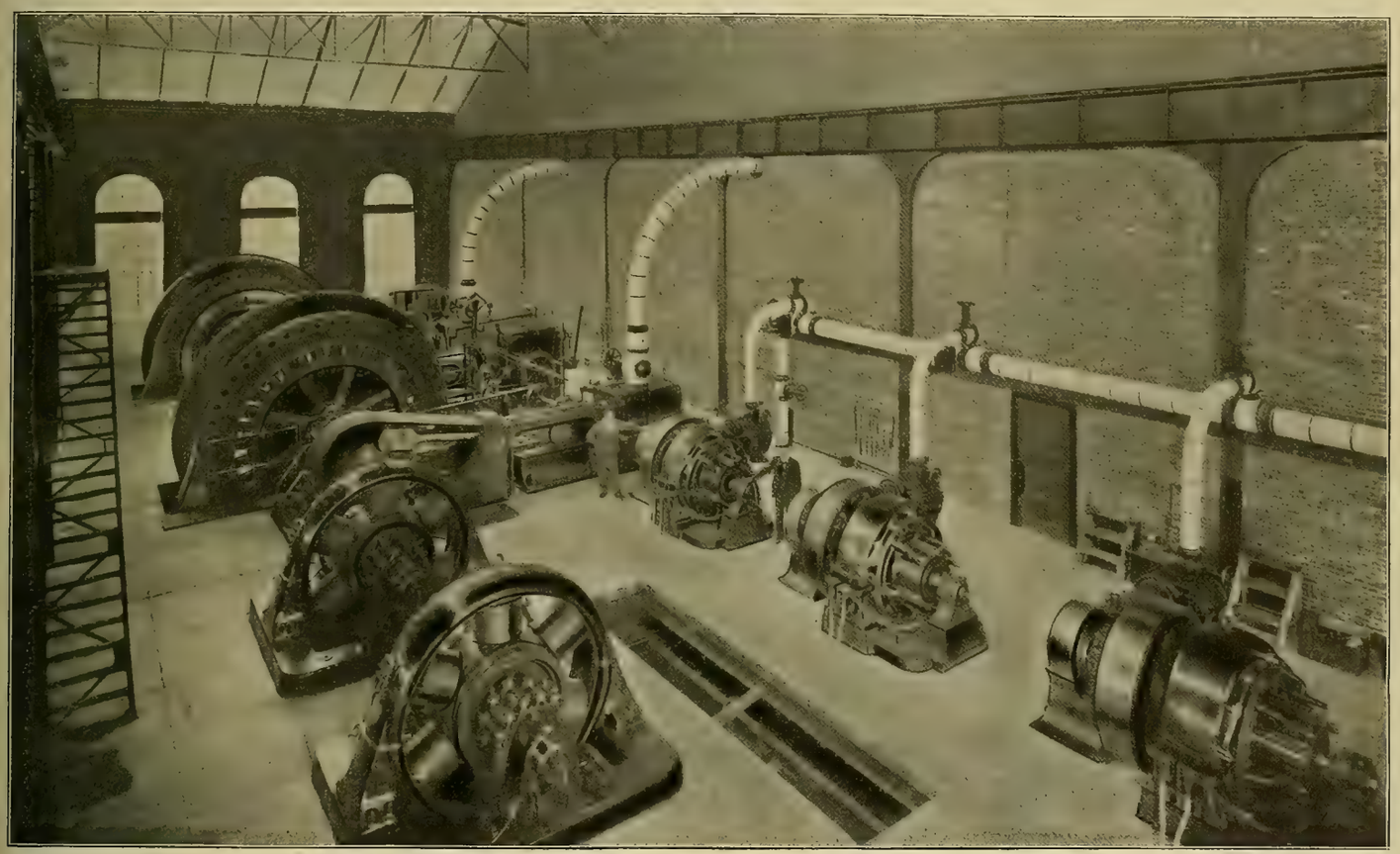
Two important extensions are being made by the owners of the Lake Shore Electric Railway Company, one from Sandusky to Fostoria by way of Fremont, and the other from Fremont to Tiffin. Connecting with other roads at both these points and passing through a densely populated section, the new lines will be important feeders for the main line, which is intersected at Fremont. Lines from Fostoria through Findlay to Western and Southern Ohio will increase the long-distance business of both this company and the connecting roads.

This system is made up of the Lorain and Cleveland; Sandusky and Interurban Electric Railway; Sandusky, Norwalk and Southern, and the Toledo, Fremont and Norwalk, the consolidation having taken place on October 1, 1901, Henry A. Everett and E. W. Moore, with their associates, being the owners of the new company. Since then some changes and improvements have been made that put the lines in good condition. The main line extends from Cleveland to Toledo, by way of Norwalk and Fremont, two branches running to Elyria, one from Lorain and the other from Beach Park. The main line leaves the lake at Ceylon, but a direct road extends on into Sandusky, and from the latter point another direct line runs to Norwalk. The local lines in Toledo and Lorain are owned by the same interests.

The power plants are located at Beach Park and Fremont. The Beach Park plant is equipped with two Siemens & Halske direct-current 400-kilowatt generators and one General Electric alternating-current 1,000-kilowatt generator, both operated by Cooper engines. A new 2,000-kilowatt Parsons turbine is now being installed in this plant also. At Fremont the equipment consists of four alternating-current 500-kilowatt Westinghouse generators, operated by Westinghouse engines. The converters and the equipment of the 12 sub-stations are all of the Westinghouse manufacture. The overhead work is bracket and span. Current is transmitted at a potential of 16,500 volts and stepped down to that required for the trolley lines.

The business of this system requires 70 cars. The cars are of various sizes, and the equipment was supplied by a number of different manufacturers. The tracks are ballasted with gravel, stone and slag, and for the most part 70-pound rails are used. The roadbed is in good condition and the cars make fast time, the schedule being one of the best in the state. Limited cars are run to Lorain, Sandusky and Toledo. At the latter point connections are made for Michigan points with various lines.

The officers of this road are: President, E. W. Moore; vice-presidents, W. H. Price and Jay Cooke, III.; secretary and treasurer, F. W. Coen.



INTERIOR OF MAIN GENERATING STATION OF SCIOTO VALLEY TRACTION COMPANY AT REESE'S STATION, OHIO.

Western Ohio Railway Company.

Another company that has made headway in the matter of filling important gaps and forming

connections of wide extent is the Western Ohio Railway Company, which operates a line between Piqua and Findlay, passing through Lima, with a branch from Wapakoneta to Celina and one from St. Marys to Minster. Last January the Findlay extension was completed and the connection with other roads at Findlay made it possible to take a trolley journey of over 600 miles east and west or more than 300 miles north and south. This event was made a matter of celebration at the time, and traction men from all over the Central States were present.

The road was built by the Pomeroy-Mandelbaum syndicate, the capitalization at first being $3,000,000, with an authorized bond issue of the same amount. Since then the capital has been increased to take care of the extensions and improvements. All of the roadbed is of the best construction, with ballast equal to that of the best steam roads. As a result the line is in excellent condition throughout the entire length. It is said that there is not a better one in the state.

The power plant is located at St. Marys. At first the 47 miles of original road was operated with an 800-kilowatt generator, but soon afterward the capacity was increased to 2,300 kilowatts. Such additions as were found necessary have been added since, together with sub-station machinery. The building was erected to accommodate apparatus of 2,800 kilowatts capacity.

The length of the road is now 112 miles. Besides local cars, this company, with the Toledo, Bowling Green and Southern and the Dayton and Troy, have made arrangements for through limited cars between Toledo and Dayton, the schedule time being four hours and a half. More than 40 cars are used in the regular traffic of the lines.

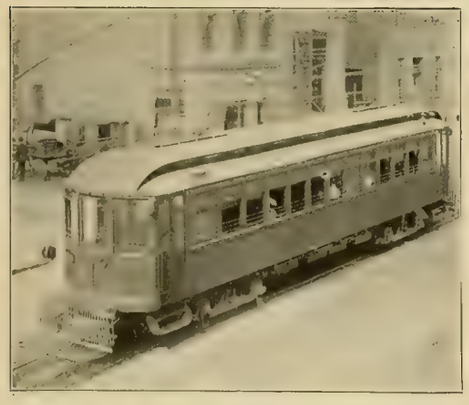
The officers of the company are as follows: President, A. E. Akins; vice-president, L. J. Wolf; secretary, H. C. Lang; treasurer, M. J. Mandelbaum. The operating offices are at Lima, and F. D. Carpenter is general manager, and C. L. Wilcoxon superintendent.

Roads Centering in Columbus.

Since particular attention will be directed to roads centering in Columbus during the forthcoming convention of the American Street and Interurban Railway Association, a brief description of two or three of them may prove interesting.

The power house of the Columbus, Delaware and Marion Railway Company is located at Stratford, on the Olentangy River, three miles south of Delaware. It is a substantial stone building and was originally planned to accommodate additional equipment, which is now being installed. The boiler room had five Heine boilers installed, but four more of the same make are now being put in place. The new boilers are capable of carrying 200 pounds pressure, but will be operated at about 150. This will be sufficient to secure full efficiency from the generators.

The generating equipment so far has consisted of one 2,000-kilowatt Curtis turbo-generator, aided by several small generators that had been removed



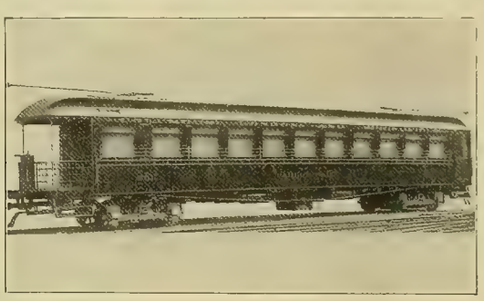
A CAR ON ONE OF THE LINES OF THE INDIANA, COLUMBUS AND EASTERN.

from another power house, but which will now go out of commission. The turbine is operated with a Bulkley jet condenser. In addition, an 800-kilowatt Curtis turbine is now being installed, and will be ready for operation in a short time. It will carry the night load and take care of the lighting business in Marion, the local plant there having been abandoned. The current comes from the turbine alternator at 2,300 volts, and, passing through three 600-kilowatt transformers, is transmitted at a potential of 20,000 volts. The main station sub-station equipment consists of two 300-kilowatt General Electric rotaries and six 110-kilowatt step-down transformers. Passing through the transformers, the high-tension alternating current is reduced to 375 volts, and from the rotaries is delivered to the trolley wire at 600 volts. The Chaseland sub-station is equipped with two 300-kilowatt rotaries and three 220-kilowatt transformers. The Prospect station has one 300-kilowatt rotary and two 220-kilowatt transformers, and the station at Marion has one 300-kilowatt rotary and three 220-kilowatt transformers. This latter station, when completed, will also have two 200-kilowatt frequency changers, changing from 25 to 60 cycles for lighting purposes. It will also have five 50-light constant-current transformers to take care of the arc lighting. Standard switchboard and equipment will be used in this station, as in the main power plant.

The high-tension wire is of aluminum, equivalent to a No. 2 copper wire. All the overhead work is of standard single-bracket construction except in the cities and towns.

Substantially built at all points, between Columbus and Delaware, the roadbed is ballasted with rock. From Delaware to Marion gravel ballast is used. Outside of the cities, the curves are long, and in many places there are extended stretches of perfectly straight track. This is especially true of the section between Delaware and Marion. The length of the line from Columbus to Marion is 50 miles, and for the most part 60-pound rails are used. In Delaware seven-inch T-rails are used on the streets and in Marion six-inch T-rails have been used.

In both Delaware and Marion the local lines are operated by current from the Stratford power house, and this is true of the lighting plants. It will thus be seen that the company controls much



PARLOR CAR OF THE INDIANA, COLUMBUS AND EASTERN.

of the best business along its line. The cities of Delaware and Marion both furnish a good business, while the villages for the most part depend upon the road for their commerce. The country is thickly settled and prosperous, some of the best farming land of the state lying in this region. Marion is one of the best manufacturing towns of its size in Ohio, and the business from its factories amounts to a handsome item.

The car equipment is as follows: Three 42-foot passenger coaches, with four General Electric motors and K-6 control; six 50-foot coaches, with four GE-73 (300 horsepower total) motors, and type M multiple-unit control; two 57-foot coaches with four Westinghouse 76 (300 horsepower in all) motors, and type M multiple-unit control; three 50-foot combination passenger and baggage cars, with four GE-73 motors and type M multiple control; two 50-foot express or freight cars, with four Westinghouse 76 motors; one 35-foot electric locomotive, with four GE-73 motors, low geared for heavy work; one 40-foot work car, Lorain No. 34 motor, equal to 200 horsepower; one double-end snow plow, and one 25-foot work or line car.

The Columbus, Marion and Bucyrus Railroad Company has been formed by John G. Webb and his associates to build a line from Marion to Bucyrus, this really being an extension of the Columbus, Delaware and Marion. The engineering work has all been completed and most of the right-of-way secured. Construction gangs are now at work north of Marion, and the road will be completed and put in operation at the earliest date possible. Through links now being constructed this road will have connection with Cleveland and Eastern Ohio points, as well as to Toledo and the west. The original company, the Columbus, Delaware and Marion Electric Railroad Company, built the main portion of this road, but later it, with the Marion Railway, Light and Power Company, and the Columbus Northern Railway, Power and Equipment Company, which built the power house at Stratford, were consolidated, forming the Columbus, Delaware and Marion Railway Company. The Worthington, Clintonville and Columbus, extending a short distance out of Columbus, forms part of the line. The officers of this company are: President, John G. Webb, Springfield; vice-president, O. M. Gottschall, Dayton; treasurer, N. J. Catrow, Miamisburg, Ohio; secretary, W. A. Black, Dayton; general manager, George Whysall, Marion. The officers of the Columbus, Marion and Bucyrus Railroad Company are as follows: President, John G. Webb; vice-president, George

BIG DARBY CROSSING OF THE INDIANA, COLUMBUS AND EASTERN.

H. Holzbog, Jeffersonville, Ind.; treasurer, James S. Webb, Dayton; secretary, H. B. Hane, Marion; general manager, George Whysall.

The Scioto Valley's Third-rail Line.

The Scioto Valley Traction Company, with general offices in Columbus, owns the only third-rail system in Ohio. It was organized in 1899, and about a year later the capital stock was placed at $1,000,000. However, the Everett-Moore people, who had subscribed for a large block of the securities, withdrew, and the Scioto Valley pool was formed, with Edwin R. Sharp of Columbus as treasurer. This pool built the lines and they were then taken over by the company. The Lancaster line was opened for traffic in July, 1904, and the other line, as far as Circleville, in August of the same year. Since then it has been completed to Chillicothe.

Formerly the cars were compelled to enter Columbus and go around the loop, but recently the company has secured a station of its own at the corner of Third and Rich streets, and all cars, both passenger and freight, stop there. This is the only interurban road so far that has an independent station in that city. From the city line south the company has a double track to Obetz, where the lines diverge to Lancaster and Chillicothe. For the most part the tracks are built on a private right-of-way on both divisions. A few miles of canal land on the Lancaster division were leased from the state, but property has been purchased adjoining this, so that the right-of-way may be widened at any time necessity requires. The Lancaster line is 31 miles in length and the Chillicothe line 47. Fourteen passenger cars are owned by the company, and seven are required for the regular-schedule service. Three motor freight cars and several flats, gondolas and box cars are employed for the freight and express business. Quite a good freight business has been worked up since the roads began operation, and prospects for the future are very satisfactory. The company has done some carload business which has proved satisfactory to the shippers, and more attention will be paid to this hereafter.

The whole territory served being tributary to Columbus, the passenger business has been good from the start. Both branches have steam roads in competition, and they have made rates equal to the electric road's rates, but have been unable to take much of the local business from it. About the same time is made on the electric and steam roads, so there has not been much to gain either way because of speed.

Reduced grades and curves of long radius permit of high speed on the lines. The maximum grade, with a few exceptions inside of municipal corporations and one or two other places, is one per cent. In no place do the grades exceed two per cent., and that for only a short distance. The track consists of 70-pound T-rails in 33-foot lengths, laid upon oak ties six by eight inches, eight feet long and two feet between centers. Fourteen inches of gravel ballast was used along the entire length of both lines. The third rail is laid on vitrified-clay insulators, 27 inches from the

gauge line of the track rail, with the top six inches above it. Where the conductor rails are broken for crossings, they are connected by cables laid in vitrified conduit. Overhead trolley is used on highways inside of the corporations.

The power plant is located at Reese's Station, and is a substantial steel and brick structure with tile roof, 183 by 115 feet ground dimensions. The boiler room is separated from the other portion of the building by brick partitions and is 184 by 46 feet in ground dimensions. The space will allow 4,000 kilowatts capacity. At the present time only half this is needed for operating the road. Franklin water-tube boilers, four in number, are used, arranged in batteries of two each, at one

POWER HOUSE AT STRATFORD OF THE COLUMBUS, DELAWARE AND MARION ELECTRIC RAILWAY.

end of the space. The same number may be installed at the other end, a stack 10 feet in diameter and 200 feet high being placed midway of the space. Roney automatic stokers are used, the coal being carried to them in a conveyor suspended upon a track from the bunker.

Two Hamilton-Corliss cross-compound engines with cylinders 26 and 52 by 48 furnish the power. They are directly connected with Bullock generators, delivering 375 volts, the current being three-phase, 25 frequency. Three 125-volt Bullock generators, direct driven by 150-horsepower engines, furnish current for exciting, lighting stations and other purposes. The current from the generators is raised to 27,000 volts by being passed through six 370-kilowatt oil-cooled Bullock transformers. The sub-station equipment of the main power house consists of two 400-kilowatt Bullock rotary converters, which furnish current to the third rail at 600 volts. The current is stepped down by three 150-kilowatt Wagner transformers. Each of the other six sub-stations is furnished with one 400-kilowatt rotary converter and three 150-kilowatt Wagner transformers. They are built to accommodate two rotaries when needed.

The high-tension wire is carried on poles 40 feet high, and all the overhead work is substantially built. Provision is made for additions when needed. This will probably be when the lines are extended.

The passenger cars and other equipment are of substantial build and the apparatus the best that could be secured. The cars were built by the American Car and Foundry Company, and are 60 feet long, their weight being 42 tons when empty. They have four GE-66 motors, with type M multiple-unit control. The trucks are of the Brill make and all cars are furnished with combination straight and automatic air brakes, and also hand brakes.

Eastern Systems with Pennsylvania and West Virginia Connections.

One of the important systems of the state will extend from the state line just east of East Liverpool to Steubenville, passing through Wellsville, Toronto and a number of thriving villages and densely populated territory. From the point indicated above East Liverpool the line will be extended to Beaver, Pa., where it will connect with other important roads. The construction of this work is in the hands of the Ohio Valley Finance Company, of which W. Caryl Ely of Buffalo is the head. The portion of the road between the state line and Wellsville is owned and operated by the East Liverpool Traction and Light Company, which also operates the lines in East Liverpool, besides the light and power plants in East Liverpool, Wellsville and Chester, the latter in West Virginia. From Wellsville to Toronto the road will be constructed by the Steubenville and East Liverpool Light and Power Company.

Arrangements have been perfected by which this company will acquire the properties of the Steubenville Light and Power Company, which controls the railway, light and power business in Steubenville and Toronto and the towns between them on the Ohio River. At Steubenville the road will connect with the Steubenville, Mingo and Ohio, which operates a line down the river to Brilliant, where it meets a line now under construction by the Wheeling (W. Va.) Traction Company to Martins Ferry. There it will cross the Ohio and connect with the Wheeling lines.

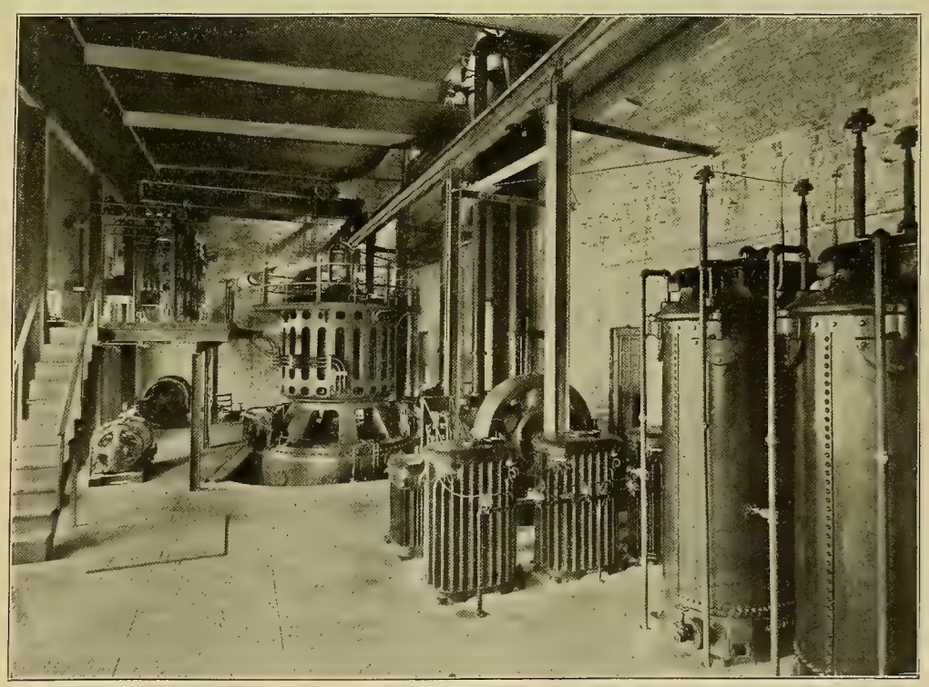
The Ely road will also connect at Steubenville with the Tri-State Traction Company, which operates a line on the West Virginia side of the river to Wellsburg, and ultimately makes connections with the Wheeling lines. The companies operating and building these roads are all controlled by W. Caryl Ely and Van Horn Ely and their associates, who plan to connect up-the-river lines into a system that will be important to Eastern Ohio and Western Pennsylvania and West Virginia.

Taking the portion of the road in Pennsylvania which is to be constructed by the Ohio River Passenger Railway Company, the projectors intend to have a thoroughly modern electric railway from Rochester, Pa., to Steubenville, Ohio. From the state line to Wellsville, the existing road has been rebuilt and double-tracked and has an excellent roadbed. As far as possible curves and grades have been eliminated, and it will be easy to make good time over the entire distance. From Wellsville to Toronto a new double-track road will be built. It will be made as substantial as steam-road construction, to be operated in connection with the other sections. From Toronto to Steubenville the present road will be double-tracked and improved, doing away with curves and grades wherever possible. The local town lines have all been well laid out, and interurban cars will have little difficulty in making good time for the entire distance of 50 miles. From the state line, a branch will be built to Lisbon, the county seat of Columbiana County.

As to power, the plans of the company have not been fully matured, but it is probable that arrangements will be made to furnish direct current from the plants now in use, with such additional machinery as may be needed. By agreement each of the companies will furnish its proportion of the car equipment, and through cars will be operated over all the lines for the entire distance. The East Liverpool Traction and Light Company at present owns 55 cars of various kinds and operates 25 on regular schedule. Thirty are owned by the Steubenville Traction and Light Company and 16 operate regularly. A steel suspension bridge at East Liverpool, over the Ohio River, is owned by the local company, over which it operates a line to Chester, W. Va. The company also owns its own mines and thereby secures plenty of excellent coal for its own use at cost.

The electric-railway companies, both street and interurban, and the lighting companies about Youngstown, Warren and Niles, have been consolidated with those of Sharon, Pa., and roads operating between that point and the Ohio line, into the Mahoning and Shenango Railway and Light Company. Cleveland and Pittsburg capitalists were interested in the consolidation, and it has been planned to spend considerable money in the improvement of the properties. The western terminus of the lines is Leavittsburg, which will eventually be connected with the Eastern Ohio Traction lines, and the eastern terminus is Sharon. They have four GE-66 motors, with type M multiple-is one of the important items, and the lines give service to a number of the most important manufacturing towns in the state.

The Youngstown and Ohio River Railway Company and the Youngstown and Southern are together building a line from Youngstown south to East Liverpool by way of Columbiana, Leetonia and Lisbon, the western terminus being Salem. The former will have a plant at West Point that will be equipped with two 1,000-kilowatt Westinghouse turbines, capable of producing 2,300 volts alternating current. It will also have four fully equipped sub-stations, while the Youngstown and Southern will have one containing a 300-kilowatt rotary. The Youngstown and Ohio River people are now grading the line between West Point and Washingtonville and electrifying six miles of steam road between Salem and Washingtonville, while the Youngstown and Southern is electrifying its steam line between Youngstown and Columbiana, and building from Columbiana to Leetonia. The Youngstown and Ohio River company is building from Washingtonville to Leetonia and East Liverpool by way of Lison. The line will be of steam-road construction land with 70-pound rails.



INTERIOR OF STRATFORD POWER HOUSE OF COLUMBUS, DELAWARE AND MARION ELECTRIC RAILWAY.

Cleveland Systems Not Elsewhere Described.

Cleveland has the service of five large trolley systems, the Lake Shore, Cleveland and South-

western; Northern Ohio Traction and Light; Eastern Ohio, and Cleveland, Painesville and Eastern. The last-named is made up of the lines between Cleveland and Painesville and those of the Cleveland, Painesville and Ashtabula, both being owned practically by the Everett-Moore people. Through cars are operated between Cleveland and Ashtabula. The company has two lines out of Cleveland, but they converge at a point near Willoughby.

At Ashtabula these lines connect with the Pennsylvania and Ohio Railway Company's line which extends on up the lake shore to Conneaut, and from Ashtabula to Jefferson. Thomas McGovern of Geneva, Ohio, is the president of this company. From Conneaut to Erie, Pa., the Conneaut and Erie Traction Company operates, and it will not be long until through trips may be made to Buffalo from Cleveland, the lines from Erie on being placed in shape for linking up.

F. B. Wagner of Cleveland is the president of the Ashtabula Transit Company, which operates the local lines in that place and also from the town to Ashtabula Harbor, the greatest coal and ore port in the country. Mr. Wagner is also interested in a line that is being built from Chicago to South Bend, Ind.

The Eastern Ohio Traction Company operates two lines out of Cleveland, one of them reaching Middlefield and the other Chagrin Falls and Hiram. A line was built, connecting Middlefield and the Hiram line, but it is not used. A branch extends to Chardon through a rich dairy and farming country. This company is now in the hands of George T. Bishop, as receiver, and has been for some time, all efforts to effect a reorganization so far having proved futile. However, another plan is being formulated which, it is believed, will go through. In all, the road consists of about 80 miles of good track, and the cars and other equipment are in good shape.

The Cleveland and Sharon Electric Railway Company was organized some years ago to build a line from Middlefield to Sharon, and thus connect the cities of Western Pennsylvania with Cleveland, and some of the construction work was done. The company is now being reorganized with the intention of carrying out the original plan. The new name will be the Cleveland and Sharon Electric Railway Company. Francis B. Morgan of Cleveland is the president of the company. Mr. Morgan is the manager of the Warren, Cortland and Jefferson Traction Company, which was organized to build a line connecting the towns indicated in the name.

The other systems entering Cleveland have already been described.

Lines Entering Toledo, and Michigan Connections.

Toledo also has five roads and systems connecting it with almost all portions of the state. The Lake Shore Electric, the Toledo, Bowling Green and Southern, the Toledo and Indiana Railway Company, the Toledo and Western, the Toledo, Port Clinton and Lakeside, and the Detroit, Monroe and Toledo Short Line, all reach this city. As the name indicates, the latter connects the city with Detroit, and the Toledo and Western has a branch extending to Adrian, Mich.

The Lake Shore has already been treated of at some length. The Toledo, Port Clinton and Lakeside now has a line in operation from Genoa to Port Clinton and Marblehead, from which it runs a ferry line to Sandusky. From Genoa it enters Toledo over the tracks of the Lake Shore. The line is 52 miles long and in excellent condition.

George B. Kerper of Cincinnati and associates built the Toledo, Bowling Green and Southern, and it has been a good proposition from the start. It extends from Toledo to Findlay, and is 50 miles in length. The road is now under the control of the Toledo Urban and Interurban Railway Company, which is owned by the same interests. It operates between Toledo and South Perrysburg.

The Toledo and Indiana Railway Company operates a line between Toledo and Bryan, through Wauseon, a distance of about 60 miles, through excellent territory. Besides a good passenger business, this road hauls a large amount of freight. An extension to Fort Wayne, Ind., about 40 miles, has been planned.

The Toledo and Western is one of the greatest electric freight roads in the state, or in the country, for that matter. It was built under the guidance of the late Luther Allen of Cleveland, and he served as president until his death. The power station and shops are located at Sylvania. Frequent sidings and many farm sidings aid those who patronize it in the freight department. About 80 miles in length, the road has more than 80 freight cars and a number of electric locomotives and one steam locomotive. A branch, the Toledo, Adrian and Jackson, extends to Adrian, and the mine line reaches Morenci, Mich. The heavy business is in sugar beets. Judge Carlos M. Stone was elected as president of the company to succeed Luther Allen, and since then it was forced to go into the hands of a receiver because of pressure brought by creditors. C. F. Franklin was appointed receiver. The stockholders have so far been unable to agree upon a plan of reorganization.

The Lima and Toledo line, now operating from Lima to Ottawa, will probably be completed into Toledo during the coming year. It is a Schoepf proposition and will operate in conjunction with the other roads of that syndicate. The Maumee Valley Railways and Light Company, under the control of the Toledo Railways and Light Company, operates a line south to Waterville. Both this and the local lines are owned by the Everett-Moore people.

Tributary to these lines is the Lake Erie, Bowling Green and Napoleon, connecting Bowling Green, Pemberville and Woodville. The line is about 20 miles in length and is being extended to Point Clinton. The Tiffin, Fostoria and Eastern connects Tiffin, Fostoria, Bascom and Pemberville.

The Toledo, Fostoria and Findlay fills a gap between Fostoria and Findlay and between Fostoria and Pemberville.

From Tiffin and Fostoria branches of the Lake Shore will shortly be built to Fremont, and a line from there directly to Sandusky. Another line is now under way from Tiffin to Port Clinton through Fremont. It is being built by the Kerlin Bros. Company of Toledo, and will be known as the Tiffin and Port Clinton Traction Company. Another new line is being built out of Sandusky, by the Sandusky, Monroeville, Bellevue and Norwalk Traction Company. It will strike the Lake Shore at Bellevue. Clark Rude of Sandusky is the president of this company. In a way these roads will all contribute to an increase of business for the Toledo roads.

Lines Radiating from Cincinnati.

Eight lines enter Cincinnati, the Cincinnati Northern, the Cincinnati Interurban, the Interurban Railway and Terminal operating three lines, the Cincinnati, Milford and Loveland, the Cincinnati and Columbus, the Cincinnati, Georgetown and Portsmouth, and the Cincinnati, Lawrenceburg and Aurora. The Cincinnati Northern connects the city with the lines of the Indiana, Columbus and Eastern and has been spoken of in that connection, being a portion of the Schoepf system in Ohio. The Cincinnati Interurban line from Cincinnati to Hamilton also belongs to these interests.

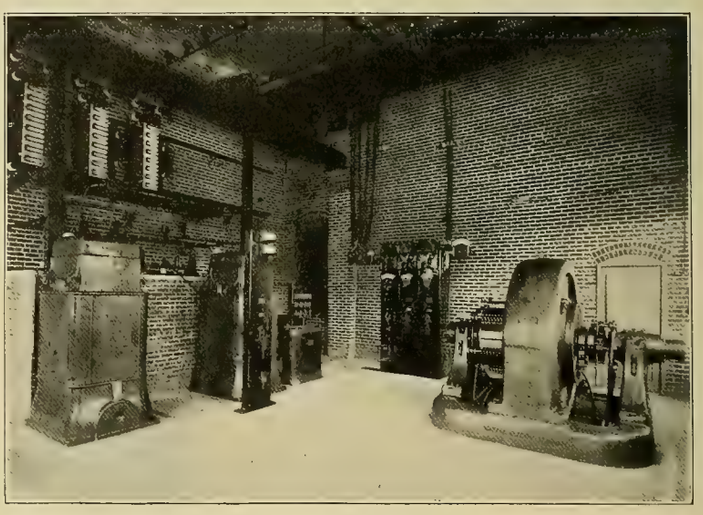
The Interurban Railway and Terminal Company operates the Cincinnati and Eastern, the Suburban Traction and the Rapid Railway lines, reaching as terminal points Lebanon, Bethel and New Richmond. Coney Island is owned by the individual members of the company, and is a prominent summer resort, which furnishes a large business. The Interurban Terminal Company is also operated by this company. George R. Scrugham was formerly president of the company, but was succeeded in office two years ago by Charles H. Davis.

From Cincinnati to Blanchester the Cincinnati, Milford and Loveland Traction Company operates a road 38 miles in length. This is a three-phase road, with power house located at Milford and two sub-stations at Indian Hill and Newtonville. Eleven cars are required to handle the passenger business, and besides the company is engaged quite heavily in freight traffic. The officers are: President, B. H. Kroger; vice-president and general manager, J. P. Peurrung; superintendent, Aug. Biedenbender.

Running almost parallel with the above line for quite a distance is the Cincinnati and Columbus Traction line, which extends from Norwood to Hillboro, 53 miles. The aggregate power that may be developed by the power plant is 2,300 horsepower, and it is operated on the three-phase system. Eight cars, operating on an hourly schedule, are required to take care of the business. The power plant is equipped with two 800-kilowatt generators, driven by Cooper engines, and one 225-kilowatt auxiliary, driven by a 300-horsepower engine. Four fully equipped sub-stations are in use. The track is gravel-ballasted and laid with 70-pound rails. A freight business amounting to from $1,000 to $1,200 monthly is done. The officers are: President, H. H. Hoffman; first vice-president, Lewis Seasongood; second vice-president, Henry Burkhold; secretary, J. R. McLain; treasurer, C. H. Rowe; general manager, Philip C. Swing.

The Cincinnati, Georgetown and Portsmouth is operated on a three-phase system, with a power station of 2,000-horsepower capacity and three sub-stations. Eighteen cars are operated upon an hourly schedule, except at noon, and two limited cars are run three times daily. Two more sub-

Prospect Sub-station.



Interior of Chaseland Sub-station.

SUB-STATIONS ON THE LINE OF THE COLUMBUS, DELAWARE AND MARION ELECTRIC RAILWAY IN OHIO.

stations will be put in. Both steam and electric cars are used in the freight business, which the officers believe will be doubled in the next year. Freight business is exchanged with the steam roads, as this road operates under a steam-road charter. This road is now 70 miles in length and reaches Georgetown, with connections to Sardinia and Ripley. Twelve miles more will be built. A. W. Comstock is the president.

The Lebanon and Franklin, officered mostly by Dayton men, connects the towns indicated in the name and is tributary to the Cincinnati roads, since it connects two of them. It serves a section of country that is not touched by other lines, either steam or electric. The line is 11 miles long.

The Cincinnati, Lawrenceburg and Aurora Electric Street Railway connects Cincinnati with a number of thriving towns, both in Ohio and Indiana. J. C. Hooven of Hamilton is president of the company. The power station and repair shops are at North Bend, Ohio.

Dayton as an Interurban Center.

Dayton is one of the most important electric-railway centers in the state and is the connecting point of Ohio and Indiana lines for the central and southern portions of the state. From this city almost any other point may be reached. Besides the three lines of the Indiana, Columbus and Eastern lines, there are the Dayton and Troy, Dayton, Covington and Piqua, Cincinnati Northern and three lines of the Dayton and Xenia Transit Company. The Dayton and Muncie line of the Indiana, Columbus and Eastern reaches Union City, and the Dayton and Western line reaches Richmond, connections being made with Indiana lines at both points. Over the Dayton-Springfield, Springfield-Columbus and Columbus-Zanesville lines, points east, north and south are reached, and connection is made with Cincinnati over the Cincinnati Northern.

The Dayton and Troy Electric Railway Company reaches Dayton, Troy and Piqua and connects at the latter place with the Western Ohio, giving through service to Toledo. It is a consolidation of two other roads under the management of Harrie P. Clegg, who is also president of the company.

The Dayton, Covington and Piqua Traction Company, of which Mr. E. C. Spring is general manager, operates a line to Piqua by way of Covington. The offices and power plant are located at West Milton, where a park is also owned.

The Dayton and Xenia Transit Company operates the Dayton and Xenia Traction Company, the Rapid Transit Company and the Dayton, Spring Valley and Wilmington Transit Company. Dayton, Xenia, Harbines, Bellbrook and Spring Valley are some of the more important places reached. Two lines between Dayton and Xenia are operated. The Miami Transit, Light and Power Company of Lebanon has a line under construction from Lebanon to Xenia, which will give direct connection with Cincinnati.

Roads Radiating from Springfield.

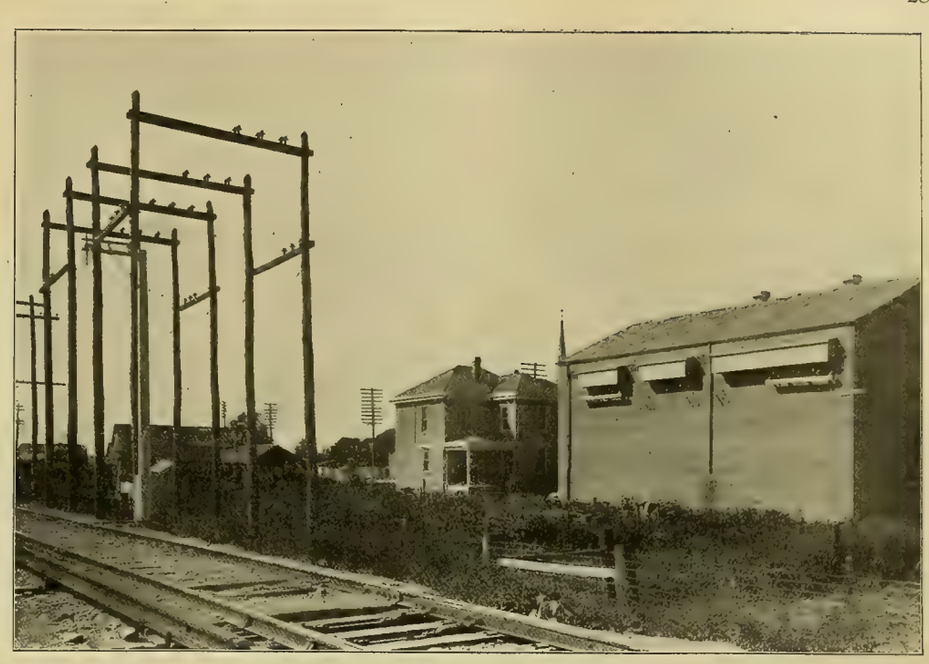
From Springfield a number of roads radiate, three of them having been spoken of in connection with the Schoepf interests. Aside from these are the Springfield, Troy and Piqua Traction Company, the Springfield and Xenia Railway Company and the Washington Traction Company. The Springfield, Troy and Piqua, from Springfield to Troy, was originated by the late ex-Governor Asa S. Bushnell, and his son, John L. Bushnell, is now president of it. The line is 30 miles long and passes through a good country.

The Springfield and Xenia Railway Company has a direct line between the two towns and passes through Yellow Springs, being 30 miles in length. Cleveland men are the owners of the property, W. S. Hayden, of Hayden, Miller & Co., being the president. A plan of reorganization has been completed and the securities will be distributed soon. Five 45-foot cars are operated and considerable express business is done.

E. W. Christy of Cleveland and associates are at the head of the Washington Traction Company, which purchased the line built by the Springfield, South Charleston, Washington and Chillicothe Traction Company. The line is now in operation between Springfield and South Charleston, and it is the intention of the officers to extend it on to Washington Court House and Chillicothe. An extensive region of rich farming country lies along the proposed line.

Columbus Lines Not Elsewhere Described.

Columbus has eight interurban roads, besides a short line to Westerville, operated by the Columbus Railway and Light Company. The Columbus, Delaware and Marion and the Scioto Valley have already been described. The Indiana, Columbus and Eastern has three roads entering the city, the Columbus-Zanesville, the Columbus-Springfield-Dayton and the Grove City lines. The others are the Columbus, Urbana and Western and the Columbus, New Albany and Johnstown. The Columbus, Urbana and Western has a line in operation between Columbus and Fishingers, a distance of nine miles. When completed the road will be 48 miles in length. Charles E. Prior of Cincinnati is the president, and J. B. Foraker, Jr., vice-president.



STRAIN TOWERS AT SUB-STATION ON LINE OF SCIOTO VALLEY TRACTION COMPANY.

The Columbus, New Albany and Johnstown has nine miles in operation, using the tracks of the local company within the corporation of Columbus under lease. Gahanna is now the eastern terminus of the road, but it is the intention of the owners to extend it from this point to Johnstown, through New Albany, making it in all 25 miles long. The road handles freight of all kinds, and people along the line are becoming educated to ordering goods in the city and having them delivered. A great deal of mercantile business is also being done. The officers of the company are: President, W. D. Brickell; vice-president and counsel, D. J. Ryan; treasurer and general manager, L. P. Stephens. These men, with George B. Cox and Thomas N. Fordyce of Cincinnati, own the entire road, no bonds having been sold.

Other Ohio Interurbans.

The Ohio Central Traction Company, controlled by the Pomeroy people, operates a line from Mansfield to Bucyrus by way of Crestline and Galion. When the Cleveland, Ashland and Mansfield is completed these two roads will be formed into a system with the Cleveland and Southwestern, owned by the same people. With the link from Marion to Bucyrus completed, there will then be a through line from Cleveland to Columbus. F. T. Pomeroy is president of the company.

A line from Mansfield to Shelby Junction is operated by the Mansfield Railway, Light and Power Company, which also operates the local lines at Mansfield.

The Fort Wayne, Van Wert and Lima line extends from Lima to Fort Wayne, and connects the Western Ohio with the Indiana lines so far as interchange of business is concerned. It also forms the Northern Ohio connection between the Schoepf lines of the two states.

From Canton to Salem, by way of Alliance, the Stark Electric Railroad Company operates a line, penetrating some good country. With the completion of the roads now under construction from Salem to East Liverpool, passengers may make the trip to the river and to Wheeling, W. Va. C. R. Morley is the president of the road.

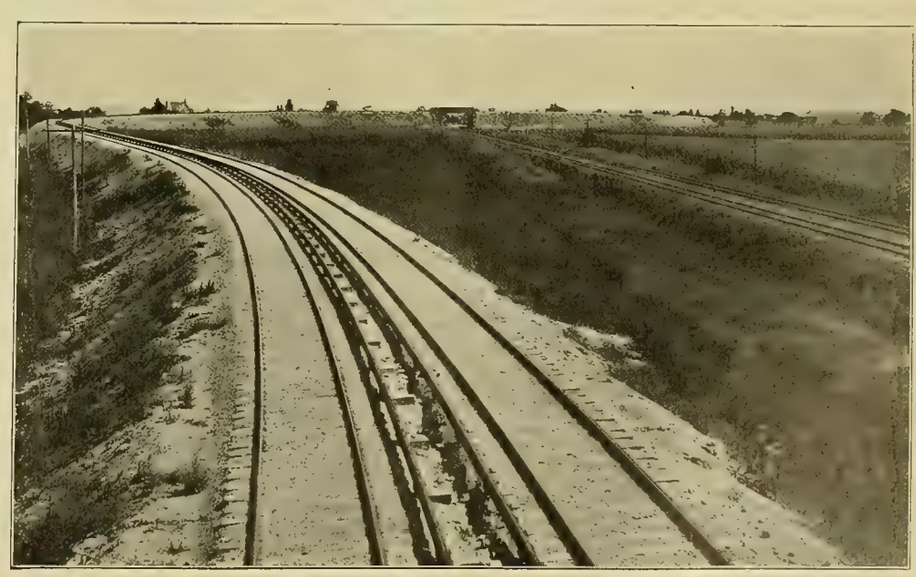
In connection with its other lines, the Wheeling Traction Company has a road connecting Martins Ferry and Bellaire, with a branch to Barton. It is planning to build up the river to meet the Steubenville line.

The Parkersburg, Marietta and Interurban Railway Company controls the local lines in Marietta and operates a road a short distance up the Muskingum River.

Pomeroy, Middleport and Racine are connected by the Ohio River Electric Railway and Power Company's line.

Ironton and Huntington, W. Va., are connected by the Camden Interstate Railway Company, which crosses the river a short distance above the former city. The local road in Ironton is owned by the same company.

The Portsmouth Street Railroad and Light Com-



A VIEW SHOWING THE FINE ROADBED OF THE SCIOTO VALLEY THIRD-RAIL LINE AND CROSSING OVER HOCKING VALLEY RAILROAD.

pany operates the local roads and a line extending from that city to Sciotoville, up the river.

A line from Marion to Galion, by way of Caledonia and Martel, has been planned by the Marion-Bucyrus Railway and Light Company, of which Ellis Bartholomew of Toledo is the president. Some construction work has been done.

The Cambridge Power, Light and Traction Company operates the local roads and a line extending from that city to Sciotoville, up the river.

WORK TRAIN ON THE COLUMBUS, DELAWARE AND MARION.

A line from Cambridge to Byesville.

A line from Bethel on the Cincinnati, Georgetown and Portsmouth road, to Felicity, has been almost completed by the Felicity and Bethel Railroad Company. It is said it will be in operation in a short time.

At the time of the Appleyard failure the Kenton and Southern was under construction. This is a line that would have connected Urbana and Kenton.

The Delaware and Magnetic Springs Railway Company owns a short line connecting the two points named. It is said to have changed hands recently and that extensions and improvements will be made.

The Lima Eastern Railway Company was organized some time ago to operate a road between Lima and Marion with Strang gasoline cars. The capital stock is $1,500,000, and the officers are as follows: President, J. A. Vandergrif, New York; vice-president, Albert G. Applefield, Kenton, Ohio; secretary and treasurer, W. N. Embert, Baltimore.

Electrical Exports for August.

Electrical exports from the United States for the month of August amounted to a total value of $1,369,079, compared with $1,131,593 for August, 1905. Electrical appliances, including telegraph and telephone instruments, show an increase in the amount exported of $201,045, while the export of goods classified as electrical machinery increased by the amount of $36,441. More in detail, the figures are as follows: Electrical appliances—August, 1905, $543,730; August, 1906, $744,775. Electrical machinery—August, 1905, $587,863; August, 1906, $624,304.

The principal importers from the United States during August, considering electrical machinery only, were the following-named countries, the value of the purchases being given: British North America, $138,697; United Kingdom, $122,394; Japan, $93,486; Mexico, $88,593; British East Indies, $32,824; Argentina, $21,380; France, $20,850; Brazil, $16,367; British Australasia, $12,916; Germany, $8,639; British South Africa, $5,759; Central American States and British Honduras, $4,598; Cuba, $3,659; European countries not mentioned above, $44,638; South American countries not mentioned above, $5,938.

Another Ohio Municipal Plant a Failure.

The Ashtabula (Ohio) Village Council has voted to sell the municipal lighting plant, which has so far proved a failure in its hands. Only two negative votes were cast. Matters had come to a point where new money had to be put in or the plant disposed of. Somewhat similar complaints are made in the case of the much larger plant at Columbus and also in relation to the plant at Hamilton, as already noted.

The Concrete Smokestack Failure in Peoria.

Further investigation confirms the belief, expressed in the last issue of the Western Electrician, that the collapse of the southeast stack of the Illinois Traction Company's new power house in Peoria was due to the introduction of faulty material. That the accident was not due to defective design or faulty engineering is shown by the fact that over 240 stacks built by the same company which erected this one have developed no similar signs of weakness.

In building chimneys on this plan sectional molds are used, having for their outer and inner walls concentric arcs of circles corresponding to the external and internal stack diameters, respectively, with due allowance for contraction. These molds are filled with freshly mixed concrete, strengthened by a network of steel stiffeners, consisting of horizontal hoops or rings spaced 18 inches apart, vertically, and vertical through-braces lashed with wire to the hoops at their points of crossing. This reinforcing web is placed well within the concrete and is firmly held together by the latter when it has set. After one cement ring, pot, or form, as it is called, has completely hardened, the mold of the next ring is superimposed upon it; the vertical braces, projecting upward from the lower ring are coupled to their respective continuations by suitable sleeve couplings, and cement is run in for the new ring. Thus the construction progresses, the completed chimney consisting of a large number of "pots" held together by their vertical stiffeners.

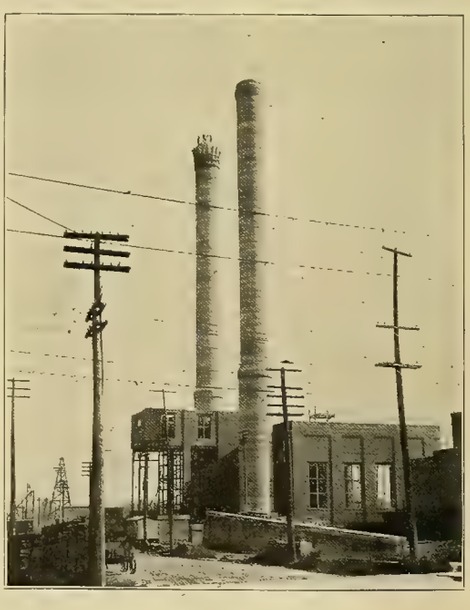


Fig. 1. Before the Accident.

Fig. 2. After the Accident.

THE CONCRETE SMOKESTACK FAILURE IN PEORIA.

As a rule each form is three feet high and is allowed to set over night before the next ring above is put on. Thus the danger of imperfect hardening is obviated in all cases where the concrete is properly mixed and poured in soon thereafter. A mixture of cement, gravel and sand is used for the base or foundation part of the stack, while the upper cylinder, usually of uniform diameter, consists of rings into the composition of which only cement and sand enter.

In the case of the collapsed Peoria stack (the left-hand one in Fig. 1) there was some delay in assembling the mold for the offset or collar portion forming the junction of the stack proper with its base. Concrete had been mixed on the ground below in anticipation of being poured after the customary interval. But the mold was not ready for receiving the concrete at the time expected.

While waiting for the completion of the mold enough time elapsed to cause some of the concrete to set. This action was intensified by the unusual heat, as this part of the work was done on August 17th, one of the hottest days of the year. Unfortunately, the foreman in charge disregarded the stringent instructions of the company not to use any concrete as much as half an hour after it was mixed. In the hurry of erection he permitted the use of the partially set mass, thereby introducing an element of weakness, which subsequently wrecked the structure.

Experts sent by the erecting company inspected the stack repeatedly after it had risen beyond the offset or "collar." Ascending within the chimney, where parts can be seen by lamplight only, and having no cause to susnect the integrity of any portion of the cement, they did not observe the imperfect form. Finding everything in seemingly good order, the constructors removed the scaffolding and considered their work completed.

A few days later Peoria was struck by the tail-end of the cyclone which had caused such great destruction at Mobile. A strong wind, reported as moving fully 30 miles an hour, produced a great pressure on the 118 by 11 feet of projected stack area above the offset. This caused a severe compression stress on the defective form, which caused a part of this pot, probably the portion not well united to its inner rings, owing to non-uniform setting, to break out. Instantly the stability of the entire upper section was destroyed, and section after section crumbled together. The broken portion did not fall over as a whole, but broke up into sections, some falling within the base enclosure, some around the base, but all within a circle described around the base (shown in Fig. 2) at a distance of 20 feet therefrom. The action would more properly be described as a crumbling down than a collapsing. It is estimated that the entire damage done can be repaired at a cost of $5,000, which the constructing company will have to bear. It is not believed that this accident should cause any widespread distrust of concrete-built smokestacks. It is evident from the nature of this construction and the material used that the latter must be applied in a particular and careful manner, and that relaxing vigilance at any stage of erection involves all the remaining parts to be added in danger. Nevertheless the error of a subordinate in departing from the prescribed instructions, with disastrous consequences, should not militate against the general principle of such constructions.

A Mountain Peak Electric Railway.

It is announced that H. E. Huntington has decided to carry out the much-talked-of project of connecting the tall peaks of Mount Lowe and Mount Wilson, near Los Angeles, Cal., by a trolley road traversing the mountain ridges. Starting from the terminal of the Pacific Electric Railway line, near the summit of Mount Lowe, the projected road will follow a very tortuous route for 10 miles to the summit of Mount Wilson. Thence it is proposed to follow the existing toll road down into the San Gabriel Valley and to a connection with one of the company's foothill electric lines.

The Newport (England) Electric Transporter Bridge.

[From the London correspondent of the Western Electrician.]

The electrically operated transporter bridge which has been erected by the Newport Corporation across the River Usk in Wales is an interesting structure, although the electrical features are mainly confined to the driving of the car. The inception of the

THE NEWPORT (ENGLAND) ELECTRIC TRANSPORTER BRIDGE (WITHOUT CAR).

idea was brought about by the fact that Newport is divided into two portions by a wide and swiftly flowing tidal river, navigable for a distance of about five miles from its mouth by large ships. Only one bridge existed hitherto, and that at the northern end of the borough. At the southern end of the town a ferry was the only means of transport across the river at this point. Various schemes were proposed for joining up the opposite banks here, and these included ferries, high-level, bascule, swing, lifting and rolling bridges, subways and movable or traversing bridges. The choice, however, ultimately fell upon a transporter bridge, each one of the other proposals having one or more insuperable objections to them, such as cost, obstruction to shipping, and so on. Parliamentary sanction was granted in the year 1900, and detailed calculations were made, designs prepared and contracts for the work entered into in the early autumn of 1902.

The photographic views give a good indication of the structure, of which the following are the chief dimensions: Span, center to center of towers, 645 feet; clear opening between faces of piers, 592 feet; clear headway from high water to underside of span, 177 feet; height of towers above level of approach roads, 242 feet.

Foundations are placed in groups of four on each bank, and from center to center the distance

END VIEW OF NEWPORT TRANSPORTER BRIDGE, SHOWING CAR.

is 78 feet nine inches on the riverward faces, and 36 feet on the faces at right angles thereto. These piers are masonry wells or monoliths, mounted on steel shoes or curbs, and were sunk by pneumatic pressure to the hard marl underlying the alluvial deposit in the river, the actual foundation depth varying from 78 feet to 86 feet below the river banks. It is believed that this is the first instance in Great Britain where masonry wells have been sunk under air pressure. The greatest pressure used during sinking was 36 pounds to the square inch, and no illness or compressed-air trouble was experienced. Each pier contains on an average 19,500 cubic feet of masonry and concrete, the total load transmitted to the foundation being 5½ tons per superficial foot.

Large blocks of masonry, resting on pile and concrete foundations, form the anchorages. Galleries, through which the anchoring cables pass, are formed in each limb, the pull of the anchor castings being taken on granite blocks placed at the rear of the masonry. Each anchorage weighs over 2,200 tons, the total force exerted by each series of cables being 920 tons.

As seen in the pictures, the towers are of open lattice steel construction. The main members of the legs are of angles and plates riveted together in the form of a cross. The general outline, looking in the direction of the stream, is an even taper from the base to the summit, but viewed from across the stream the legs are of spindle form. The extreme summit of the legs is heavily reinforced by steel girders. The legs are mounted at their feet on articulations or joints, constructed of cast-iron saddles and steel rocking pins, an arrangement which provides flexibility and vertical loading through the piers when the towers are subjected to heavy wind pressures. There is a stairway up each of the towers to the platform level.

An electrically driven crane was used for the erection, and less than 1,000 kilowatt-hours of electricity, costing about $45, was sufficient to lift and place in position the whole of the temporary scaffolding and staging, as well as the permanent structural steelwork in both towers, a total weight of some 800 tons.

Suspension cables are 16 in number, four inside and four outside of each of the stiffening girders, each cable being composed of 127 wires, giving a sectional area of 3.945 square inches. The breaking weight of each cable is nearly 254 tons, but the maximum load is only 48½ tons, so that there is an ample margin of safety. The total loads and breaking weights are 776 tons and 4,064 tons, respectively.

There are 16 anchor cables or backstays, each having 127 wires and a total section of 4.27 square inches. The total load on these is 868 tons, and the breaking weight 4,432 tons.

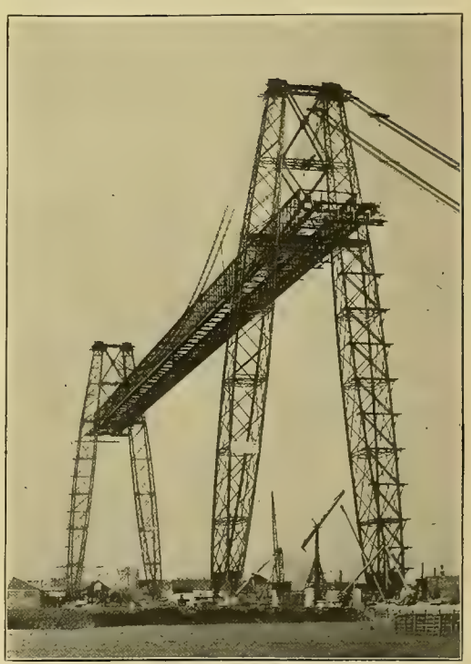
A portion of the span is carried by diagonal cables, and the weight of the suspension and anchorage cables is 196 tons, that of the diagonal cables 19 tons, exclusive of sockets and shackles.

Stiffening girders have been placed the whole length of the upper platform and act as stiffening beams and distribute the moving load over the suspension parts, while at the same time providing sufficient flexibility to allow of the compound structure giving to the movement of the suspension and for the necessary alteration of form due to temperature changes. They are placed at central distances of 26 feet three inches, and their depth is 16 feet overall. The bottom member is built up as an ordinary plate girder, each lower flange carrying the rails on which the wheels of the traveling truck run.

This truck is 104 feet in length and it is fitted with 60 wheels, 15 inside and 15 outside the web of the bottom members of each stiffening girder. The wheels are of steel, carried in steel brackets; each bracket is fitted in addition with two horizontal guide wheels, engaging on the edges of the girder flanges. From this frame is suspended the platform or car, 33 feet in length by 40 feet wide. The car is divided into a central roadway space, as seen in the illustration, and two footways, the latter being roofed in. The car beams and deck are designed for the simultaneous passage of two four-wheeled vehicles, each carrying 15 tons. The car is electrically lighted. The traveling truck weighs 16.3 tons, the suspension cables 2.9 tons, and the car 31.5 tons, making a total of 50.7 tons. There are 30 suspension cables of a total length of 1,620 yards, which are crossed to form triangular trussing, in order to prevent swaying motion during high winds. These suspension cables have a breaking load of 550 tons.

The car is propelled to and fro by what is in effect a continuous rope of flexible steel wire (in reality, for convenience of erection and maintenance, two ropes) driven by an electrically worked drum erected in the motor house near the eastern end of the bridge. The first rope passes up from the drum to a guide pulley at the eastern end of the bridge, then along supporting pulleys on the upper part of the platform to a main return pulley at the western end. Then it comes back under the platform (where it is supported by further pulleys fixed underneath) to a swan-neck in the center of the frame to which it is secured. The second rope is attached to the swan-neck, passes under the bridge, over the pulleys, to a second guide pulley at the eastern end and thence descends to the drum.

The motors, two in number, are each of 35



ANOTHER VIEW OF NEWPORT TRANSPORTER BRIDGE (WITHOUT CAR), SHOWING TYPE OF CONSTRUCTION.

horsepower, and may be used together or singly. Two power cables are led from the corporation street mains to the switchboard, one being connected to the tramway circuit, and the other to the power and lighting circuit. The current is controlled by switch apparatus on the motor-house switchboard, whence insulated leads are taken up to the bridge platform, thence along bare wires through contact trolleys and insulated conductors down to the controlling gear in the pilot house on the car. The controllers on the car are duplicated, and under normal conditions the working will be performed from this position, but in order to provide for emergencies a third controller is fitted in the motor house from which the car can be operated in case of necessity.

The motor-house board contains the change-over switch for connecting either to the tramway or lighting circuit. The controllers are arranged for starting, increasing or reducing speed, stopping and reversing the motion of the car. Braking can also be done by them in case of need. Special care has been taken to duplicate the electrical apparatus, in order to provide against the possibility of stoppage.

A sliding buffer worked by a counterweight is arranged at each abutment to absorb the momentum of the car and prevent shock. The journey is performed at the rate of 10 feet a second, and the distance to be traveled is some 600 feet.

I am indebted to Mr. R. H. Haynes, the borough engineer at Newport, for the information and photographs contained in this article.

WESTERN ELECTRICIAN

EVERY SATURDAY.

PUBLICATION OFFICES:

507 Marquette Building, - CHICAGO.

TELEPHONE, MAIN 1746.

Eastern Office, 150 Nassau Street, New York.

Telephone, 8220 Beekman.

Trade Supplied by Western News Co.

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SUBSCRIPTION, in advance, postage prepaid, $3.00 for a full year of 52 numbers; in clubs of four or more, $2.50, with free extra copy for eight subscriptions; foreign countries, $5.00 a year; single copies, 10 cents. When change of address is requested, the **old address** as well as the new should be given.

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REMITTANCES.—All checks, drafts and other remittances should be made payable to the order of the publishers, the **Electrician Publishing Company,** and addressed to the offices of publication, Suite 507, Marquette Building (204 Dearborn Street), Chicago, Illinois, U. S. A.

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DATES AHEAD.

American Street and Interurban Railway Association (annual convention), Columbus, O., October 15th to 19th.

Railway Signal Association (annual meeting), New Willard Hotel, Washington, D. C., October 16th, 17th and 18th.

Western Association of Electrical Inspectors (second annual meeting), Denison Hotel, Indianapolis, Ind., October 17th, 18th and 19th.

IT IS OF interest to observe that the list of electrical patents published this week contains an unusually large number of inventions relating to railway signaling and switching devices. There are eight patents on railway signaling systems, three on railway switching and signaling apparatus and six on railway switching apparatus. While applications for some of these inventions were filed several years ago, the average year of filing is 1905, indicating an increased attention to this subject manifesting itself in that year. This subject is one of growing interest to the electric-railway systems, for as their lines are being rapidly extended and the traffic is increasing, the necessity of automatic and reliable safety devices grows. It will be remembered that in the Berlin-Zossen experimental runs the limit of speed was set, not by the power, but by the possibility of distinguishing signals.

OHIO affords a fine example of the extent and importance of the modern electric interurban railway. Mr. Carter takes advantage of the fact, in this issue, to set forth the number, characteristics and usefulness of the Ohio interurbans, and his article is interesting and timely. Until one stops to consider these railways in detail, one is apt to overlook their number and consequence and their value to the communities which they serve. The author of the article on "The Electric Interurban Railways of Ohio," to which reference has been made, enumerates no less than 63 of such roads in the state, although a number of these originally distinct lines have been merged in larger systems, as the process of consolidation is to be observed in the electric-railway field no less than in the case of steam railroads. Surely this is a remarkable showing when it is considered that the very oldest of these undertakings cannot date back more than 15 years, while the greater number were built during the last decade.

UNLESS all signs fail, the conventions of the American Street and Interurban Railway Association and its subsidiary organizations in Columbus, Ohio, next week will be the most notable in the history of the society—and that is saying a good deal. This will be the first full convention to be held under the new constitution and new name and under the direction of the new secretary from the new administrative headquarters in New York. It promises to be a great success. Columbus is well located for such a convention, for it is in the center of a notable electric-railway region, is in itself a pleasant city and is conveniently accessible to the great majority of the members of the various associations. Having inserted "and Interurban" in its name, it is fitting that the remodeled parent association should pay its first visit to a city to which interurbans contribute in such a marked degree as is the case with Columbus. No doubt the thousands of visitors who will attend the meetings will have no reason to regret the selection.

PRESIDENT ROOSEVELT gave no comfort to the advocates of public ownership in his important speech at the dedication of Pennsylvania's capitol at Harrisburg on October 4th. The plain inference from his address points to the saner, safer view that the railroads and other great corporations should be controlled or regulated, not that the government, state or national, should take upon itself the ownership or operation of these properties—a task for which it is not fitted.

"The extraordinary industrial changes of the last half century have produced a totally new set of conditions," said Mr. Roosevelt, "under which new evils flourish; and for these new evils new remedies must be devised. Some of these evils can be grappled with by private effort only, for we never can afford to forget that in the last analysis the chief factor in personal success, and indeed in national greatness, must be the sturdy, self-reliant character of the individual citizen. But many of these evils are of such a nature that no private effort can avail against them."

What, then, should be the government's attitude in grappling with these pressing evils? The president told of the work accomplished in the last five years by the federal government in the way of regulating corporations, citing the Northern Securities case as an example. He continued: "A similar extension of the national power to oversee and secure correct behavior in the management of all great corporations engaged in interstate business will in similar fashion render far more stable the present system by doing away with those grave abuses which are not only evil in themselves but are also evil because they furnish an excuse for agitators to inflame well-meaning people against all forms of property, and to commit the country to schemes of wild, would-be remedy which would work infinitely more harm than the disease itself."

This sets forth the situation clearly: Government ownership as a remedy would prove worse than the disease. The conclusion, we believe, will commend itself to all intelligent students of the industrial situation in the United States who investigate the conditions earnestly and dispassionately. And it applies to the problems of the municipality as well as those of the government. Municipal ownership should only be adopted as the last refuge against intolerable abuse. But honest, intelligent municipal control is worth striving for.

A DIGNIFIED SILENCE has thus far characterized the attitude of the United States government and its delegates to the Wireless Telegraph Conference at Berlin, concerning their view of the controversy between the English Marconi Company and the rest of the world of space-telegraphy, which has produced this international meeting. But the Western Electrician, with no official entanglements, may with propriety present its own views on the subject.

When an invention of international usefulness has been put on the market by one company or individual or set of individuals, and has become a matter of common use in the intercourse between nations, rival companies using original inventions tending to the same result as that attained by the first invention should not be prohibited from using the public, and, more than that, internationaly public, service arrangements instituted by the first company. The British government, in its support of the Marconi company, leans to the view that, as its stations and operators are the results of its own expense and enterprise, other companies and governments without correspondingly important stations, cannot, in equity, ask to benefit by the Marconi plant, except by entering into agreement with the Marconi company for proper reimbursement.

On the face of it this would seem fair, but it must be remembered that any inventor may secure patent protection in any and all civilized governments of the world. So that Mr. Marconi had it in his hands to secure a monopoly for any features of his invention which were really original. The really great inventive ideas have almost invariably occurred at about the same time to different people in different parts of the world. If one man happens to secure the financial backing to establish commercially his particular system of communication first, this should certainly not bar others from using the stations erected for international use just because the others reach the same result by different means. If the contention of the Marconi company is allowed, it establishes that company in a monopoly of the space-telegraph communication in the most important parts of the world, because it will be the judge of what is "proper reimbursement."

We have seen in the United States what control of one method of communication by one company means, in the case of the telephone.

Ethically considered, Mr. Marconi's rights as well as those of Prof. Slaby are by no means established. Years before either of these physicists were known, Prof. Hughes of England conceived the invention of space telegraphy and proved its success by experiment. Being more interested in science than in money, and having some concern for the world at large, he gave his invention to the public. Let Mr. Marconi ponder the example thus set, and consider that when his stations were erected, and public use of them was invited, yes, and public support in the shape of stock subscriptions was solicited, an implied guarantee went with these invitations to the effect that the communication should be open to all the world at reasonable compensation.

Berlin Wireless Conference.

Thirty-one governments are represented in the Wireless Telegraphy Conference which assembled in the Parliament Building, at Berlin, in October, by invitation of the German government for the purpose of reaching a common agreement for an exchange of messages between the users of various wireless telegraph systems and to define the basis on which private wireless companies may operate with the consent of governments.

Owing to the persistent refusal on the part of all stations of the English Marconi Company to accept messages sent by any of the rival systems, international communication by space-telegraphy has been seriously hampered. As the German Slaby-Arco system was most prominently opposed by the Marconi company, Germany procured the assembly of this conference with the main idea of establishing an international bureau for the control of space telegraphy in order to regulate conflicting activities of commercial exploiters of this art.

A serious clash of interests is not unlikely at this conference, as lines had been partially drawn prior to its assembling. Great Britain and Italy are supporting the Marconi company, with France and Japan tending towards their side. The Japanese are aggrieved because they have been accused of stealing the German system of space-telegraphy. Opposed to this group of states is a combination headed by Germany, and including Austria and the Balkan States. The United States is considered to favor the German side of the controversy in view of the peremptory order removing the Marconi station placed in the approach to New York harbor on the Nantucket lightship, which was issued in consequence of the Marconi company's refusal to accept Slaby-Arco messages.

Mr. Marconi appears at the conference as representative of Montenegro, which is taken amiss by Germany because Prof. Slaby, his principal rival, declined to become a delegate.

The American delegates, representing the state, war, navy and commerce and labor deparments, are keeping their own counsel, giving no indication that they reservedly favor the German proposals, as has all along been taken for granted here.

Assistant Minister of Posts Sydow has been elected president of the conference. A committee was appointed on the first day of the meeting to draw up a program and the conference then adjourned to meet at the call of the president. Several days probably will be required by the committee to prepare the order of business. The discussions of the conference will not be open to the public.

Owing to the many points to be discussed and the existing conflict of interests the conference is expected to continue its session for at least one month.

A Possible Street-railway Subway for Chicago.

It may transpire that by the time this issue of the Western Electrician is off the press an ordinance will be presented to the local transportation committee of the Chicago Council which will provide for a downtown subway as one of the means of settling the traction problem. It is said that both the Chicago Union Traction Company and the Chicago City Railway Company have agreed to construct a subway in the downtown district, to cost $5,000,000, provided the other requirements of the ordinance can be agreed to.

The new traction ordinance, now said to be nearly completed, was prepared by the special traction counsel for the city and representatives of the traction companies. The question of franchise or license under which the companies could operate is said to be overcome in the new draft by a provision which would give the companies the right to operate, terminable by the city at will by purchase on six months' notice given in any January or July.

Only one important question, it is said, remains upon which the city and the companies have not come to at least a partial agreement. This is the question of the value of tangible and intangible properties of the companies. Such figures were submitted by the companies some time ago and were printed in the Western Electrician. The city then appointed experts to review the figures and this committee was also scheduled to report this week. An agreement on this point, it is said, will bring a temporary settlement of the traction tangle.

The system of subways would be constructed on plans laid down by Bion J. Arnold in his report to the local transportation committee as a solution of Chicago's traction problem in the congested district. The initial cost of the system is given as $5,000,000; the Union Traction Company would expend $3,000,000 and the Chicago City Railway Company $2,000,000.

The companies are not willing to build a complete subway at this cost and share it with electric lighting, gas or other public utility corporations that may wish to use it. If these companies wish space in the subway the companies will insist on their paying part of the cost. But the traction offer is to put the amount of $5,000,000 into the improvement, whether it costs that sum and is for the exclusive benefit, or double that sum, with half the use of it only for traction purposes.

American Street-railway Conventions at Columbus.

The American Street and Interurban Railway Association and its three subsidiary bodies, the Accountants', Engineering and Claim Agents' associations, will hold their annual conventions on the State Fair Grounds, Columbus, Ohio, from Monday, October 15th, to Friday, October 19th, inclusive. The hotel headquarters will be at the Southern, which is 14 minutes from the fair grounds by the cars of the Columbus Electric Railway and Light Company. The convention and exhibit halls on the grounds are three or four minutes' walk from the entrance.

Exhibits will be in charge of the American Street and Interurban Railway Manufacturers' Association, which is now thoroughly organized along lines similar to those of the parent association. The exhibits will be larger and more comprehensive than ever before. One hundred and thirty-five different companies have already been assigned exhibit space, and the total amount of floor space will be nearly double that used at the 1905 convention exhibit in Philadelphia.

Hotel arrangements may be made through Ben H. Harmon, secretary Columbus Board of Trade. Aside from the Southern, the Chittenden, Hartman and Neil are the principal hotels. The Hartman will probably be the headquarters for the ladies of the convention.

Outside of the state of Ohio railroad rates of a fare and a third have been granted for nearly all sections of the country. A special train will leave Boston (Boston and Albany Railroad) at 10:45 a. m. on October 14th, and New York (New York Central Railroad) at 2:04 p. m. on the same day, the two sections uniting at Albany and proceeding through Schenectady, Syracuse, Rochester and Buffalo, arriving in Columbus at 6:58 a. m. on October 15th.

It is expected that there will be a theater party on Wednesday evening, October 17th, and that the annual banquet will be held on Thursday evening. In addition, there will be interurban trolley parties, automobile rides, golfing and a number of other forms of amusement, most of which will be especially arranged for the ladies of the convention.

On Wednesday morning there will be a joint session of all the associations. Otherwise, the Engineering and Claim Agents' associations will meet separately on Monday, Tuesday and Wednesday; the Accountants' Association on Tuesday, Wednesday and Thursday, and the "American," or parent association, on Wednesday, Thursday and Friday. Hours of meeting are 10 in the morning and two in the afternoon.

The Engineering Association, among other things, will listen to reports on control apparatus and electrical equipments on Monday afternoon. There will also be a paper on "Ties, Poles and Posts," by C. A. Alderman, chief engineer of the Cincinnati Traction Company. On Tuesday morning there will be the report of the committee on standardization, a paper on "Gas Engines," by Paul Winsor of the Boston Elevated Railway Company, and another on "Underground Cables," by H. G. Stott, of the Interborough Rapid Transit Company of New York. In the afternoon of that day will be read the paper of E. H. Anderson of Schenectady on "Economy of Car Equipment, Weights and Schedules."

The "American" association will consider reports on carrying mails, car wiring, standardization and other subjects on Wednesday afternoon. The report on municipal ownership is down for the executive session of Friday morning. On Thursday forenoon will be the "interurban" meeting, of which this is the programme:

Report of committee on Heavy Electric Railroads.

Paper—"Elevated Railways and their Bearing on Heavy Electric Traction," by H. M. Brinckerhoff, consulting engineer, New York city.

Paper—"Electric Railways in Sparsely Settled Communities," by E. P. Roberts, of The Roberts & Abbott Company, Cleveland, Ohio.

Paper—"Interurban Limited Trains," by Harrie P. Clegg, president Dayton and Troy Electric Railway Company, Dayton, Ohio.

Paper—"Interurban Freight and Express," by E. C. Spring, general manager, Dayton, Covington and Piqua Traction Company, West Milton, Ohio.

Paper—"Tickets and Rates," by F. W. Coen, secretary and treasurer, Lake Shore Electric Railway Company, Cleveland, Ohio.

Paper—"Some Distinctions Between City, Suburban, Interurban and Railroad Traffic," by Theo. Stebbins, expert, National Civic Federation, Cohasset, Mass.

The Accountants' and Claim Agents' associations will consider subjects appropriate to their respective duties.

Electrical Conditions in San Francisco.

[From the San Francisco correspondent of the Western Electrician.]

The electrical machinery and supply business in San Francisco, which has been large almost ever since the fire of April 18th, which destroyed large numbers of electric motors, generators and supplies, has increased rapidly during the summer. Local representatives of the big electric manufacturing companies say that they are rushed in a vain effort to keep up with orders. While but few contracts for large units of electric machinery have been placed of late, several are pending, and there is enough inquiry to keep all the engineering talent and supply firms busy figuring.

There is undoubtedly a big movement of some sort going on beneath the surface of affairs in connection with the electric lignting and power interests of San Francisco, and also some of the electric railway interests of California. Just what sort of a consolidation of existing companies, or readjustment of relationships between the companies, will result, is unknown and all sorts of rumors are afloat. Conditions in the financial and physical interests of the Pacific Gas and Electric and other electric companies, have altered so much since the fire that radical changes in the alignment of interests would not cause surprise.

The following-named men, prominent in the electric companies of the state, are now in New York, presumably conferring on some plan for a consolidation of interests or for a division of the field: John Martin, Frank Drum, Cyrus Pierce, F. B. Anderson, E. J. de Sabla, H. H. Taylor and F. L. Brown. President Mortimer Fleishhacker, of the Reno Power, Light and Water Company, is also on his way East. The latter acknowledges that his trip is for the purpose of closing a deal for the sale of the Reno Power, Light and Water Company, the Truckee General Electric Company, the American River Electric Company and the Nevada Transit Company.

Railway Signal Association.

This year's annual meeting of the Railway Signal Association will be held in the New Willard Hotel, Washington, D. C., October 17th, 18th and 19th. Among the committee reports and papers on the program are the following: "Standard Specifications for All-electric Interlocking, and Material for Construction Work;" "Storage Battery—Installation, Maintenance, etc.;" "How to Remedy the Effects of Foreign Currents on Automatic Block Signals;" "Rubber Covered Wire;" "Signal Lamps;" "Interlocking and Block Signals;" "Circuits for Automatic Block Signals—Steam, Elevated Electric and Surface Electric Roads." There are a number of other interesting subjects not purely electrical.

Besides the entertainment provided by the Railway Signal Association, the Signal Appliance Association has arranged sight-seeing trips, theater parties, etc. On Wednesday afternoon the members of the association will be received at the Executive Mansion by President Roosevelt. In the evening the annual banquet of the association will be held.

The executive committee extends a special invitation to the ladies to be in Washington during the convention. C. C. Anthony of Washington is chairman of the entertainment committee. R. S. Balliet, Grand Central Station, New York city, is secretary of the association.

Illuminating Engineering Society.

A meeting of the Chicago section of the Illuminating Engineering Society will be held at 8 p. m. on October 16th at the rooms of the Western Society of Engineers, 1741 Monadnock Building. The two papers presented at the New York meeting of October 12th will be discussed. Both relate to "Data of Indoor Illumination," one being by Mr. J. E. Woodwell, inspector of electric-lighting plants for the United States Treasury Department, and the other by Mr. E. C. White, illuminating engineer, Winnipeg, Man. The membership of the whole society now exceeds 600, with sections in New York, Boston, Philadelphia, Pittsburg and Chicago.

Adjuncts to the Power Load.

By C. J. Russell.

Part II.

The electric furnace presents marked advantages over the old crucible methods. The first cost is from 20 to 25 per cent. of that of gas furnaces of similar capacity. There is no great mass of surrounding and containing materials to be heated to a temperature even higher than that necessary for the operations of fusion and refining. Repairs of all kinds are cut down to a small figure. The expense of crucibles in the gas processes amounts to from $10 to $16 per ton of steel, as against $2 to $4 per ton with a built-up induction furnace. The cost of labor is radically reduced, and the discomforts of the old process are almost entirely done away with.

From these statements it will be seen that the cost of heat energy is not the only factor in considering the electric furnace as a substitute for existing appliances. Prominent metallurgists prophesy that the steel industry will be revolutionized by its introduction and that gas must give way to electricity.

While the central station may have no part in the large operations involving thousands of kilowatts of capacity, it would appear that there should be a good field for the supply of electric current for furnace purposes in relatively small plants, requiring moderate quantities of special and high-grade steels.

Electrochemical Processes.

The subject of electrochemical processes is closely allied to the electric furnace and requires similar consideration. Leaving aside for the moment the question of central-station supply of electric current for the purpose of the manufacture of various chemical compounds on a large scale, there are many processes which are applicable on a moderate scale to several industries with which we come in contact in the light and power field.

The various compounds and solutions used for bleaching interest our textile customers. In certain lines the use of chlorine for this purpose is universal, and most of us are familiar with the disadantages of the method of bleaching by the use of bleaching powder or chloride of lime.

By passing a current of electricity through a solution of common salt, hypochlorite of sodium, or electro-chlorine, is obtained. In properly arranged apparatus no gas escapes, which is a point of vast importance to the manufacturer.

The activity of nascent products is well known, and it can be readily understood that the work done in this manner is superior and much more permanent than that done by the older methods.

This process has been widely adopted abroad, where 2,000 horsepower is used for this purpose in various establishments in a type of cell put out by the Siemens-Schuckert Works. It has also been adopted by several leading manufacturers in this country, and is highly recommended in the linen and cotton trades. The process is also applicable to the bleaching of fibers for paper, artificial silk, oils, etc.

Some work of this character has been done on our system, and a motor-generator outfit of 15 kilowatts capacity has been found ample for the satisfactory bleaching of a ton of fiber per day of 10 hours.

The expansion of electric processes for bleaching, finishing and waterproofing fabrics will be an interesting subject to follow up for central stations desiring to sell current for electrolytic work.

Another promising outlet for the sale of current is the industrial application of ozone. Regarded as a rare product until recently, and its production as a laboratory experiment, several large establishments are now producing this powerful agent in large quantities for bleaching and purifying purposes. The application for this, Nature's own bleaching and sanitary agent, seems to be almost unlimited. Some of the most practical of its uses are in the bleaching of flour and starches, of textile yarns and fabrics, of paper pulp intended for the higher grades of product, the refining of alcohol and spirituous liquors, the treatment of varnishes and oils and for the improvement and purification of water used for drinking or manufacturing.

The last-named application is the widest one, and here ozone has proven its superiority over all known methods. The purification and sterilization of water without destroying any of its natural qualities, without the addition of any chemical compound and at a minimum cost, is a subject that vitally interests all classes of industries and individuals.

A gramme of ozone may be obtained with the expenditure of about 60 watt-hours. Two hundred and fifty gallons of water of average river variety can be treated with this amount of ozone.

Naturally, the amount of ozone required depends upon the number of colonies, or thousands, of bacteria present in the water. With an average of 200 per ounce, none remain after the amount of treatment described. With 2,000 to 4,000 per ounce, from three to 30 remain if the process stop at this amount of ozonization.

The method of treatment consists in aerating the water with ozonized air in apparatus arranged to make the air thoroughly mix or come in contact with every part of the water.

The electrical apparatus for the treatment of the air consists of a step-up transformer delivering high-potential current, about 60,000 volts, to specially arranged discharge plates, between which the air passes on its way from the pump which forces it through the water.

The air may be dried by refrigeration or by passing it over chloride of calcium before it passes to the discharge chamber.

Two types of ozone generators have been used upon our system. In one the dielectric was of glass and the discharge plates in multiple, each provided with a high series resistance which permitted of the cutting out of any which developed defects. In the other the discharge took place across air gaps, and a choke coil and condenser were provided to prevent the formation of an arc and to raise the secondary voltage.

It has been our privilege to witness many chemical and bacteriological tests of the results obtained in the purification of water, both by the Webster process, employing iron electrodes, and by the ozone process. The former is principally efficacious in practice by coagulation, and the water needs aeration afterward. The latter process provides aeration, improves the quality of the water, and is, by microscopic observation, much like machine-gun practice to the unfortunate bacteria.

One of the installations mentioned was put in

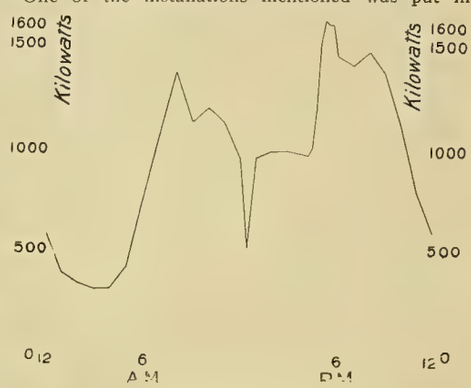


FIG. 4. CURRENT GENERATED IN A SMALL STATION DECEMBER 15, 1905.

for the purpose of improving spirituous liquors. The method of treatment is similar to the water-purification process, and the object is to produce within a brief period all the qualities given by age to liquor of different sorts.

With the expenditure of a few kilowatt-hours per barrel, very crude, raw liquor can be made equal to that which has been aged in wood for several years.

The purification of water used in breweries, both for the brewing and for sterilizing receptacles for the product, should offer quite an extensive field for the exploitation of the ozone process.

Several municipal plants are using the ozone process of purifying water in Europe. Individual residence equipments have also been quite extensively introduced in European countries, and it may be interesting to note that portable outfits for the same purpose were used in the field during the Russo-Japanese war.

Specific details of the various existing electrochemical industries and applications would fill volumes. While undoubtedly in their infancy, it must be admitted that their future growth depends upon the supply of large quantities of electrical energy at reasonable rates.

Relation to Peak of the Load.

Considerable discussion has taken place as to the desirability of this class of business to fill in the hours between peaks and thus to equalize the station load. In these discussions great importance has been attached to the alleged fact that such business need not cross the peak and could be supplied with large or small volumes of current according to the capacity of generators in service and the amount of other load upon the system at a given time.

There is no question that such a class of busi-

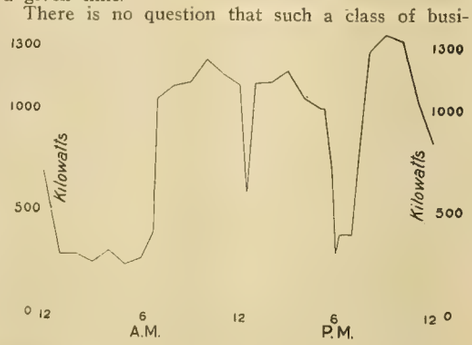


FIG. 5. CURRENT GENERATED IN A SMALL STATION JUNE 13, 1906.

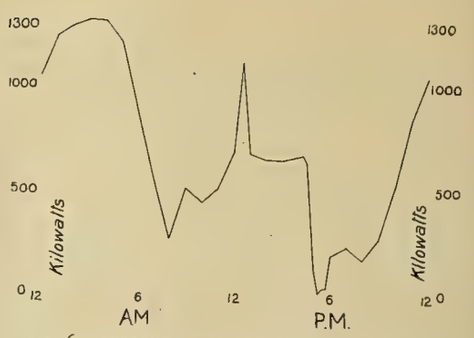


FIG. 6. CURRENT AVAILABLE DECEMBER 15, 1905.

ness would enable a station to operate under ideal conditions. It is evident that the question, however, must be dealt with according to the exact conditions of capacity and load of each individual station contemplating such supply. General statements may lead to a serious misconception of the true possibilities in this direction.

The character of load diagrams of all central stations which have cultivated the electric power field have undergone a radical change. In such cases the old condition of morning and evening peaks, which represented almost the total generated load, has passed. In the present load diagrams the kilowatt area of such peaks as exist bear a much smaller ratio to the area of the daylight load.

An examination of some mixed-load diagrams may help to draw some conclusions in this matter.

Fig. 4 shows a load diagram of a small generating station on the highest day of 1905.

Fig. 5 shows the load diagram of the same station on a day close to the shortest of the present year.

In the case of the first diagram, the total kilowatt area was 23,540. In order to equalize the load to the maximum of 1,643 kilowatts capacity, it would be necessary to utilize in the 24 hours 15,892 kilowatt-hours, and the time and rate at which this was available is shown in Fig. 6.

In the case of the shortest day, the total kilowatt output is 19,040, and in order to attain the maximum use of 1,643 kilowatts capacity we should have available a supply of 20,392 kilowatt-hours. The time and rate at which this was available is shown in Fig. 7.

An examination of Figs. 6 and 7 will show that an electrothermic or electrochemical process must be capable of wide ranges of current utilization in order to meet the requirements of equalizing the load upon the station.

As a matter of fact, electrothermic processes require for their successful and economical operation nearly continuous supply. The initial operation of bringing the furnace and materials up to the proper working temperatures may involve three times the energy required for their operation there-

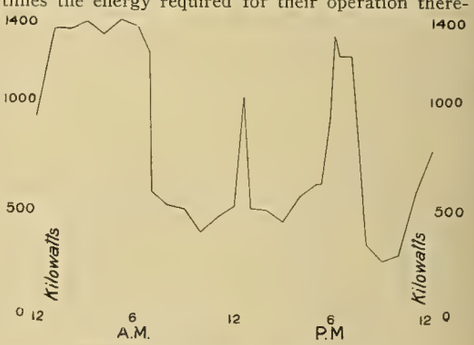


FIG. 7. CURRENT AVAILABLE JUNE 13, 1906, AT MAXIMUM RATE OF DECEMBER 15, 1905.

after. Not only is this true, but the chilling and reheating of such furnaces is an operation quite as destructive to them as to the older types of apparatus.

Electrolytic processes are mostly continuous. They depend for their successful operation upon a certain ampere density at a fixed voltage, and from this it is obvious that the only method of control would be to cut out cells or sets of cells when the current supply must be reduced. Many of these operations are chemically reversible, and the effect of shutting down the process would involve considerable attendance.

Barring out as impracticable the filling in of all the depressions in the load diagrams, it will be seen that either process could be supplied with a capacity of 240 kilowatts for 20 hours per day in winter and for 24 hours in summer, without exceeding the winter maximum peak of 1,643 kilowatts.

It is also apparent that a capacity of about 550 kilowatts could be supplied for seven hours per night at any period of the year.

The addition of these processes to the system would place on the first chart an area of 8,650 kilowatt-hours and on the summer chart an area of 9,610 kilowatt-hours.

The suggestion has been made of the use of

storage batteries for the purpose of handling electrolytic work. As the current for such purposes must be sold at a low rate and the storage equipment is rather costly, this method of handling such a proposition would seem to merit little consideration.

While it may be possible to find processes to fit into the conditions shown in these diagrams, we have never seen anything of the nature of an efficient intermittent process.

It may be concluded that electrothermic and electrolytic propositions must be considered on a straight 24-hour basis and handled in all respects as any other business of similar load factors.

It may also be concluded that, for purposes of load equalization, it would only be possible to add such processes to any system as should be under the absolute control of the central-station interests which were to supply them with electric current.

LOCATION AND OTHER CONSIDERATIONS.

One of the most important points in connection with such processes as involve the supply of large volumes of electrical energy is the question of location with regard to the station. The elimination of distribution expense to a large extent, as well as the fact that the service investment would be very low, should make quite a difference in the rates central stations would offer to such industries as located in their immediate vicinity.

While the tendency seems to be to locate such industries where waterpower is available, there are other factors which may help the central station to secure consideration in the matter of current supply. The question of facility and low cost of transportation of raw materials and the location of principal market centers for finished product are important to any industry.

While waterpower may seem reasonable, these items of expense may make central-station service in some other and more favored locality the cheaper in the end.

There are some electrochemical industries located now in out-of-the-way places which could obtain better results near some of our great shipping centers, for the reason that the cost of transportation of raw and finished product plus the loss of certain by-products which cannot now be utilized more than offsets the advantages gained by the price of electricity at the present location. This condition of affairs was entirely unforeseen and those interested had no one to show them the great white way leading to the central station.

A study of the various electrochemical industries will reveal that purchased electric power has been attractive to them for the reason that their inception was experimental and the exact type of equipment needed was unknown. The installation of large generating units under such circumstances was not warranted, whereas it was possible to purchase transforming apparatus adjustable to several possible conditions.

Here is where the advantage of our service comes in. We can meet these exact conditions, and, with the facilities it is possible to offer them and the low rates we can name them for 24-hour business, it would appear that the attraction of locating in accessible and desirable market centers should make it possible to present some very strong arguments for this class of business.

There is one point in considering these electrochemical and electrothermic propositions which should be represented in its true light in every possible case. In estimates of the current used for any given operation, either furnace or electrolytic, foreign usage, sanctioned by adoption on this side of the water, has adopted the unit, "electrical horsepower-year." In estimating, if a pound of finished product requires the expenditure of 746 watt-hours, for example, the cost of an electrical horsepower for one year is divided by 8,760 (24 hours × 365 days), and the result is assumed as the cost of energy per pound of finished product.

The originator of this method was probably an optimist along the same lines as ourselves, in that he hoped to utilize every horsepower of generator capacity during 8,760 hours per annum.

Experience has taught us the true possiblities in this direction, but the truth does not seem to have penetrated deeply enough to make any change in the estimating methods of our sanguine electrochemists and electrometallurgists.

No process can continue at its maximum for 24 hours a day and 365 days per year. Furnaces need repairs, baths need renewing and overhauling; in fact, the very processes themselves require considerable current regulation and are not prosecuted at a maximum rate.

These, as well as humane reasons, prevent the fulfillment of the figure named. If the actual use averages from 50 to 70 per cent. of the maximum, and we have never seen the latter figures continually exceeded, quite a radical change in the estimated cost per pound of finished product as well as per kilowatt-hour utilized has been effected.

As a practical check upon this, it is rather satisfactory to learn the electrical capacity of an installation, the amount of energy estimated per pound of product, and then to learn the actual amount of finished product turned out in a year. The results of this character of information received from several operations in different parts of the world would seem to indicate that, if the amount of calculated energy per pound is correct, the actual load factor of the plants runs from 30 to 50 per cent. based upon a 24-hour day and a calendar year.

The kilowatt-hour is the only true basis for calculation, and the cost of this unit for purposes of estimation should be based upon the cost of a kilowatt-year, modified by the actual or calculated load factor.

Computation along these lines, taking into account the cost of transportation of materials, will show the range of possible business in the field of large electric furnace and electrochemical operations.

As adjuncts to the power load, electrothermic appliances and electrochemical processes offer means of increasing the usefulness of the central station and broaden the field of salesmanship.

The commercial departments which have for their motto "Electricity for everything everywhere" must view with some satisfaction the record of every new adaptation which brings them closer to their ideal.

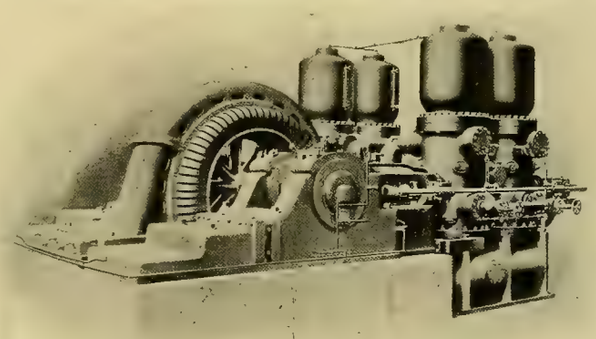
[*The end.*]

Electrical Mine Pumps at the Ward Shaft.

BY LEON M. HALL.

The pumping plant just received at the Ward Shaft, Virginia City, Nev., is probably the largest, best and most complete electrically driven mine-pumping installation ever constructed, so that a brief description of the same, together with the reasons for its existence, may be of interest to those engaged in the mining and electrical industries.

The Ward Shaft Association was formed some three years ago, with the ostensible purpose in view of opening the Ward Shaft and of draining the middle group of mines on the Comstock, in order to explore this lode to its very lowest depths. This shaft was originally sunk to a vertical depth of 2,480 feet, and just before reaching this point has passed through the vein, which proved to be a mineralized fissure over 60 feet in width. Some 15 years ago this shaft was abandoned on account of the stagnation then existing in the silver market, and, with the cessation of work, it was allowed to decay and partially fill with rock and refuse of all kinds.



ELECTRIC MOTOR OF 800 HORSEPOWER DIRECTLY CONNECTED TO DUPLEX PUMP.

The shaft was rehabilitated and retimbered without much trouble to the 1,600-foot level, at which point a drainage drift was run 275 feet to connect with the south lateral branch of the Sutro Tunnel. Below this level difficulties of all kinds incident to hot water and its attending evils were encountered, and the progress has consequently been slow and expensive. Today the shaft is in perfect condition to the 2,430-foot level, leaving but 50 feet of the old shaft to recover. From the 2,480 to the 3,100-foot level the work will all be in new ground, probably free from water, so that it is confidently expected that progress will be rapid and the new electric pumps in early operation.

In reopening this shaft a considerable flow of very hot water was encountered, so that quite an extensive temporary pumping plant was necessary. This will be briefly described. On the 2,100-foot level a 6¾ by eight-inch Knowles vertical triplex pump, geared to a 100-horsepower type C Westinghouse induction motor, was placed and arranged to take its water from a three-step Byron Jackson centrifugal pump belted to a 50-horsepower Westinghouse induction motor, located on the 2,330-foot level. In turn, this centrifugal receives its supply from a nine-inch Blake sinking pump at the bottom of the shaft. Two 100-horsepower Ingersoll-Sergeant compound air compressors, driven by two 100-horsepower Westinghouse motors, are in operation on the surface and supply this sinker with the necessary motive power. This temporary plant is raising 300 gallons per minute 855 feet, from the present sump to the Sutro Tunnel level.

In order to supplement this plant, a five-step Byron Jackson centrifugal pump, directly connected to a special Westinghouse induction motor, has been installed on the 2,410-foot level. This pump has a capacity of 600 gallons per minute against a head of 900 feet, and it will take its supply of water directly from the sinking pump, thereby doing away with the triplex and centrifugal pumps before mentioned. This pump is entirely of bronze, operates at 1,700 revolutions per minute, and under these conditions shows an efficiency of 67 per cent. with the water temperature 160° F. This pump will be duplicated immediately for safety of operation, and, with these as an auxiliary, the company confidently hopes to reach the 3,100-foot level at no distant day.

On the 3,100-foot level the excavation of a pump station 80 feet long, 24 feet wide and 20 feet high is contemplated, in which will be placed the permanent pumping plant, the real subject of this sketch. The capacity of this permanent installation will be 3,200 U. S. gallons per minute against a total head of 1,550 feet, and this will be divided between two units, each separately driven by a special slow-speed 800-horsepower Westinghouse induction motor. The pumps are of the Knowles express type and are the embodiment of all the best mechanical and electrical ideas obtainable for this class of work. They are outside end-packed duplex double-acting pumps with plungers 6 11-16 inches in diameter and 15-inch stroke. The rotating element of the motor is placed directly on the crank shaft and will operate at 195 revolutions per minute.

The valves are automatic poppet valves, arranged in nests of 13 each. The valve area (103.35 square inches) is unusually large, so that the consequent movement of the valves is extremely small, all of which is conducive to a high rotative speed with a minimum of wear. The valves, stuffing-box glands and other vital parts exposed to the action of the water are of bronze and are arranged so that they may be readily renewed.

The plant will be equipped with a three-stage electrically driven air compressor for charging the air receivers, a vacuum pump and an automatic oiling system. For convenience of erection and repair, the pump station will be fitted with a 15-ton traveling crane; in fact, it is intended to include in this plant everything that will insure reliability and ease of operation.

The over-all dimensions of each pump are 27 feet 3¾ inches in length, 17 feet in width and 14 feet 2½ inches in height. The motor is 13 feet in diameter and the steel crank shaft, forged from one piece, is 13¾ inches in diameter and 14 feet 4½ inches long. The total cost complete for operation will be about $125,000. These pumps will be supplied by either one of the two centrifugals located in the sump at the bottom of the shaft and operated by special 75-horsepower motors on a vertical shaft.

The water will be discharged through a steel column 16 inches in outside diameter, with welded steel flanges. The thickness of this pipe varies from one-fourth inch at the tunnel level to nine-sixteenths inch at the bottom. The column will be supported by means of heavy-weight iron clamps six inches in length, which in turn will rest upon the wall and end plates. To resist the pressure of 675 pounds to the square inch, male and female flanges are used and each fitted with a lead-filled copper gasket.

Electric current is taken down the shaft at 2,240 volts over a three-conductor lead-covered steel-armored cable of 400,000 circular mils capacity. The electric equipment, from the automatic oil circuit-breakers on the surface to the motors themselves, is the best that money can buy, so that once in operation, with the splendid Westinghouse plants of the Truckee River General Electric Company behind it, results are anticipated that have never before been approached for this class of work.

Old Time Telegraphers Meeting.

The annual meeting of the Old Time Telegraphers and Historical Association and the United States Military Telegraphers was held in Washington, D. C., this week. The following officers were elected: President, Harvey D. Reynolds, superintendent, Postal Telegraph-cable Company, Buffalo, N. Y.; first vice-president, George A. Burnett, superintendent, Great Northwestern Telegraph Company, Buffalo, N. Y.; second vice-president, I. McMichael, general superintendent, Great Northwestern Telegraph Company, Toronto; third vice-president, George F. McDonald, superintendent, Great Northwestern Telegraph Company, Ottawa, Canada; executive committee, William H. Young, Washington, D. C.; J. C. Barclay and Charles C. Adams, New York, all former presidents of the association; Hugh J. Fry, Milwaukee, and three others to be named by the president. Niagara Falls was chosen as the place of meeting next year, the local executive committee to fix the date.

THE SMALL CENTRAL STATION.

Practical Hints on Its Construction and Operation.

CHAPTER XIII. (*Continued.*)

LINE CONSTRUCTION.

Mounting of Transformers.—Transformers should be hung from cross-arms not used for high-tension lines, and should be reached easily and with safety. Reinforcement of cross-arms is necessary when extra large or heavy transformers are hung. In cases where the transformer is liable to interfere with a lineman in reaching the top of the pole, a bottom arm should be placed underneath it. Never install a transformer so as to interfere with regular line work.

Where the three-wire system of secondaries is employed, the neutral wire should always be grounded. In two-wire secondary work it is also advisable to ground one wire. Good practice also requires additional grounds at the premises of each consumer. Where a number of transformers are connected in multiple, each transformer should be grounded individually. In connecting a two-wire meter, the fields should be placed in the grounded side of the system in order to avoid a loss of revenue due to the meter being shunted by other grounds in the same building. When making meter inspections always examine all grounds in the building, renewing the same when necessary.

Division of Service.—As far as possible, the territory to be supplied with service should be cut into subdivisions having definite boundaries. These subdivisions should be made with regard to series-arc and alternating-current circuits. These subdivisions or districts should be drawn out on maps of the city, and all additions to any circuit should be immediately put upon the maps. In this way a full and easily followed record of all line work is always at hand in case of trouble. These maps should locate all arc lamps, primary circuits, secondaries, where feasible, transformers and their capacity, junction poles and any other appurtenances liable to be useful in case of trouble, changes in line construction, etc.

Arrangement of Circuits.—Bring as few lines into the station as possible. Do not operate alternating circuits at 1,000 volts where 1,100 volts can be carried equally as well. A better service will be maintained, while the wire difficulty will be lessened materially. On the other hand, do not operate with less than two main trunk lines leading from the station, and take these to centers of distribution over streets in which there are few telegraph and telephone poles already set and where there will be the least public objection. Cater to public good-will, even though additional expense be incurred by so doing.

Series circuits should be so laid out as to require, excepting main lines, but one line on a street. Go down one street and return on another.

Where series lighting is employed, the line construction should be such as to allow of cutting out a number of lamps in one district without interfering with the remainder. This will be found of advantage in cases where a fire necessitates cutting out any section or where open circuits or grounds are being located.

All line wires should be well drawn up in order to prevent crosses. A sag of from 12 to 24 inches will be found sufficient for a span not exceeding 125 feet. Each circuit should occupy the same position on each pole with reference to the other circuits. If this rule is carried out, a lineman will know at a glance where to locate a certain circuit on any pole on the company's lines. First branches, in going out on the trunk lines, should be taken off below, allowing feeders for distant points to remain above. This arrangement will afford ease of repair to the lines most liable to need it. Lines to distant points will, as a rule, supply a small demand in comparison with those taken off near the station, which, in this instance, is assumed to be placed near the business district, with its heavy demand for current.

Continual-service high-tension lines should be strung on the top cross-arms. Street-lighting circuits and those supplying commercial lights least liable to day use should be given the lower arms. This will give linemen an opportunity to work during the day on the lighting circuits without having to come in contact with live wires. This may be taken to apply to secondary circuits also, since they are of low tension. Never attach secondaries and primaries to the same cross-arm unless on opposite sides of a pole. Twenty-four-hour-service lines are sometimes strung on a special type of insulators, thereby affording a ready means by which the lineman may recognize live circuits. This scheme is only employed on high-tension service.

Branch circuits ought properly to lead from reverse arms except in case of single arc loops, which may be taken from an iron break-arm located on an outside or end pin. Where alternating-current circuits branch both ways from one pole at cross streets, the two branches should be joined and but one pair of taps taken to the main line.

Practical Hints.—Fuse boxes for protecting main lines are placed on the first pole, each side of the trunk line.

Guard wires (two No. 10 galvanized-iron wires) are stretched between the tops of poles which include a span over which numerous telephone and telegraph wires cross. These guard wires are strung on six-pin cross-arms (one on each outside pin) attached to the tops of the two poles.

Line wires should be tied to insulators by passing the tie wire around the insulator and then twisting each end of the tie wire four times around the line wire. All joints in solid wires should be made Western Union style, with four turns on each end and joints in copper, then soldered. Good practice requires the joint to receive, first, two layers of rubber tape; second, two layers of black friction tape, and third, an outside coating of asphaltum paint.

The sizes of tie wires recommended with line wires varying from No. 000 to No. 4 are as follows:

Size of Line Wire.	Size of Tie Wire.
No. 4	No. 4
No. 2	No. 4
No. 0	No. 1
No. 00	No. 1
No. 000	No. 0

Ends of all tie wires should be cut close to line wires after being twisted about the latter.

Rules for Linemen.—Where the territory to be supplied has been divided into districts or subdivisions, it is well to operate under a given set of rules and diagrams, in order that the line construction in the several districts shall be uniform. This will enable linemen of one district to operate anywhere on the system with safety and without hesitancy.

The following rules are selected from a set in use by the Association of Edison Illuminating Companies and are standard practice everywhere:

RULES FOR LINE FOREMEN.

1. No wire of smaller size than No. 6 B. & S. gauge shall be used for either primary or secondary work.
2. All arc line wire shall be erected on double-petticoat glass insulators.
3. Alternating-current and arc line wires shall in no case be placed upon the same cross-arm unless the pole is between.
4. All joints shall be well soldered and taped.
5. Secondary lines shall at all points be at least 18 inches from primary or arc lines unless covered with heavy porcelain tubes.
6. Fuse boxes shall be placed upon all branch circuits.
7. The main circuits shall not be fused as long as the wires are maintained of the same size as at the station.
8. Fuse boxes for branch circuits shall in all cases be fused 25 per cent. smaller than the main fuse at switchboard; and in no case shall branch fuse boxes be fused with copper wire.
9. Fuse boxes for branch circuits shall be placed upon the first pole from the junction pole.
10. Transformers shall not be placed on the exterior of buildings, sheds or other property belonging to the consumer.
11. All poles having transformers or fuse boxes upon them shall be stepped.
12. No fuse box or transformer shall be placed upon a junction pole or lamp pole, except where absolutely necessary, in which case the office shall be notified and permission obtained.
13. Transformer poles shall in all cases have full six-pin arms.
14. In placing transformers for motors, one kilowatt should be allowed for each horsepower up to 30 horsepower, except where a number of motors are installed upon one group of transformers, in which case the capacity may be reduced in accordance with the condition of load.
15. In connecting two-wire consumers upon three-wire secondary circuits, care should be taken that the load is evenly balanced as to location and time of burning.
16. Wherever practicable, consumers should be grouped upon one transformer, or system of transformers, and secondary wires.
17. The object in grounding a secondary wire of transformers is to prevent high-tension current from reaching the secondary wires. The neutral wire of all three-wire secondary circuits must be grounded, and also one side of all two-wire secondary circuits.
18. It is of the utmost importance that the primary fuses protecting each transformer shall be of a size proportionate to the capacity of the transformer. When a transformer is fused excessively heavy, or with fuses of dissimilar sizes, one fuse only is liable to blow, thus leaving current on the defective transformer.
19. It is essential that when a primary fuse on the transformer is blown through any cause the secondaries should be disconnected from the transformer and the latter tested to full line voltage between the primary and secondary coils so as to determine that there is no breakdown in the insulation between these coils.
20. All alternating-current circuits should be tested daily for grounds.
21. All series lighting circuits should be tested for grounds within 10 minutes after the circuits are taken off, and for open circuits, crosses and grounds at 12:10 p. m. and 3:10 p. m., and also one hour before starting time.

[*To be continued.*]

New Spanish Markets.

American trade prospects in Spain as a result of the commercial agreement between the United States and Spain, which went into effect September 1st, are detailed in a report by Consul-general B. H. Ridgely from Barcelona.

By the terms of this new agreement Spain concedes to the United States the lowest scale of its new tariff. Out of a total of 66,000,000 pesetas worth of machinery and tools imported annually into Spain, only about 2,000,000 is credited to the United States. The new agreement should encourage American machinery exporters to work the Spanish market more vigorously.

Dynamos, electric motors, etc., not exceeding the weight of 400 kilos (880 pounds) will pay 75 pesetas ($13.50) per 100 kilos instead of 100 pesetas ($18); over 400 kilos, 37½ pesetas ($6.75) instead of 50 pesetas ($9). Telegraph and telephone fixtures, 2.50 pesetas (45 cents) per kilogram instead of three pesetas (54 cents). Arc lamps and parts for same, excepting the carbons, will pay two pesetas (36 cents) per kilogram instead of four pesetas (72 cents). Incandescent electric lamps, eight pesetas ($1.44) per kilogram instead of 13 pesetas ($2.34). A substantial reduction is brought about in the duties of all kinds of iron and steel bars, rails, plates, etc. Cast and wrought iron and steel parts of machinery all benefit greatly by being now assessed on the same basis as if imported from European treaty countries. [The monetary conversions of the consul-general are based on the Spanish peseta at 18 cents American currency, presumably the present exchange value of the peseta. Import duties in Spain, however, are payable in gold, and the value of the gold peseta is 19.3 cents.]

Testing Street-car Safety Devices.

In accordance with an act of the Legislature, the Massachusetts Railroad Commission has taken up the investigation of safety devices for street cars or street railways. At a hearing a few days ago nearly 100 inventors and promoters offered their devices for consideration, but these were only cursorily examined. The board will soon have a street car ready for demonstrations of these devices. The car will be operated on the Newton Street Railway Company's tracks in Newton. Among the devices already brought to the commissioners' attention are over 30 fenders, three headlights, a ventilating device, five block signals, three switch devices, three fire extinguishers, several trolley retrievers and some special signals.

Western Electrical Inspectors to Meet.

The second annual meeting of the Western Association of Electrical Inspectors will be held in the assembly room of the Denison Hotel, Indianapolis, Ind., on October 17th, 18th and 19th. The program is an interesting one and includes committee reports, tours of inspection, and discussion of problems encountered by inspectors in the performance of duty. Special committees will report on 12 important subjects affecting electrical inspection and public safety. One of the interesting trips will be an inspection tour of the electrical equipment of the Indianapolis and Cincinnati Traction companies' single-phase railway.

A correspondent of the Boston American says: "The telegraphers are responsible for the new style of spelling. It is customary, among telegraph operators while conversing on the wire to spell the words as they sound and to abbreviate as much as possible. In proof of the assertion, Mr. Andrew Carnegie is an old-time telegraph operator."

New Line of the Toledo, Port Clinton and Lakeside Railway.

Up to the present time the Toledo, Port Clinton and Lakeside Railway, one of a network of Ohio and Indiana lines, has operated cars from the Toledo city limits to Genoa, 10 miles, over the tracks of the Lake Shore electric railway, and has its own traffic arrangement with the city company for entrance to Toledo and the use of the terminal station. The company has now arranged for an independent entrance to Toledo, confident that it will prove a profitable addition to its holdings. A private right-of-way was secured from the present junction north to the village of Curtice, thence to Booth and into Toledo by way of a city line, which gives a shorter route to the center of the city. The new section is now practically ready for operation. The standard construction which was adopted by the company, in building the remainder of its line, has been followed for track, roadbed and overhead equipment. An overhead crossing is made at Clay Center with the main line of the Lake Shore and Michigan Southern Railway.

A sub-station located near the limits of Toledo will furnish power for operating cars over the new section of track. A three-phase 20,000-volt transmission line is led from the power house at Port Clinton to the rotary sub-station. There are sub-stations at Genoa, Oak Harbor, Port Clinton, Marblehead, and the new one installed near Toledo, making an average distance of 13 miles between stations.

The main equipment for the entire road was furnished by the Allis-Chalmers Company of Milwaukee, including the power house and sub-station apparatus, car motors, controllers, etc. In the main station two horizontal cross-compound condensing engines are direct-connected to revolving-field engine-type alternating-current generators of 800 kilowatts each, delivering current at 275 volts, three-phase, 25 cycles. Current from each large generator is led via six rubber-insulated cables through the switchboard to three 500-kilowatt 375-20,000-volt oil-filled water-cooled transformers, placed back of the switchboard. The sub-stations are each equipped with a 400-kilowatt rotary converter and suitable step-down transformer and boards.

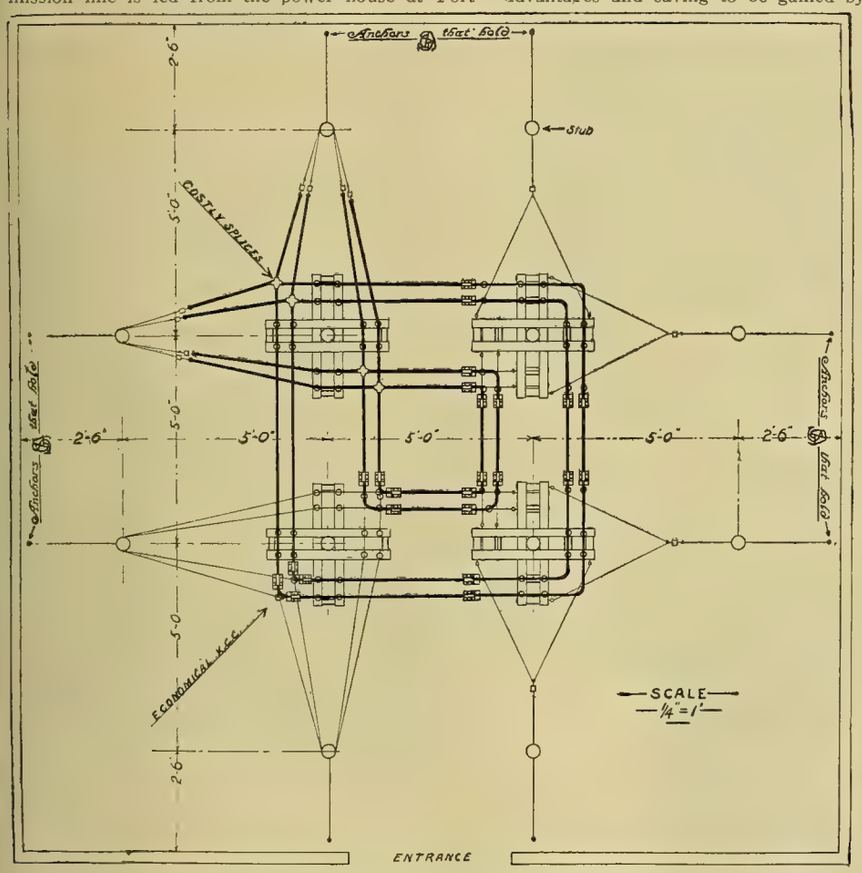
Street-railway Fire-alarm System.

To aid in taking care of its traffic in case of big fires, the Saginaw Valley Traction Company of Saginaw, Mich., is installing the necessary electrical and mechanical apparatus for the announcement of fires by box numbers in exactly the same manner as alarms are received by the city fire department.

When an alarm comes in at the central station, the gong in the barn of the traction company will immediately give notice of the fire. If the blaze proves to be of consequence the necessary apparatus from the barn will immediately be taken on the wrecking-car to the scene of the fire and the proper steps taken to avoid any unnecessary delay to the cars of the city lines which are obliged to pass the fire district. The devices used for protecting the hose lines will be on the first car out, and this will enable the company to keep up the usual schedule, granting, however, that the conflagration does not assume such proportions that this could not be accomplished. The installation of the system meets with the hearty approval of the fire department and will undoubtedly prove of great value on occasions where the use of the traction company's apparatus is made necessary.

A Line-equipment Exhibit at the Columbus Convention.

The plan view shown herewith will give a clear idea of the elaborate exhibit of Stombaugh guy anchors and Kearney cable clamps, which is to be made by W. N. Matthews & Bro. of 203 North Second Street, St. Louis, at the American Street and Interurban Railway convention to be held at Columbus, Ohio, next week. This enterprising firm has taken a space 20 by 20 feet in Section B, Spaces 18 and 19, Building 6, and will exhibit four corner poles, which will show the Kearney cable clamp and Stombaugh guy anchor under actual conditions. One of the four poles is made up in the old manner more clearly to show the advantages and saving to be gained by the use of the Kearney clamp. Each pole is anchored by a six-inch Stombaugh guy anchor.



PLAN OF EXHIBIT OF W. N. MATTHEWS & BRO. AT COLUMBUS STREET-RAILWAY CONVENTION.

In addition to the cable clamp and guy anchor, Matthews & Bro. will have a working exhibit of their new specialty, the Lima jack box. This will be installed on each pole, and it will be possible to talk by means of a portable telephone from one pole to another. This scheme will show the advantages of the Lima jack box. The Hold Fast lamp guard will also be exhibited, and delegates will be invited to try to break a lamp in a guard.

The firm will be represented by Claude L. Matthews and James R. Kearney.

BOOK TABLE.

A Graphical Treatment of the Induction Motor. By Alexander Heyland. (Translated from the Second Edition by G. H. Rowe and R. E. Hellmund.) New York: McGraw Publishing Company. 1906. Pages (5¾ by 8¾), 50. Price, $1.

A treatise covering the general theory and principles of operation of the induction motor is presented. It gives a method of determining graphically the various losses, torque, slip, output, input and efficiency from certain tests. Several practical applications of the method are given in the form of problems and their accompanying solutions.

Complete Examination Questions and Answers for Marine and Stationary Engineers. By Calvin F. Swingle. Chicago: Frederick J. Drake & Co. 1906. Pages (4¾ by 6¾ inches), 368, with 211 illustrations.

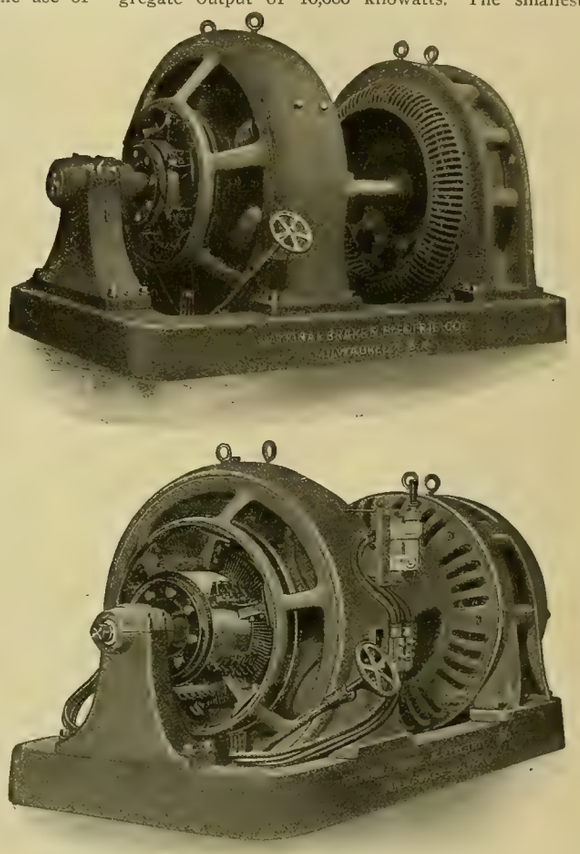
This work contains in catechetical form information covering the various details appertaining to the operation of modern steam plants both stationary and marine. Special attention has been given to boilers, discussion of different types of engines, the indicator, the turbine and auxiliary machinery.

Power Plants of the Columbus Railway and Light Company.

The power plants and systems of the Columbus Railway and Light Company of Columbus, Ohio, are among the most modernly equipped stations in the Central West. The company was incorporated in Ohio in 1903, and acquired by lease the Columbus Railway Company and the Columbus Edison Company. On July 1, 1906, the company also acquired operating control of the Central Market Street Railway, which was one of the Appleyard properties, but was obtained by the Ohio syndicate at a receiver's sale. The Central Market Street Railway owns 16 miles of track and leases 15 miles. The Columbus Railway and Light Company owns 107 miles of track, making a total of 138 miles in the combined system.

The system consists mainly of broad-gauge lines on which 331 cars are operated. On the standard-gauge lines about 60 cars additional are operated, making a total of nearly 400 cars in use. The majority of these cars are equipped with GE-67 motors, with a scattering of GE-52 and 800, and Westinghouse 12 and 49.

Current for operating the railway and lighting system is generated in four stations, with an aggregate output of 10,000 kilowatts. The smallest of these is the Milo station, just outside of the city limits, which had a capacity of 800 kilowatts. The Milo station has within the last month been converted into a sub-station, and a National 500-kilowatt motor-generator set installed to supply current to the system in this district. This set is of the three-bearing type, and consists of a 750-horsepower three-phase 60-cycle 600-revolutions-per-minute synchronous motor, receiving current at 4,100 volts and driving a 500-kilowatt direct-current generator which generates current at 575 volts and 870 amperes. The construction of these machines provides for a liberal rating and low temperature rises and at the same time gives a compact set of very rugged appearance and graceful lines.



NEW MOTOR-GENERATORS OF COLUMBUS RAILWAY AND LIGHT COMPANY.

The Columbus Railway and Light Company has also recently installed a National induction motor-generator set in a new sub-station at the corner of High and Town streets. This set is used for bridging-in on the underground Edison lighting circuit. This set comprises a 375-horsepower motor, wound for three-phase 60-cycle 4,100-volt current and driving a 250-kilowatt 250-volt direct-current generator at a speed of 720 revolutions per minute. The present connected lighting load of the company is about 150,000 16-candlepower lamps. In the business section of the city the lighting system is underground.

The Atlantic Coast Line Railroad will construct at Waycross, Ga., a coal-storage plant with a capacity for storing 40,000 tons of coal. The building will be constructed of brick and equipped with electric coal conveyors and electrical machinery. About $65,000 will be expended. E. B. Pleasants, Wilmington, N. C., is chief engineer.

Types of Portland Cement.

In a brief discussion of the advance made during 1905 in the technology of cement, Mr. Edwin C. Eckel of the United States Geological Survey has grouped Portland cement into four different types, according to the raw materials used in its manufacture.

The first type includes cement produced from a mixture of argillaceous limestone ("cement rock") and pure limestone. This is the combination of materials used in all the cement plants of the Lehigh district of Pennsylvania and New Jersey and also at several western plants.

The second type includes cement manufactured from a mixture of marl and clay. This type of mixture is used only in the states of Michigan, Ohio, Indiana and New York.

The third type includes cement manufactured from a mixture of ordinary hard limestone and clay or shale. This mixture is employed at many plants all over the United States. In order to prevent the publication of statistics concerning individual enterprises, the Portland cement made from slag and limestone is included in this group. At present the only Portland cement plants using a slag-limestone mixture are those of the Illinois Steel Company at Chicago, Ill., and Buffington, Ind.

The statistics of the American cement industry show very clearly the direction in which it is trending. Over half the total product is still made from a mixture of "cement rock" and limestone, but this percentage is slowly decreasing. The marl-clay mixture shows a similar decrease. The proportion of the product made from a mixture of hard limestone and clay or shale is, on the other hand, increasing rapidly.

Mr. Eckel's paper on the cement industry in 1905 is published as an extract from the annual volume entitled "Mineral Resources of the United States, 1905," and may be obtained on application to the director of the United States Geological Survey.

Portable Electric Tool for Rail-bonding.

A new portable electric drill to operate on street-railway circuits has just been placed on the market by the Chicago Pneumatic Tool Company, and is attracting marked attention. This company's 110 and 220-volt drills have been favorably known to the trade for the last two years or more, and the mechanical features of these machines have been retained in the new drills.

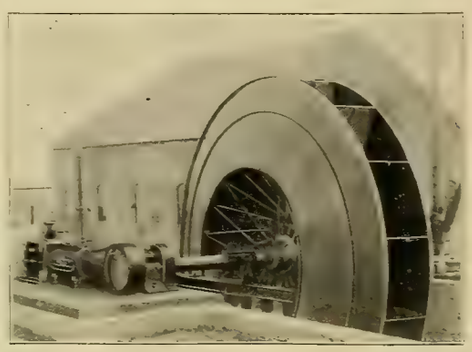
The accompanying cut shows a 550-volt drill in operation on rebonding work. It is shown drilling seven-eighths-inch holes in hard steel rails, and a fair idea of its size can be obtained by comparison with the men in the picture. This size of drill weighs 35 pounds, and will drill a seven-eighths-inch hole through an ordinary rail in less than two minutes. The electrical parts are built to operate at 500 to 650 volts without external resistance, and a quick-break barrier-type switch many times the normal ampere rating of the drill is mounted directly on the housing. The insulation is of the highest type throughout, and the drills are built to withstand the conditions of severe service in street-railway construction and maintenance. Special precautions have been taken to prevent any danger of shock to the operator should any part of the windings become grounded, and in the hands of operators of average intelligence this danger has been eliminated.

PORTABLE ELECTRIC DRILL FOR RAIL BONDING.

The above company has also brought out a portable electric grinder wound for 500 to 650 volts, for use on railway work. This grinder weighs 20 pounds and drives an eight-inch-diameter by 1¼-inch-face emery wheel at a speed of 2,500 revolutions per minute. The tools will be shown in operation at the convention of the American Street and Interurban Railway Manufacturers' Association, October 15th to 19th, at the State Fair Grounds, Columbus, Ohio, in space B, 3 to 5, Building No. 3.

A 35-foot Direct-connected Fan.

The Allis-Chalmers Company for some years past has made a specialty of large ventilating fans, with diameters varying from 12 to 35 feet. These are of the double-intake center-draft type. They are built up of sheet steel and angles, the blades being rigidly fastened to sheet-steel arms, which are in turn clamped between two cast-iron centers, so shaped as to present the least possible resistance to the air as it enters the fan; the blades are also well braced to insure their running true. The sides



FAN 35 FEET IN DIAMETER DIRECTLY CONNECTED TO STEAM ENGINE.

of these fans are enclosed from the periphery of the intake to the periphery of the outside or top of blades by steel plates reinforced by angle rings on the outside and by angles on the sides of the blades on the inside. The fan is usually mounted upon a hammered iron shaft secured to it by heavy keys. Then large set collars in halves are placed one upon either side against the fan centers and clamped in recesses turned into the shaft; these prevent the fan from working upon the shaft. A bronze-bushed water-jacketed bearing is placed upon either side of the fan, and these bearings, braced by suitable columns, are supported on long sole plates, the ends of which rest on the foundation and are securely bolted to it. These fans may be arranged for direct connection to the motive power or provided with pulleys for belting. When the fans are required to be placed in damp and dirty passages, the direct-connected unit has many advantages, for the use of belting under such conditions is far from desirable. The limited space available in such cases is also another argument in favor of this arrangement. The fans may be driven either by small engines or by electric motors—preferably induction motors, where alternating current can be supplied. In the case illustrated a Reynolds-Corliss engine supplies the power.

Stromberg-Carlson Interurban Railway Telephone.

The large increase in the number of interurban railways, both electric and steam, the need of rapid and frequent train service, the desire and advisability of a more flexible system, have made necessary a change in the old methods of issuing orders to conductors, engineers and motormen. The telegraph, with its copied orders, is not practical where stations are close together, the block

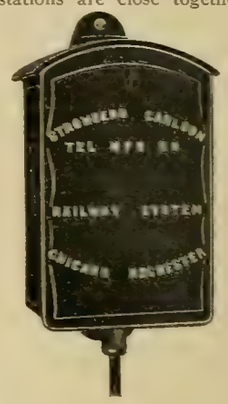


FIG. 1. JACK BOX.

system is too expensive to maintain. With the dispatching telephone no mistakes can be made, no guesswork, no wrongly read orders—the correct understanding of an order is acknowledged as soon as it is delivered.

The method of applying telephones to railway trains and electric cars, worked out by the Stromberg-Carlson Telephone Manufacturing Company of Rochester, N. Y., is as follows:

Each train or each car, if an electric railway, is equipped with a semi-portable telephone. This telephone can be used direct from the car by making connection with the telephone line wires in one of two ways:

First, by bringing into use the cord and plug

FIG. 2. INTERURBAN RAILWAY TELEPHONE SERVICE.

with which each instrument is provided, inserting the plug in the jack box (Fig. 1), which is usually mounted on a pole at the switch or along the track, as in Fig. 2. These are located at intervals along the line wherever they are needed.

Second, by using the Stromberg-Carlson jointed extension pole, which is provided with a jack, mounted in the lower end, in which the plug, attached to the telephone, is inserted as in the plug box above described. The opposite end is

FIG. 3. CITY RAILWAY TELEPHONE SERVICE.

provided with two hooks for catching the line wires. The pole is jointed, thoroughly wired, well and substantially built, and when put together is electrically connected. Thus in the open country and where there is no plug box at hand, instant communication can be had by this means with the dispatcher, superintendent, or with any station on the line.

City lines are also feeling the need of such a system, and the service is rapidly extending. Fig. 3 shows a box in service on a city line.

Metheany-Matthews Interurban Railway Telephone.

While the telephone is recognized as an efficient instrument for the dispatching of steam and electric trains, up to the present time such a system has been considered expensive. To equip a line with a telephone system has required the construction of booths at frequent intervals and the installation of telephones to be kept under lock and key. Each conductor has had to carry a key which necessitates his getting off the car and consuming valuable time unlocking and locking the booth. The booths are not infrequently destroyed by grass fires or overturned by windstorms, and are always subject to frequent repairs because of the action of the elements, rodents, etc.

George H. Metheany, a practical telephone man from the interurban district of Ohio, has invented and obtained broad patents on the Lima jack box, for use in steam and electric train dispatching. This jack box enables the train crew to obtain instant connection with the dispatcher without the delay of lock and key and without leaving the car.

Fig. 1 shows the Lima jack box ready for instant use within convenient reach of the car. Fig. 2 shows the ease of "plugging-in" for connection to portable telephone. Fig. 3 shows the parts of the Lima jack box grouped in the order they are assembled. It will be noticed that the spring-jack holder is completely insulated from the outside casing. The spring jacks are made especially heavy and are mounted on a fiber block. The connections pass through mica bushings and are soldered to the weather-proof wire on the back of the spring-jack holder. As a still further precaution the jack plug is equipped with a fuse which will blow if a high voltage were to get through, thus protecting the conductor and his telephone from accident. The plugs have long handles and are so constructed as to leave no metal parts exposed or uninsulated in the jack box.

There is absolutely no chance of a short circuit or ground. The lock washer shown at the bottom of Fig. 3 securely holds the spring-jack holder in the casing and cannot be removed without special tools. This prevents the possibility of irresponsible persons tampering with the inside of the box.

Figs. 4 and 5 show a cross-section of the Lima jack box and the way the parts look when assembled. Fig. 4 shows the plug engaged and ready for conversation, the metal ball being displaced. Fig. 5 shows the plug being withdrawn and the manner in which the ball drops back into the opening and closes it perfectly against the entrance of dust, moisture and insects. The cone-shaped mouth of the plug opening guides the plug instantly to its position. This cone-shaped mouth in conjunction with the outer cast-iron shell of the receptacle forms a double petticoat which effectually shuts off rain, sleet and snow.

The Lima jack box has been in constant use on the lines of the Ft. Wayne, Van Wert and Lima Railway Company for over a year and a half. One is installed every half mile so that the crews do not have to go more than a quarter of a mile at any time to obtain instant communication with the dispatcher's office. The boxes are also installed throughout the lines of the Muncie and Portland Traction Company and several others.

The patents and rights of manufacture of the Lima jack box and plug have recently been purchased by W. N. Matthews & Bro., 203 North Second Street, St. Louis. Those who attend the street-railway convention at Columbus next week will be given an opportunity to inspect the working exhibit of the device in building 6, section B, space 18.

Fig. 1. Lima Jack Box Ready for Use.

Fig. 2. Conductor "Plugging In."

Fig. 3. Parts of Lima Jack Box.

Fig. 4. Plug Engaged.

Fig. 5. Plug being Withdrawn.

METHEANY-MATTHEWS INTERURBAN RAILWAY TELEPHONE.

Single-phase Equipment for the Washington, Baltimore and Annapolis Railway.

The announcement that the Washington, Baltimore and Annapolis Railway has finally adopted the single-phase system and has placed contracts for the entire electrical equipment required, will attract considerable interest in engineering and railway circles, partly because the original promoters of this line were the first to adopt the single-phase system.

Some three years ago contracts were let for the construction of this line, but, owing to financial difficulties, the road was never built. It will be interesting to compare the electrical equipment proposed at that time with the present equipment, which has been ordered from the General Electric Company and which represents the present state of the art.

In the former plans for single-phase equipment between Baltimore and Washington it was proposed to use a trolley potential of 1,000 volts, current being delivered at this voltage at a frequency of 16⅔ cycles per second. The present contract calls for a trolley potential of 6,600 volts at a frequency of 25 cycles per second. On the cars a four-motor equipment was proposed, each motor having a capacity of 100 horsepower. The new car equipments will consist of quadruple GEA-603 motor equipments for direct or alternating currents, each motor having a capacity of 125 horsepower. While the first proposed motor equipments would have driven the cars at about 40 miles per hour, the new equipments, totaling 500 horsepower, will enable express trains on the road to attain a speed on straight, level track of 60 miles per hour.

The details of the new road have been carefplly worked out by the Roberts & Abbot Engineering Company of Cleveland, Ohio. Single-phase equipment was chosen only after the most careful study had made it appear that this system would prove most economical and best adapted to meet the special service conditions existing on this road.

Some 60 miles of road will be operated by the new company. The main line will be constructed between Baltimore and Washington, with a branch line from a point on the main line near Odenton extending to Annapolis. This station on the new line will be known as Academy Junction. Over the main line between Baltimore and Washington an express and local service will be established, express cars being operated under a 15-minute headway and making the run in 72 minutes. The roadbed will be double-tracked throughout, with sidings arranged at suitable intervals so that locals may be sidetracked to enable the expresses to maintain schedules. The rolling stock equipment is to be very complete. Nineteen express cars, capable of making 60 miles per hour on a tangent level track, will be operated. In addition two work-cars will be equipped, each sufficiently powerful to haul a train of five ordinary passenger coaches at 45 miles per hour, while four lower powered cars will be used for local service. These last-mentioned cars will run at a speed of 45 miles per hour. The express and work-cars will each be equipped with four GEA-603 (125 horsepower each) A. C.-D. C. motor equipments with the Sprague-General Electric type M train control. The local cars will be similarly controlled but will be driven by two instead of four GEA-603 motors.

Power for the new road will be purchased from the Potomac Electric Company at Washington, D. C., and will be delivered by that company at 6,600 volts three-phase to a transformer substation located about three miles from Chesapeake Junction. In order to obtain a balanced load on the three-phase generators, the current as received at the substation will be changed from three-phase to two-phase by groups of two transformers connected three-phase on the 6,600-volt primary side and two-phase on the secondary side. Half of the transformers will have the secondaries wound for 6,600 volts and the other half for 33,000 volts. The 6,600-volt windings will all be connected in parallel on the same phase supplying single-phase current to the trolley as far as Academy Junction. The 33,000-volt secondary windings will all be connected in multiple on the second phase, to the 33,000 volts transmission line, which will supply current to a stepdown substation located at Academy Junction. The Chesapeake Junction substation will contain seven 800-kilowatt water-cooled transformers, three with 33,000-volt secondaries and four with 6,600-volt secondaries, one of the latter transformers forming a reserve.

At Academy Junction there will be four water-cooled transformers, 25 cycles, 800 kilowatts, reducing the single-phase 33,000-volt current of the transmission line to 6,600-volt current suitable for delivery to the cars. These transformers will supply the Baltimore and the Annapolis sections of the line.

The substation at Academy Junction will be located adjacent to the car barns. For greater safety in inspecting and handling the cars, all of the trolley circuits in the car barn will be arranged for 600-volt direct-current, and for this purpose two 300-kilowatt motor generator sets will be installed in the transformer substation, changing the 6,600-volt alternating-current to 600 volts direct current. The motor end of these motor generator sets will be connected direct to the trolley circuits, one phase being fed from the trolley coming from Chesapeake Junction and the other from the Academy Junction transformers. A feeder regulator will be placed in one phase so that the motor generator sets will act as balancers, permitting the Academy Junction transformers connected on phase "B" to feed into the trolley line supplied by the Chesapeake Junction transformers on phase "A." In addition to acting as balancers and to supplying current to the cars in the barns, the motor generator sets will also supply direct current to the motors in the repair shops located at this point.

Government regulations within the District of Columbia prohibit the use of the track return, so that within this section the cars will be operated with a double trolley. This portion of the tracks, as well as that within the city of Baltimore, is at present operated by direct current, and the new cars are designed to operate on direct current over these sections of the line.

The present Washington, Baltimore and Annapolis Railway Company, which is constructing the line, is quite distinct from the initial corporation. The new company, under the head of its president, Mr. George C. Bishop, has considerably broadened the former plans. Land has been purchased for a wider right-of-way along the route, and new bridges are being built so that the roadbed will be excellent. The engineering work is in charge of the Roberts & Abbot Engineering Company of Cleveland, Ohio, and contracts have been placed with the General Electric Company for the complete electrical equipment. The construction and operation of this road will be watched with great interest, as it is one of the largest and most imporant installations of the single-phase railway system ever undertaken.

Electrolytic Disintegration of Water and Gas Pipes.

At the session of the Central States Water Works Convention, held in Cincinnati, Ohio, on September 27th, a discussion of service-pipe electrolysis took place which was interesting mainly because it brought out the fact that while all participants were convinced of the existence of such electrolytic injury to the water and gas-pipe lines in cities, there was a decided difference of opinion as to the identification of the sources of leaky current productive of the damage. The Western Electrician gives the following condensed report, not as indorsing the sentiments expressed, but as showing the contentions of the "other side."

Mr. Joseph J. Pater, formerly of the Hamilton (Ohio) waterworks plant, reviewed with some pride the fact that he and Mr. Rowe of Dayton had started the agitation on this subject in the association some time ago and had kept it up ever since. He was emphatic in asserting that the trouble was due mainly to the single-trolley system of electric traction, and unequivocally declared that the remedy was the adoption of the double-trolley system throughout. Interesting was the statement incidentally brought out, that Cincinnati owed its double-trolley system, said to be the only one in the United States, to the resistance made by the Bell Telephone Company to having its service interfered with by the ground return of the Main Street single-trolley line. The ground had been used for a return by the telephone company, and as it had "seen it first," it secured a perpetual injunction against the use by the Cincinnati Street Railway Company of the single trolley. Necessarily this brought on the double trolley. In reviewing the address one may look at this point for a statement that Cincinnati, owing to its double-trolley system, is immune from electrolysis of subterraneous service pipes, but he will look in vain. Reasons are given why the current leaks from the rails. Chief among these, it is asserted, is the inefficiency of all existing rail bonds. It is asserted that the Edison bond, most frequently used, becomes worthless in six months because the joint between the uniting copper strand and the smooth hole in the rail into which it is inserted becomes destroyed by oxidation of the hole walls; also, that even welding the rails together will not do, because a considerable length of rail cannot be joined by welding, owing to the expansion and contraction due to heat and cold.

To one of impartial judgment it appears that the relator does not give much credit for common sense to the engineers who have introduced the welded rail joint, as it is well known that they allowed for expansion by providing expansion joints at suitable distances.

Mr. Pater is convinced that, owing to electrolysis, the life of water mains is reduced from a possible one hundred years, which should be attained by clean gray cast-iron pipe laid in good soil, to from 18 to 20 years. Dayton's case is cited, where some water mains were taken up wholly disintegrated, so that a pick could be driven right through the walls. "In the evening it was hard, it had oxidized," said Mr. Pater, "yet the same main in the morning was soft when first taken out of the ground, because its tenacity was destroyed, its strength was gone. The same conditions exist in St. Paul, where they are bringing suit against the street-car company. Suits are being brought at other points. Judge Carter of Indianapolis has decided that the street-car company must seek the remedy, and not the waterworks companies and other companies that use pipe, because there is no place to put the pipe but in the ground, and the street-car companies must seek the remedy."

To show the extent of this danger the investigations of Mr. Brownell of Dayton are cited, who is said to have taken pieces of steel as large as a man's thumb from the foundation columns of "skyscrapers."

As an argument in favor of the double-trolley system Mr. Pater's address was weakened by himself in citing Mr. John W. Hill, the engineer now in charge of the Cincinnati waterworks, as authority for the statement that there is a slight current on the water plugs even in the city of the double trolley.

One is informed that electrolysis has buckled the Brooklyn Bridge. It is conceivable that the shore fastenings and supports may have been weakened, but how the bridge structure proper could be buckled by this cause one cannot at this distance perceive.

"For a mile on one side of the Brooklyn Bridge," Mr. Pater continues, "the people who have shops where one or two hundred girls and men are employed on sewing machines, go out into the streets and put in copper plugs and run wires into their plants, getting sufficient current to run 10 or 15 sewing machines from one little plug put into the water mains."

And further: "In many towns they have the Holly system and are only ordinarily using 40 to 45 pounds domestic pressure, which is all that is needful; but just as soon as the fire alarm goes in, extra pumps are turned on or the velocity of the pumps increased, so as to put on a pressure of 100, 110 or 115 pounds. Above that the water mains will go to pieces. This, though the pipes may have stood a test of from 200 to 250 pounds when laid down. Mr. Pater closed his address with the assertion that the use of the double trolley is the only preventative of electrolysis.

Mr. George Hornung, formerly superintendent of the Newport (Ky.) waterworks, and now consulting engineer in Cincinnati, took up the discussion from the viewpoint of the waterworks as well as the electrical engineer, he having frequently served as one and the other. He was consulting engineer for the Main Street road referred to by Mr. Pater. Concerning his experience there he is thus reported:

"I remember in extending that road that I hitched to everything I could get hold of for the single trolley. The road was operated two or three years before the telephone company made any fight upon us. There was no evidence of any electrolysis anywhere upon that line. The road was operated afterward for a number of years before the Cincinnati people 'knocked' it, and still along this line you will find no electrolysis of the water pipe. Now, to say that there is no electrolysis would be nonsense. We know there is; but to say that it is due to the single-trolley system is something that I will take issue with. You can produce electrolysis from any stray currents. If we had in this country nothing else but single trolleys or railroads operated by electricity, we might blame them for it; but all your large generating stations produce more, much more, current than your railroads do for lighting and other power purposes. The currents which the railroads use, being of high tension, are almost impossible to insulate. Those currents are at work right along. Theoretically, the double system is a preventative, but practically we know that the difficulties to be overcome are such that it is not a sure preventative."

Numerous features mentioned brought out very strongly the fact, animadverted upon by the first speaker, that the double-trolley system in Cincinnati is no protection against electrolysis. There are so many leaks, it is asserted, that horses have been killed by contacting with fallen wires of this system.

On one occasion a motorman of a single-trolley line reported that his lamps glowed when he accidentally got his trolley in contact with one of the wires of the double-trolley system. This could have resulted only in case there was a ground in the double system, which would give a current through lamps of the single-trolley car in case connection was established by the trolley pole between the double-trolley potential and the single-trolley ground return.

As the suit against the single-trolley company referred to by Mr. Pater was on at the time, the speaker, realizing that this was pertinent evidence, procured a car and verified the motorman's statement by making the lamps glow through the connection mentioned. Next day, to test the amount of leak, he tried to run the car with this purloined current. Though there was not sufficient to start the car, a perceptible torque was observed, the speaker said. Some time later this experiment was repeated in the presence and for the benefit of an English engineer who had been commissioned by his government to investigate whether the double-trolley system was a protection against electrolysis. This engineer stated, Mr. Hornung said, that the English people were unwilling to have the single trolley, as it would ruin their water pipes. The practical demonstration of leakage by making the lamps glow was conclusive for this engineer. He reported to the effect that the double trolley was not a complete protection against electrolysis.

As another proof of this fact Mr. Hornung stated that he used to observe the ammeters on the single-trolley switchboards and note their reading drop to zero when all the cars had been run into the barn, whereas in the Cincinnati double-trolley system the ammeters did not go to zero "by considerable." This showed that electricity was being forced from the machines into the ground and back again.

The following discussion as to exact producing cause ensued:

Mr. Pater: Would you say that where a street-car company uses the earth for a return circuit it is not dangerous to the water mains?

Mr. Hornung: I say it is; but other currents do the same thing.

Mr. Pater: Are not the other currents kept from the ground?

Mr. Hornung: The wires are kept from the ground, but the currents are not kept from the ground on account of the leaks. Theoretically, we ought to get a certain result, and our aim is to reach that result practically. Let a wire from a double-trolley system drop on the street, and see what it will do.

Mr. Pater: You mean one wire, or two?

Mr. Hornung: One trolley wire. A stray current from an electric road will produce electrolysis. A current from any other generator will do the same.

Mr. Veach: All the generators are grounded at the station, are they not?

Mr. Hornung: Not necessarily. We aim to have a mechanical return, you know. We don't want to ground them, but there are unsurmountable difficulties from a mechanical standpoint that we cannot entirely wipe out. The railroad companies want to do it, for it is a loss to them which they would avoid if they could. They appreciate that fact. There was a time when the Main Street line did not produce any electrolysis along the line it was running over. I investigated that when the first reports came out about electrolysis, which occasioned as much interest as did the question of microbes when first broached. I said to our men: "We are going to get in trouble here; we don't want to destroy any of this pipe." If I found a plug that would help my return, I would wrap my wire around it and afterward, being sometimes employed as a waterworks engineer and sometimes as an electrical engineer, I wanted to know all about it. A number of times I tried to find out any trace of electrolysis along that Main Street line, and could not find it anywhere. The St. Bernard plant that I built is parallel to their line for quite a long stretch, and there is no electrolysis. It is a single-trolley road which goes through Carthage and Elmwood. You never hear those people complain about electrolysis.

Mr. Pater: You hear them complain in Franklin, Ohio, where they have nothing in the town except the single trolley, not another electric motor in the whole town. You can see the sparks fly off the fireplugs at night.

Mr. Hornung: Of course, when you have no other current in the town but the railroad, you have a clear case.

That the alternating current may also cause trouble was intimated by Mr. Hornung, as gathered from the reports on this subject published in the London Electrician. Mr. Philip Dawson is quoted as follows: "Fairly low frequencies which must be adopted for traction with alternating current cause electrolytic action nearly as bad as with the continuous currents. The difference is that with continuous currents the resulting damage is limited in area; it can be predetermined and safeguarded by means of additional return cables or negative boosters; whereas, with the alternating currents, the area is not limited and the damage is likely to be caused over the whole system." In the same discussion Mr. W. H. Massey said, with regard to alternating currents and electrolysis, that experiments he had conducted about four years ago had left no doubt whatever that, provided the frequency be low enough and the currents sufficiently large, electrolytic action occurs just as fully, or even worse, with alternating current as with continuous currents.

At the close of this discussion the convention adjourned to meet in Wheeling, W. Va., in 1907.

In connection with this subject Mr. E. O. Ackerman, chief engineer of the Columbus Railway and Light Company, is authority for the statement that the absence of electrolysis in Columbus is due to the fact that much of the track is now laid in cement instead of on ties, and he says that where rails are well bonded the current will follow them back to the power house, but in case a bond breaks, the current will then take a straight course to the power house, no matter what may be between it and that point. Damage to water and gas pipes does not result, he said, from the current entering them, but from its leaving them. One of the surest ways to prevent damage, he thought, was to feed directly from the negative pole.

Electrical Development in New Zealand.

The report of the Post and Telegraph Department of New Zealand for the year ended March 31, 1906, has made its appearance. It is presented to the General Assembly by Mr. J. G. Ward, postmaster-general and electric telegraph commissioner. The report says that never has the revenue been so buoyant as during the year just closed. The year has throughout been a record one, and it is gratifying to find that an increase in earnings of £51,572 over the previous year has been gained at the moderate increase of expenditure of £18,805. Even on the telegraph side, where an annual deficiency is looked for, the excess of expenditure over revenue was comparatively so slight that it is reasonable to hope that a small surplus will be shown for the current year.

Telegrams show a far more satisfactory rate of increase than in the previous year, the number dealt with having risen from 5,159,745 to 5,640,219. The revenue amounted to £180,474.

The telephone exchanges still continue to rapidly expand. The number of connections on March 31st last was 15,333. The year previous it was 13,423. The receipts increased from £79,061 to £89,542.

The amount expended on telegraph extension was £77,186; but there are liabilities amounting to £83,295 on account of works for which the authority of Parliament was granted too late for the necessary expenditure to be brought within the financial year. On March 31, 1906, there were 8,355 miles of telegraph line and 25,116 miles of wire. The length of cables within the colony was 283 knots.

The rapid expansion of the telegraph business made it necessary to open a school for learners. As there was sufficient spare accommodation at

Oamaru, that office was selected, and a class of 24 lads commenced on February 19, 1906. A second class is now in course of tuition.

The total value of the telegraph and telephone business for the year ended March 31st, last, including miscellaneous telegraph receipts and government telegrams, was £298,079 17s. 11d., as compared with £270,660 13s. 1½d. for the previous year—an increase of £27,419 4s. 9½d., or 10.13 per cent.

The telegraph receipts for the financial year, including telephone-exchange subscriptions, private-wire rents, etc., amounted to £273,911 7s. 7d., compared with £250,063 1s. 3½d in 1904-5. There were 8,355 miles of line and 25,116 miles of wire at the close of the year.

Ocean Cable Services.

There has been an increase of 6.2 per cent. in the number of messages, but a decrease of 0.37 per cent. in the value of the colony's ordinary outward international cable traffic for the year, while the ordinary traffic from Australia shows increases of 3.37 per cent. in the number of messages, and 0.54 in the value. The proportion of cable messages to and from New Zealand transmitted by the Pacific cable exceeds 75 per cent. of the total traffic.

The working of the Pacific cable has been satisfactory. Delays due to weather conditions and forest fires occurred occasionally on the Canadian land lines, but as a rule they were trifling.

Telephone Exchanges.

Sixteen new exchanges were opened during the year, and the number of subscribers increased by 1,910. The total number of exchanges now numbers 101, made up of 29 central and 72 sub-exchanges. The total number of subscribers is 15,333, compared with 13,423 in 1905. They may be classified as follows: Paying, 14,108; free, 296; bureau, 929. New connections numbered 2,537, and those given up, 627. The increase in connections is equal to 14.23 per cent.

On March 31, 1906, there were 885 miles of telephone line and 12,798 miles of wire.

Wireless Telegraphy.

Much attention has been given to wireless telegraphy. Negotiations have been proceeding with the commonwealth government for establishing a wireless-telegraph system between Australia and New Zealand, and some of the outlying islands, but nothing definite will be settled until there has been practical experience of the working of the installation just completed by the Marconi company between Queenscliff, Victoria and Devonport, Tasmania.

The commonwealth and the New Zealand governments have been approached by the Marconi company, London; the International Telegraph Construction Company (Shoemaker's system), New York; the Lodge-Muirhead Wireless and General Telegraph Syndicate, London; the Gesellschaft für Drahtlose Telegraphie (Slaby-Arco-Braun system), Berlin; and the Wireless Telegraphy Company (Telefunken system), Berlin. No business arrangement has been made with any company, as the intention is to invite tenders, under certain well-defined conditions, at the proper time.

Superimposed Circuits.

As will be seen from the reports on telegraph inspectors' districts (a part of the report), the department has during the year extended the work of superimposing telegraph circuits on telephone wires, and of telephone circuits on telegraph wires, wherever this has been practicable and the volume of business has called for it. It should, however, be again stated that only where the conditions are suitable may circuits be superimposed, and that a general application of this means of increasing accommodation is not practicable. A third metallic circuit has been provided between Invercargill and the Bluff by superimposing on two circuits already existing, and a similar improvement has been effected between Invercargill and Gore.

Electric Tramway and Electric-light Undertakings.

One order in council for electric-tramway extension has been reviewed by the department during the year on behalf of the Board of Control, and supervision is being exercised over the tramway systems in operation to insure the regulations for their control being complied with.

Three licenses for the electric lighting of boroughs under the "Electric Lines Act, 1884," have been issued, and applications for several others are under consideration.

The Wichita Gas, Electric Light and Power Company of Wichita, Kan., has been solicited and is considering reducing the price of artificial gas to 27 cents per 1,000 feet until it brings in natural gas for distribution through its mains. This company has secured and has under lease a large acreage of gas land, and is now drilling wells, and expects to be able to deliver natural gas to its customers by January 15th.

Ohio Telephone Notes.

The dates fixed for the district meetings of the Ohio Independent Telephone Association are as follows: District No. 1, Electric Building, Cleveland, October 16th, E. G. Miller, vice-president; No. 8, Boody House, Toledo, October 17th, R. E. Hamblin, vice-president; No. 7, Lima House, Lima, October 18th, G. H. Metheany, vice-president; No. 9, Telephone Exchange Building, Mansfield, October 23d, Dwight E. Sapp, vice-president; joint meeting, No. 5, W. Gilbert Thompson, vice-president, and No. 6, I. H. Thedeck, vice-president, Dayton Home Building, Dayton, October 25th; No. 4, Washington Hotel, Portsmouth, October 26th, H. P. Folsom, vice-president; No. 3, Clarendon Hotel, Zanesville, October 30th, J. B. Rhodes, vice-president; No. 2, McKinley Hotel, Canton, October 31st, W. F. Laubach, vice-president. Manager Frank L. Beam expects these meetings to be of much interest and profit to the members.

It has been decided by the directors of the Cincinnati and Suburban Bell Telephone Company to sell $450,000 of the new stock now in the treasury, the money thus secured to be used in making extensive improvements.

An order has been placed with the Dean Electric Company of Elyria, Ohio, by the United States Telephone Company for one of the largest toll boards that has ever been installed by a long-distance company. A test board and telegraph equipment will come with the board. It provides for 25 operators, in addition to the desks for chief operator and assistants, and also has a special messenger-call system. The board will be made under special order and will be very complete in every respect, being equipped for simultaneous telephone and telegraph work.

The New Weston and Rossburg Telephone Company of New Weston has been incorporated with a capital stock of $20,000 by W. D. Rush and others.

Donald Critchfield, for some time connected with the Citizens' Telephone Company of Columbus, has resigned to accept a position with an Independent company at Rochester, N. Y.

According to an interview recently given out by James S. Brailey, the United States Telephone Company is now connected with over 400 plants and exchanges and reaches 230,000 telephones in Ohio alone. The toll lines aggregate 24,000 miles.

A contract has been awarded by the Central Union Telephone Company to the H. L. Speiker Company for a new branch station, to be located on Delaware Avenue, Toledo, at a cost of $20,000. The building is to be of reinforced concrete, with a terra-cotta exterior As it is in the residence district, it will be built on a line with the residences and be in keeping with the appearance of the other buildings. The exchange will serve the residence district in that section and will accommodate about 1,000 telephones. It is expected that another branch building will be erected soon.

Articles of incorporation have been issued to the Haverhill Telephone Company of Haverhill. The capital stock is $2,500, and A. S. Goddard, O. F. Irish and W. A. Brush are among the incorporators. The company will build a local exchange and probably connect with one of the local companies at Ironton and Portsmouth.

The Westwood, Cheviot, Mt. Airy and Grosbeck telephone properties have been purchased by the Cincinnati and Suburban Bell Telephone Company.

C.

Pacific Slope Telephone News.

Presidents and other officers of Independent telephone lines at Garfield, Silver Creek, Crabtree, Cory and other points west and south of Spokane, are denouncing the Pacific States Telephone and Telegraph Company for attempting to absorb their lines, and five towns will be cut out of the Pacific States service in October, it is said.

Representatives of the Pacific States Telephone and Telegraph Company gave out statements at Waterville, Wash., west of Spokane, that the company has set aside more than 125,000 for the development of the field in central Washington.

The Interstate Telephone Company is making progress with its line from Post Falls, Idaho, to Spokane, and it will probably be in operation before the end of the year. It is announced that no rural telephones are to be installed for the present, but that a majority of the ranchers south of the foothills in Idaho and Eastern Washington will be given service the coming year.

Ten thousand eight hundred telephones are in operation in Spokane under the direction of the Pacific States Telephone and Telegraph Company. This is an increase of 1,200 over three months ago.

At the last meeting of the San Francisco Board of Supervisors the Home Telephone Company was granted a franchise to construct and operate a telephone system in the city. The company secured the "resolution of intention and the passage to print" of the ordinance over three months ago; paying $25,000 for the right and donating $75,000 to the city's relief funds. Since then the legality of the grant had been questioned, but the present action disposes of the matter finally.

The Home Telephone Company, which has laid a number of miles of underground conduit in Oakland, Cal., and has built a modern telephone-exchange building there, is waiting for action from the Board of City Trustees on the application for a franchise to lay its mains throughout Berkeley.

A farmers' telephone company is preparing for the construction of a system of rural telephone lines from Byron, Cal., to Antioch. A large farming district will also be covered with central offices at Oakley, Knightsen and Brentwood.

It is announced that the Pacific States Telephone and Telegraph Company will place all of its wires underground in the business district of Vallejo, Cal. The entire city is being rewired and equipped with new telephones. The sum of $75,000 has been appropriated by the company for these betterments.

The capital stock of the Interstate Telephone Company is to be increased to $500,000, which will be used in building extensions. M. A. Phelps, president of the company, announces that already 250 miles of line is in operation and that lines will be pushed into various parts of Washington, Oregon and Idaho. An exchange is to be established in Spokane, which will probably be headquarters for the company. Mr. Phelps has called a meeting of the stockholders for November 2d, when several plans will be discussed.

W.

Indiana Telephone Items.

The first fall meeting of Indiana telephone men was held in Plymouth on September 29th with 30 members present, representing 50 exchanges and 20,000 telephones in the five counties in the north part of the state comprising the First District. The convention was not only the best attended but the most enthusiastic the Independents ever held in this district. After transacting routine business, discussing a number of subjects of a common interest to all the companies in the district and arranging for the future meetings for the year, a resolution was adopted commending the efforts of the Home Telephone Company of South Bend in securing toll line connection with Chicago. Previous to adjournment the president appointed a committee of adjustment with power to arbitrate and adjust disagreements and misunderstandings between neighboring companies and to consider demands for toll-line improvements and recommend the changes necessary for a first-class toll-line service.

The board of directors of the Lafayette Telephone Company have increased the capital stock from $75,000 to $120,000. The additional capital is to be used in making improvements. The sum of $18,000 is to be expended for conduits in which to place the wires now overhead. The company has bought the large three-story building on the corner of Fourth and South streets and will remodel it into a modern exchange building. Within the next two weeks the directors will contract for a complete new plant and will decide whether to use the manual or automatic switchboard. The sum of $100,000 or more will be expended for the work and for new equipment. If the automatic system is decided upon, it will dispense with the services of 60 girls employed in the local exchange.

The Grammer Telephone Company has purchased the exchange building and equipment of the Burnsville Telephone Company, and the exchange of the last-named company will be removed to Grammer. Both companies are in Bartholomew County, and about 500 telephones are involved in the merger. The Burnsville people will be without a local exchange in a few days, and are not pleased with the arrangement. They are trying to effect arrangements with the Citizens' Telephone Company of Columbus to establish a branch exchange in Burnsville.

The Citizens' Telephone Company of Columbus is completing a new building at Elizabethtown, and will establish a new exchange therein.

Frank W. Gregor, receiver for the Hannah Jackson Telephone Company, Greenneld, has been ordered by the court to sell the plant, franchise and good-will of the company at private sale. This is a good piece of telephone property.

The Indiana Appellate Court has held the Western Union Telegraph Company liable for the statutory penalty of $100 for its failure to deliver a message directed to a passenger on a railway train.

Concerning the agitation as to the danger of the telephone as a carrier of disease germs, the health authorities of Indiana contend that the danger is so comparatively unimportant as not to warrant any action looking to an improvement along sanitary lines.

S.

Telephone News from the Northwest.

The Northwestern Telephone Exchange Company has offered the city of Minneapolis the free use of its conduits for the new police and fire-alarm service, a saving to the city of probably $15,000.

The council in St. Paul proposes to bring the telephone companies to time in the matter of removing poles as ordered, by withholding permission to erect new lines until orders have been obeyed.

A. G. Chase has been appointed manager of the

Northwestern Telephone Company's local exchange at Faribault, Minn.

A. T. Whittel of Waterloo and associates propose to establish a telephone system at Ackley, Iowa, with toll-line connections with all neighboring points.

C. W. Smith of New York has succeeded D. W. Coffey as manager of the Bell Telephone Company at Iowa City, Iowa.

G. A. Drew will succeed A. S. Romano as manager of the Nebraska Telephone Company's system at Seward, Neb.

The Martin Telephone Company of Webster City, Iowa, has filed articles of incorporation with a capitalization of $200,000. E. H. Martin heads the list of stockholders. R.

Independent Telephone Entrance Into Chicago.

In relation to the telephone projects centering in and about South Bend, Ind., the following statement has the authority of the gentleman with whose name it begins:

"Mr. Joseph Harris, vice-president of the Automatic Electric Company, Chicago, acting as an individual for and with a number of Independent telephone operating interests, both East and West, has secured control of the South Bend Home Telephone Company of South Bend, Ind., for the purpose of making that city a focal point at which to center for distribution the Independent telephone toll and long-distance lines, which will enter Chicago from the entire territory north, northeast, east, southeast and south of that city. This is the first and most important step in the opening of Chicago to the Independent long-distance service, for which the Independent telephone interests of the country have long been striving.

"It is the intention of the Independent operating interests which Mr. Harris represents at once to begin work on this great project by rehabilitating the South Bend plant and equipping it entirely with automatic telephone apparatus in place of the part automatic and part manual equipment now in use.

"The development of the local telephone business of the South Bend Company will be pushed energetically, with the idea of making South Bend one of the best telephoned cities in Indiana.

"The establishment of the long-distance distributing plant at South Bend and the improvement in the local plant mean much to that city. The work of arranging for the long-distance connections with South Bend and important centers north, northeast, east, southeast and south is now under way and will be pushed to conclusion as rapidly as possible."

A Large Order for Telephone Equipment.

Contracts were awarded last week for the central-office switchboards and the sub-station telephones which are to form the equipment of the Home Telephone Company's new plant in Detroit, Mich., described in the Western Electrician last week. This is one of the largest contracts for telephone apparatus ever placed at one time. The central-office switchboards are to form the equipment of the four large central offices at present being built. The total present capacity of these switchboards is for 15,000 lines, and they are designed to have an ultimate capacity of 40,000 lines. The number of sub-station telephones covered by the contract is 10,000. Leading telephone manufacturers competed and the contract was awarded to the Dean Electric Company of Elyria, Ohio, represented by W. W. Dean, vice-president and chief engineer. The total amount of the Dean contract is said to be nearly $500,000.

Contracts were also awarded for the underground cables, which are to be drawn into the conduits at present being constructed by the Home Telephone Company. The successful firms were the John A. Roebling's Sons Company of Trenton, N. J., represented by W. P. Bowman, and the Stromberg-Carlson Telephone Manufacturing Company of Rochester, N. Y., represented by M. S. Connor and S. W. Menafee.

The actual work of constructing this Detroit plant is under the direct supervision of W. B. Woodbury, general manager, and W. C. Polk, the engineer of the Home Telephone Company.

GENERAL TELEPHONE NEWS.

The Beaver Bend Telephone Company of Valley Springs, S. D., has been incorporated.

The Northwestern Telephone Exchange Company will install a local exchange at Rice, Minn.

The Celia (Neb.) Independent Telephone Company has been incorporated with a capital stock of $3,000.

The East Kentucky Telephone Company of Mount Sterling, Ky., with lines all over that section of Kentucky, has been sold to the People's Independent Ice and Coal Company of St. Louis. The new owners will rebuild and reorganize the plant.

CORRESPONDENCE.

Continental Europe.

Paris, September 25.—It is proposed by the German government to "electrify" all the city and suburban-railway lines of Berlin, and measures are being taken at present to secure the necessary funds for carrying this out. For some time past, as shown by a series of technical tests made upon these lines, the use of the electric system would have been of great advantage over steam, especially in relation to the amount of passenger traffic which can be handled. To carry out the project a large amount of current is needed, and this will likely be furnished from three large stations which will be erected for the purpose, so as to secure about 60,000 horsepower for the lines. Single-phase motors are to be used for running the roads. It is estimated that the expense involved in electrifying all the existing lines will reach $45,000,000. For the portion lying within the city limits, the roads could not be changed over before 1915, and for the suburban lines the work would not be completed before 1920. By keeping the existing tracks, it is thought that an increase of traffic of 27 per cent. can be obtained, but should other tracks be added to the lines, which is quite possible, the traffic may be doubled.

As the ventilation in the Paris Subway tunnels has been far from perfect, it was decided some time ago to improve it as much as possible. Accordingly a number of air holes are now constructed which run from the tunnel to the surface of the ground, and it is found that a decided improvement is thus secured, a good current of air being the result. One of these air holes is 20 feet long and six feet wide, and lies flush with the surface of the boulevard. An iron fence surrounds it, and the opening is covered by a grating.

A new space-telegraph station has been erected by the Berlin Space Telegraphy Company in Switzerland upon the elevated point of Rigi-Scheidegg. It is designed to signal to the station of Fort Stockli, which lies some 25 miles off. Some disturbances have been experienced in the former station, ascribed to the distant Poldhu station in England, lying over 600 miles away. But the atmospheric conditions must be specially favorable in order to receive such waves, and the instruments must be regulated to the required point.

Experiments lately carried on in Germany by E. Wartburg and G. Leithauser show that ozone can be very well produced by silent discharges passing between small spheres, the best diameter being 0.04 inch or less. Such spheres give a greater quantity of ozone than a discharge between points. By passing ordinary air, first purified, between a series of such spheres, there may be obtained some 30 grammes of ozone per kilowatt-hour, using a strength of eight or nine grammes of ozone per cubic meter of air. A very small current is used in this case.

A patent has been secured in Austria by H. Gerdes for a new method of train lighting. A pump mounted on the car axle supplies oil or other liquid to a hydraulic motor which is connected to it. This motor drives the dynamo which gives the lighting current for the train. The object of the system is to give a constant speed of the hydraulic motor at different speeds of the train, so as to run the dynamo at constant voltage. The system allows of the use of speed governors which change the admission of the liquid so as to give a good regulation. Valves are provided, so that the motor always runs the same way, even should the pump be reversed.

The large station erected in order to supply the Teltow Canal furnishes current for hauling the boats and working the locks as well as for the lighting. For 2,000,000 tons annual traffic about 500 horsepower is needed. Three-phase and direct-current generators are erected in the Zehlendorf station. Steam turbines of the Zoelly system are coupled to these machines. Each of the two turbines is coupled to a three-phase alternator of 650 kilowatts and 6,000 volts and also to a 200-kilowatt direct-current generator working at 600 volts. The latter current is used for the hauling motors and for the electric capstans.

In France the electric-furnace method is applied on a commercial scale in the production of different iron alloys which are of use in steel manufacture or foundry work. One of these is ferrosilicon, and nearly the total of the production is turned out by the electric furnace. This industry is in a prosperous state at present. One such plant is located at Moutiers, not far from Lyons. This product is even exported to the United States.

A new company has been formed in connection with the Berlin Space Telegraphy Company for carrying on operations in the Far East. It is known as the East Asia Space Telegraphy Company of Tsingtau, and is to use the Telefunken system in China, Corea and adjacent countries.

The new telegraph cable which is to connect Indo-China and Borneo will soon be put in service. It is to extend from Cape Saint Jacques, in Indo-China, to Pontianak, Borneo, and will connect besides with the island of Condore.

A. de C.

Great Britain.

London, September 26.—Municipal trading is becoming such an integral part of industrial activity in Great Britain that it is impossible to avoid constant reference thereto, especially when one feels that that British commercial success, which has been so manifestly built up by private effort, is being slowly but surely endangered. The question of whether or not municipalities should enter into commercial speculative undertakings is so frequently made a political plank that unless the tendency kills itself disaster must come, not wholesale, but by degrees. The case in point is the Manchester municipal parcels-delivery service, which is worked in conjunction with the tramway service. Parliamentary powers were secured to carry on this business, and the corporation, despite opposition then by the local carriers, and later in a test legal action, gained the day and embarked upon a large capital expenditure in the way of horses, carts, vans, etc., renting, receiving and dispatching depots, and so on. After a short term of operation the corporation now complains of that very competition which it forced upon the local carriers, and this is put forward, mainly, as the reason for the loss upon the undertaking of some $25,000 annually. In a report to the committee the tramway manager states that the position is serious and calls for immediate consideration.

Both the Portsmouth and Devonport naval dockyard electrical installations are now complete and have been put into service. At Portsmouth there are six reciprocating engine sets, three of 600 kilowatts and three of 300 kilowatts each, and 10 boilers. At Devonport there are three similar generating sets and four boilers. In both towns there are municipal works, and it would be interesting to know the reason why some arrangement could not have been come to for a supply from these. Several special points occur in connection with the wiring and fitting, especially in case of the magazine, where the wires have been excluded from the buildings altogether and carried in piping along the outside. The coal-conveying plant is also of interest, for the coal is crushed to a certain size before use, and, in addition, there is an electrical tipping arrangement to the coal trucks. In both cases the most complete use will be made of electricity, both for lighting and motive-power purposes.

An interesting application of a voltage regulator in connection with a lighting supply from a tramway feeder has recently been made at Chesterfield, and is believed to be the first case of its kind in Great Britain. There is a suburb of Chesterfield called Whittington, to which the corporation tramways extended, but which was 1½ miles away from the nearest lighting feeder. In order to obviate the expense of laying special lighting feeders, and at the same time not wishing to lose the custom which was waiting to be served, the borough electrical engineer decided to bring into use the tramway feeders. Obviously, the difficulty of regulating the voltage had to be overcome, and the somewhat exceptional results obtained with a piece of apparatus provided by the British Thomson-Houston Company are sufficient to merit attention being called to them. The tramway voltage varies from 480 to 520 volts, but a perfectly steady lighting voltage is obtained, the total cost of the apparatus, including buildings, motor, generator, etc., being $2,500, against $12,500 had special feeders been laid. There are a large number of outlying districts on the route of tramways in various parts of the country where a supply of electricity is not otherwise available, and the plan adopted at Chesterfield should interest all engineers similarly situated.

The feature of the engineering and machinery exhibition now being held in London is the large show of machine tools in which electricity is used as the driving power. There are numerous specimens of German and American tools, but one specimen of British manufacture is deserving of special mention. A Halifax firm, Messrs. J. Stirk, show a number of lathes, boring and turning mills and slotting machine, in which the electric motor is built up as part of the framework. In the case of the lathe there is a 7½-horsepower electric motor running at any speed between 400 and 1,200 revolutions per minute, combined with the end box, the power being transmitted by a chain drive up to the spindle. The motor is as accessible as with the ordinary electric drive. The same principle, which obviously has several advantages, is applied to the other machines, and a peculiarly neat appearance is produced. The slotting machine has a motor wound to give 1½ horsepower at any speed between 500 and 1,500 revolutions per minute. A chain transmits the power to the pinion shaft, and a further reduction is accomplished by the usual gearing at the back of the machine. The speed regulator is so marked that the operator can see at a glance what is the correct position of the controller arm for the work the machine is engaged upon.

The recent regrettable accidents to tramcars through the alleged failure of the brakes—doubtful in several cases—has naturally led to the publication of a good deal of literature on the subject, and more may be expected in the near future. A paper read by the manager of the Burnley tram-

ways, however, strikes out in quite a new line, for he indulges in what is practically a wholesale condemnation of magnetic brakes, which attitude was naturally keenly criticized. Mr. Mozley, the writer in question, states that from his experience in Burnley he has found that magnetic brakes, particularly those which affect the wheel brakes, are unsuitable for tramways, either for service or safety purposes. They can only be considered as auxiliary to the rheostatic brake and not as independent track brakes; they are highly destructive to the motors and they are treacherous and uncertain in their action. Unfortunately the author's opinions are based upon experiments carried out in 1903, and, as Mr. Fell of the London County Council pointed out in the discussion, he seems to have ignored all the improvements made in the interim. G.

Dominion of Canada.

Ottawa, October 6.—The town of Lindsay, Ont., is to have competition in the telephone business, the Town Council having passed a by-law granting a 21-year franchise to the Canadian Machine Telephone Company of Toronto. The new system is to be installed in a year.

The Montreal Street Railway's financial year came to an end on September 30th. At a rough estimate the road carried 98,000,000 passengers during the year. The gross earnings of the road amounted to about $3,080,400. This compares with $2,707,400 earnings and 86,433,000 passengers last year.

There is great rivalry at present between the five electrical companies supplying power to seven industrial companies locating at Welland, Ont. This competition will insure cheap power to the manufacturers there.

J. W. Lyon of Guelph, Ont., secretary-treasurer of the Western Ontario Municipalities Niagara Power Association, says that the demand for electric power will be very great. The applications so far are: Toronto, 30,000 horsepower; London, 10,000 horsepower; Woodstock, 1,200 horsepower; Paris, 1,000 horsepower; Galt, 2,500 horsepower; Preston, 800 horsepower; Hespeler, 750 horsepower; Berlin, 3,000 horsepower; Guelph, 2,000 horsepower; Waterloo, 900 horsepower; Stratford, 2,000 horsepower; Brantford, 3,000 horsepower. A number of other towns will also want power, and in all some 75,000 horsepower will be required, thus making a very cheap rate possible.

The Maritime Coal Company of Nova Scotia will introduce an electrical plant near its coal mines, seven miles outside of Amherst, N. S. Here the company will generate electricity and supply the big manufacturing and other concerns in Amherst. A contract has been signed with the Westinghouse company for the apparatus. The coal will be burned in furnaces alongside the mine, and electricity generated at that point. The power line is nearly finished, and the plant will be complete and in operation before the first of the year. Power will also likely be carried to Moncton, New Brunswick, about 50 miles distant. Towns will be supplied within a radius of 100 miles of the central power station situated at the mines. W.

New England.

Boston, Mass., October 6.—The New England Telephone and Telegraph Company has leased a portion of the Endicott Building in Beverly, Mass., and will move its exchange to that place. The company has also bought 5,466 square feet of land on Norwood Street in the Dorchester District of Boston.

Frank R. Starkey, assistant superintendent of the New England Telephone and Telegraph Company, and Myra Belle Bucklin were married September 20th.

The American Writing Paper Company is contemplating the installation of electric power in the large manufacturing plant it will build next spring in Holyoke, Mass. The power necessary to run the machinery will amount to 1,800 to 2,000 horsepower.

The Derry and Goffs Falls Company has filed its articles of incorporation with the city clerk of Manchester, N. H. It has a capital of $50,000 and it proposes to build an electric railway between Goffs Falls and Derry, N. H., via Londonderry and Manchester. Roswell Annis of Manchester, N. H., heads the directors.

The Underwriters' Association has notified the New Britain (Conn.) Board of Public Safety that it will reduce insurance rates in that city five per cent. if the city will create a municipal electrical inspection department.

The Connecticut Railroad Commission has approved the method of construction of the Connecticut Railway and Lighting Company's proposed electric railway between Waterbury and Woodbury, also the Naugatuck Valley Electric Railway Company's road through Naugatuck, Beacon Falls and Seymour. The latter is a subsidiary of the Connecticut Railway and Lighting Company, and its road will be the final link in a continuous electric railway between Waterbury and New Haven, through the Naugatuck Valley.

The W. D. Kendall Company of Worcester, Mass., has been incorporated and will deal in electrical apparatus.

The Standard Manufacturing Company has increased its capital from $5,000 to $15,000. The company will enlarge its electric specialties and supplies factory in Bridgeport, Conn.

The Connecticut Railway and Lighting Company is planning to spend about $1,500,000 for a new power dam on the Housatonic River and a steam electrical generating plant at Waterbury, Conn.

John Hemingway is completing a machinery plant in Lynn, Mass., which will be equipped with electric power and an electric-light plant.

Hearings relative to safety devices on electric and steam cars will be held by the Massachusetts Railroad Commission on October 2d and 3d. Inventors representing 29 street-car fenders, six block-signal systems, three headlights, one ventilating device and one device for removing snow from switches will be present.

Twenty-three capitalists and business men are interested in a proposed company to build an interurban electric railway between Boston and Providence. The road if built will have double tracks and will be on a private right-of-way. Steel cars will be used. It is planned to eventually extend the road to New York. Theodore N. Vail of Lyndonville, Vt., director of the American Telephone and Telegraph Company and chairman of the directors of La Capitale Traction Company of Buenos Ayres, is one of those interested.

Ex-Mayor Josiah Quincy has been nominated as a member of the Boston Transit Commission by Mayor Fitzgerald. This appointment is to fill the vacancy caused by the resignation of C. H. Dalton. The salary is $5,000 per annum and three years is the term of office. The aldermen laid the nomination on the table for a week, under the rules.

The Twin State Electric Light and Power Company has assumed control of the Dover Gaslight Company, which operates electric-light plants in Dover, Somersworth, Rochester and Salmon Falls, N. H., and Berwick, North Berwick and Lebanon, Me. The deal involved $250,000. It is said that the Twin State company controls the Atlantic Shore Line, which owns the Dover, Portsmouth and York Beach Street Railway.

The Boston Board of Aldermen has refused to extend the time for the consideration of the subject of municipal lighting, and the matter is closed for the present, at least.

Allison W. Stone, superintendent of the New England Telephone and Telegraph Company's private branch exchanges, is fishing and canoeing in Maine. Before his return to Boston, next month, he will take a canoe trip through Aroostook County to the St. John River, going down the latter to the coast.

The two Walker prizes for the best memoirs on scientific subjects have been awarded at the Institute of Technology. The first, of $100, was taken by Prof. Amadeus W. Grabau of Columbia University for his essay on "The Interpretation of Stratiary Overlap," and the second, of $50, was taken by Prof. Douglas W. Johnson of the Institute of Technology for his essay on "Drainage in the Tallulah District; a Study in River Capture."

The Board of Corporation of the Institute of Technology has created the office of secretary of the Institute. This work has been done by Professor Tyler, secretary of the faculty. Prof. George C. Shaad has been appointed assistant professor of electrical engineering, vice Prof. William L. Puffer, resigned.

The Georgetown, Rowley and Ipswich Street Railway was formally transferred to the Boston and Northern Street Railway Company on September 29th.

The Edison Electric Illuminating Company of Boston will hold its annual meeting October 9th. Only routine business will be transacted. The company will take no present action regarding the issue of new stock.

The Jackson Clock Telephone Company has filed its certificate of organization with the Maine secretary of state. It was organized at Portland with a capital of $1,000,000. It proposes to make and deal in all kinds of electrical apparatus. Hayes Longee of Boston is president.

The Boston and Northern Street Railway Company's brick car barn in Chelsea, Mass., was destroyed by fire last week, the loss being $350,000; fully insured. Seventy-one cars were destroyed, which were all the company had on that division except the two sand cars and two cars which were on the road. The fire started in a dismantled car, and it is believed that it was of incendiary origin. The state marshal is investigating the case. Eighty-nine motormen and conductors made their headquarters at the barn and nearly every one of them lost some clothing. Nearly all the signs used for the ends of the cars were destroyed and passengers have been confused by the lack of route marks on the cars.

The American Telephone and Telegraph Company has declared a quarterly dividend of two per cent., making eight per cent. paid this year. Previously the regular dividends have been six per cent. annually and an extra dividend of 1½ per cent. The directors announce that eight per cent. will be the regular annual dividend in the future.

The Merchants and Miners' Transportation Company has installed a DeForest wireless-telegraph equipment on one of its steamers which plies between Boston and Baltimore.

The Old Colony Street Railway Company has petitioned for the Massachusetts Railroad Commission's approval of freight and express rights in Fall River. The company wishes to run such cars to connect with the Enterprise Transportation Company's New York line of boats.

The Pittsfield Electric Company of Pittsfield, Mass., has petitioned for authority to issue new stock amounting to $75,000 and bonds amounting to $150,000, the proceeds to be used for refunding, meeting floating indebtedness and making improvements.

The Massachusetts railroad commissioners have refused to approve the Boston Elevated Railway Company's plans for an elevated station in Forest Hills Square on the ground that the station would take too much of the space provided for the use of the public with no suggestion of giving an equivalent. B.

New York.

New York, October 6.—The first electric train was run through the New York Central tunnel this week, the trip being from Highbridge to the Grand Central Station. The train consisted of two private cars and five Pullman coaches drawn by electric engine No. 3406. Vice-president W. J. Wilgus acted as motorman. A company of 100 made up the party on the test run, consisting of prominent electrical engineers and railroad men. The engine weighs 100 tons, and the total weight of the train was 550 tons.

Among those who made the journey were the men who have been working on the "electric zone" of the New York Central. These were: Vice-president Wilgus, E. B. Katte, electrical engineer; G. A. Berry, who has been in charge of the 4,000 men engaged in construction work; Azel Ames, signal engineer; Designing Engineer V. Spangberg, Bridge Engineer J. Holst, Constructing Engineers B. J. Arnold and F. J. Sprague, and General Superintendent of Motive Power J. F. Deems. These men will continue with the work of making a complete electric system in the zone as planned. They estimate that this work can be completed in four years. With the staff were Messrs. J. Castensen and A. H. Smith and E. W. Rice, Jr., and other officials of the General Electric Company, and Charles Powell of the Westinghouse company. The journey of seven miles was made in 18 minutes. Mr. Wilgus said the trip was thoroughly successful. He expects to have engines regularly running by November 10th. The staff still has several years of work ahead, and it is very well pleased with the showing.

It became known yesterday that the motormen and engineers of both the Subway and the elevated railroads are being organized under the auspices of the American Federation of Labor. Circulars have been sent broadcast to the employes inviting them to enroll, and it is intended to organize the men as a branch of the Amalgamated Association of Street and Electric Railroad Employes, of which William D. Mahon is president.

A bulletin issued by the New York and New Jersey Telephone Company shows a gain of 7,584 telephones for the month of September in Greater New York and adjacent territory. This brings the total number of telephones in service and under contract up to 276,000. The bulletin states that this is approximately one telephone to every 14 persons. Comparison with other cities shows, the bulletin says, that no other city in the world has half as many telephones as New York. If the present ratio of growth keeps up, the bulletin says, there will be 600,000 telephones in use in New York city in 1910.

New Jersey is to be governed by long-distance telephone from Blooming Grove, Pa., where Gov. Stokes has gone for the fall shooting. Under the state constitution, in the absence of the governor, the president of the Senate is sworn in as executive, but Gov. Stokes says he is going to be gone so short a time it would not be necessary to swear in Senate President Bradley to act in his absence. He also said that while long-distance telephones are in existence he can be in touch with affairs in the state at any time.

The West Chester Traction Company of White Plains, with a capital of $30,000, has been incorporated by L. W. Prince and J. P. Wilcox of White Plains and Isidor Tachna of New York.

The Hudson Companies, the concern which is building the McAdoo tunnels under the North River, has awarded an initial contract for 50 steel cars to the American Car and Foundry Company. The cars will be of almost the same type as those in operation in the Subway except that they will have side doors to facilitate ready ingress and egress. They will have a seating capacity of 50 persons each and will be delivered in February. These are for use in the Morton Street tunnel. One hundred and fifty similar cars are to be used in the Cortlandt Street tunnels. C. I. C.

Ohio.

Cleveland, October 6.—The proposition to issue bonds to purchase $140,000 worth of new equipment for the municipal lighting plant is now before the Columbus City Council, and on suspension of

rules reached the second reading at the last meeting. Superintendent Reid of the plant said that it was the finest and most economical lighting station of the kind in the country. It is now producing current, he said, including interest and placing depreciation at five per cent., at 2.82 cents per kilowatt hour.

The Cleveland, Bedford and Geauga Lake Traction Company of Cleveland has been incorporated with a capital stock of $10,000, the incorporators being L. A. Smart, W. V. Coons, Fred Edwards, A. W. Schurring and D. F. Sherbondy. The plan contemplates a line to Garrettsville, where it could connect with the Youngstown lines which reach that point. Dr. Smart, who is at the head of the new company, says that the idea is to become a part of a through line. Pittsburg and Cleveland capitalists are said to be interested. Dr. Smart was for some time connected with the Appleyard roads and has had much experience in the selection of routes.

With the incorporation of the Lake Superior Railway Construction Company of Cleveland, with a capital stock of $10,000, the announcement is made that the company will build an electric railway from Marquette to Negaunee, Mich., a distance of about 15 miles. The incorporators are J. W. Barber, Kit Carson, L. M. Sigler, E. S. Hartman and T. F. Laist.

The Ohio and Southern Traction Company of Columbus has been incorporated with a capital stock of $75,000 to build a traction line from Columbus to the stock farm of Dr. S. B. Hartman. The incorporators are mostly men associated with Mr. Hartman in business.

The Lorain Street Railway Company of Lorain has given a mortgage for $2,000,000 to the Citizens' Savings and Trust Company of Cleveland. It is said that this move is for the purpose of covering the consolidation of the Avon Beach and Southern with the local company at Lorain, and the Lake Shore Electric is behind the deal.

A motion to advance the injunction case of William N. Reynolds against the Forest City Railway Company of Cleveland, to test the validity of its franchises, has been denied by the Supreme Court, and it will have to come in its regular order. This will allow the company to go on with its construction work until the decision of the court is rendered, since it won the cases in the lower court. The Supreme Court also denied a motion of the Forest City Railway Company to dismiss the case.

Master Commissioner B. F. Cowen a few days ago sold the Springfield and Western, the last of the Appleyard properties, to A. E. Locke of Boston, representing the Schoepf syndicate, for $25,000, which is the upset price. The line is only four miles long and extends from Medway to New Carlisle.

The Mansfield and Southern Traction Company and a company made up of Mansfield and New York men have been consolidated. Their idea is to build a line from Mansfield to Mt. Vernon. The president of the new company is S. N. Ford of Mansfield.

A temporary restraining order having been refused by Judge Beacom, the Forest City Railway Company of Cleveland has been at work on the extension of its Fulton Road line through Franklin Circle on the West Side for several days. A hard fight was made against tearing up this pretty little plot, but to no avail. The fight between the three-cent road and the city on one side and the Cleveland Electric Railroad Company on the other continues. The attitude of the City Council, so far as can be ascertained, is against allowing the proposition of the old company to be put to a vote of the people.

The People's Light, Heat and Power Company of Springfield has passed its October dividend, but the directors state that it will resume the payment of dividends on December 1st. They say that this action was deemed advisable on account of the expenses in completing the new plant and rewiring a portion of the city, and because there has as yet been no income from the heating business.

The Miami Heat, Light and Power Company has purchased Hartman's Mills, on the Little Miami River, where a power plant will be located. Hartman's Grove, a pleasure resort, goes with the mills, which have stood there for a century, it is said. They are the only mills on the river that are entirely operated by water-power.

The committee on railroads and telegraphs of the Toledo Council has approved the ordinance granting the Toledo, Port Clinton and Lakeside Railway Company a franchise to enter the city over the tracks of the local company, on condition that it pay the city one-quarter of a cent for each passenger carried over the Cherry Street bridge and one-half of one per cent. of its gross receipts. Several councilmen object to this charge until all the roads entering the city can be placed upon the same basis.

The Kanauga Traction Company of Pennsboro, W. Va., has been incorporated to build a line from Gallipolis to Pomeroy. The capital stock is placed at $30,000. M. K. Duty of Pennsboro is at the head of the enterprise.

Work has been begun on the construction of the Magnetic Springs Northern Railway, which is to extend from Richwood to Magnetic Springs. The company, it is said, has the backing of the Columbus, Delaware and Marion Railway Company.

Asserting that Mayor Johnson of Cleveland is financially interested in the success of the Forest City Railway Company, and that he procured the organization of the company and obtained franchises and assumes financial responsibility for the company, the Cleveland Electric Railway Company has filed a petition in Common Pleas Court asking that all work on the new company's lines be enjoined and that interference with its own lines be prohibited. It is charged that Mayor Johnson obtained a franchise on Denison Avenue for Albert E. Green; that the Forest City Railway Company and the Municipal Traction Company were formed through his action, and that all other franchises for these companies were procured by him.

O. M. C.

Michigan.

Grand Rapids, October 6.—In the sale of the Boardman River Electric Light and Power Company, capitalized at $1,000,000, and the Traverse City Gas Company to the Heald-Stevens Company of this city, the control of lighting and power in Traverse City is held by Grand Rapids capital. Formal possession to the properties will be given November 1st. The new company will install modern machinery, will build a dam on the Boardman, developing 6,000 horsepower, and in all will expend $200,000 in improvements.

At a meeting of the stockholders of the Boyne River Power Company, held in this city, directors and officers were elected, with E. A. Stowe as president. Fredrick Miller will be the manager of the concern and will establish an office at Boyne City and direct the erection of a 33-foot dam across Boyne River. Power will be utilized to light Boyne City, Boyne Falls, Clarion and the resort on Waloon Lake.

The village of Shepherd is considering several electric-lighting propositions. The Webber Gas Engine Company of Chicago offers to install a plant on a contract system and furnish 10 arc lights at $60. The Chippewa power plant offers the village a perpetual right to lighting service from the plant for $7,000.

Benjamin F. Bailey of the electrical department of the University of Michigan has reported to the Holly City Council that the electric-light plant is worth $10,000, the price placed on it by the banks which own the property and hold the franchise. He estimates that the plant can be run for $1,000 above the receipts for commercial lighting. The city will vote on the proposition.

Escanaba citizens are considering the advisability of disposing of the municipal lighting plant. For a period of six months, after allowing interest on bonds and depreciation, the electric and gas plants have showed a net earning of $4,400.

It is said that the Washtenaw Light and Power Company will put its first dam on the Huron River next spring, near Ann Arbor.

The Elk Rapids Common Council has granted a 10-year lighting franchise to William E. Donley of Big Rapids. The plant is to run on a moonlight schedule, and 25 arc lights are to cost $75 each per year, additional lights to cost $70.

The South Haven municipal light plant is said to show a profit of nearly $4,000 for one year after paying running expenses of $13,000 and interest of $1,100. The city pays $63 each for 30 arc lights and $22 for 90 incandescent lamps.

The Wellman electric-light plant at South Boardman has been destroyed by fire. The plant was in the hands of a receiver.

The appointment of a county electrical inspector is being considered in Houghton County, where an immense amount of electrical work is done about the mines. The city of Calumet has an inspector who looks after the villages of Red Jacket and Larium.

It is reported that New York capital has been secured for the building of a trolley road from Traverse City to Old Mission, a line that has long been projected. With the revival of the talk of a line between these points, the Benton Harbor and St. Joseph Railway and Light Company has sent representatives to investigate the field.

Superintendent Manning of the Owosso and Corunna Electric Railway declares that grading on the extension to Durand will commence at once.

At a meeting held in Detroit the difficulties which confront the Detroit, Flint and Saginaw in its project for a trolley line from Detroit to Saginaw were ironed out, it is said. Timothy Tarsney and T. G. Sullivan, who control the line, agreed to retire as directors and a new company is to be organized. Isaac Applebaum and Markl Mischkaum of Detroit will either sell the road or finance it. It is believed that they will assure its construction from Frankenmuth to Flint, and this will complete a trolley connection between Detroit and Bay City. The affairs of the Detroit, Flint and Saginaw have long been in the courts.

The Commonwealth Power Company, it is said, is aiding a project for an electric road from Augusta to Allegan, by way of Richland and Otsego, connecting at Augusta with the Kalamazoo and Battle Creek road. Much of the right-of-way has been bought.

The Sault Ste. Marie Council has granted an extension of the franchise of the St. Mary's Traction Company to give it a life of 20 years, the company to extend its line to Algonquin. Cars are to be running by December 1st.

The Northwestern Ohio Electric Railway Company is preparing to build a road from Defiance to Montpelier, Ohio, and then considers an extension to Coldwater, Mich. E. C. Bell of Cincinnati, L. J. Weadock of Toledo and W. G. Boone and W. W. Chamberlain of Montpelier have been in Coldwater investigating the prospects for such a line.

L. W. B.

Indiana.

Indianapolis, October 6.—The rapidity with which the interurbans of Indiana are growing will be readily noticed by comparing up-to-date maps of the interurban systems of the state with maps issued only six months ago. The American Engineering Company has just issued a new and revised map of the interurban systems of the state, which shows 222 miles of track now in operation that had not been built January 1st, when the last map was issued. The officials of the company are preparing to make the issuing of the map a semi-annual affair, as it is the only way that they can keep it anything like accurate while there continues to be such constructive activity among the traction companies. There are now 200 miles of road under construction, all but 134 miles of which is expected to be in operation by January 1, 1907.

On September 4th the Tippecanoe County Commissioners granted a franchise to the Lafayette and Hoopeston Interurban Railway for the right-of-way through the county, with the provision that the line be in operation within two years.

With the merging recently of several traction lines entering Evansville, another traction syndicate has been formed in Indiana. The new syndicate is to be known as the United States Railway Company, and will have under its control the Evansville and Mt. Vernon, the Evansville and Newburg, the Evansville and Boonville, and the Evansville and Eastern. The capital stock will be $3,000,000, of which $100,000 will be held by Evansville people and the remainder by capitalists of Indianapolis, Cincinnati and Pittsburg. The new company is contemplating the erection of a terminal station in Evansville fashioned after the one in Indianapolis, and is planning to make extensions and to build several new lines. The only road entering Evansville not included in the merger is the one from Evansville to Princeton, which was recently purchased, along with the Evansville Street Car Company, by Henry Marshall and the Murdocks of Lafayette. In this is the possibility of a conflict between the two syndicates. The new syndicate is now in position to block the McGowan interest at Evansville, as by controlling the lines leading out of Evansville it can prevent the Indianapolis men from moving on toward Louisville.

The Columbus Street and Suburban Railway Company has approved the plans, and will soon award a contract for the construction and equipment of a new power house.

The Fort Wayne and South Bend Railway Company has filed articles of incorporation. The capital stock is $2,500,000. The objects are to construct an electric railroad connecting Ft. Wayne, Cherubusco, Meriam, Wolf Lake, Kimmell, Wawasee, Syracuse, Milford, Nappanee, Wakarusa, Mishawaka and South Bend, and to construct and acquire street-railway systems in these above-named towns. The company will also plan to supply electric light, heat and power in the towns mentioned. John H. Grisamer, E. B. Swift and Fay P. Randall are among the directors.

The Indianapolis-Fort Wayne limited pasenger service is attracting attention of traction men in other sections of the country. A number of capitalists interested in the development of the New England Interstate Traction Company recently made a trip over the line from Lima to Fort Wayne and thence to Indianapolis. They reported the service the best patronized and most comfortable and satisfactory in every particular they had ever enjoyed.

From Rushville comes a curious complaint. It is said that a number of families living within a short distance of the Indianapolis and Cincinnati Traction Company's power house at that place, have vacated their premises on account of the atmosphere being so highly charged with electricity, especially during storms, that they cannot live in the houses with any peace or degree of safety. Three men have already been killed in the vicinity while attempting to cross a wire fence, and it is declared that leakage from the high-tension circuits is here to blame. The landlords may bring suits for damages because of the conditions that are alleged.

The directors of the Indianapolis and Eastern Railway Company have decided to enlarge and improve their power house at Spring Lake, 10 miles east of Indianapolis. They will install therein a 1,500-horsepower turbine engine and several additional boilers This improvement and

equipment will make it one of the best power plants in the country. These changes were made necessary to propel the new and large cars that will be used on the through service between Indianapolis and Columbus, Ohio.

The Indianapolis and Western Railway Company has expended a total of $100,000 for the entire right-of-way through Putnam County. The company expects to have its Danville and Greencastle line in operation by the first of the year. When completed, the company will have through service from Indianapolis to Brazil, by way of Greencastle and Terre Haute.

On the Indianapolis and Northern Traction Company the motorman of a northbound car failed to see the signals at the substation and proceeded northward. Realizing that two cars would soon meet, E. L. McCoy, electrician in charge of the sub-station, threw off all power on that section and the north and southbound cars came to a stop on a curve, only 20 feet apart, thus averting a wreck.

The Indiana Supreme Court has decided that the operation of an electric-light plant by a city to light its streets is not such a governmental capacity as to relieve the city from liability for injury caused by its negligence in leaving a live wire where a person may come in contact with it without his own fault. S. S.

Northwestern States.

Minneapolis, October 6.—Plans of the Great Northern Power Company for furnishing cheap electrical power for the head of the lakes are rapidly being completed, and the company will have the first 10,000 horsepower available by December 1st. All the electrical equipment has been shipped and the transmission cables are now being placed.

The electric-light system at Rochester, Minn., has been found to be inadequate for the demands, and extensive improvements will have to be made at once, involving a considerable amount of new machinery.

An election will be held October 16th at Algona, Iowa, for the purpose of voting $20,000 worth of bonds for the purchase of the electric-light plant.

A municipal electric-light plant will be put in at St. Hilaire, Minn. Bonds for $10,000 will be issued.

Neil Brown and others have formed a corporation for building a trolley line from Wausau to Merrill, Wis. Mr. Brown is president of the company.

A franchise has been granted for an electric-lighting system at Giltner, Neb.

The International Harvester Company will put in a private electric-light plant in its building at Alliance, Neb.

Oscar Nelson has applied for an electric-light and power franchise at Essex, Iowa. An election will be held on October 22d to vote on the question.

J. P. Martin is figuring on putting in an electric-light plant at Beaver Crossing, Neb.

The City Council at Superior, Wis., has voted down the ordinance proposed by the mayor for a municipal lighting plant, for the reason that it failed to provide for a commercial system to be run by the city also. R.

Pacific Slope.

San Francisco, October 4.—The Coast County Power Company, which is subsidiary to the Pacific Gas and Electric Company, and which now controls the situation at Santa Cruz, Cal., will increase the equipment of the Big Creek Power Company's system, which it has purchased. That company's waterpower plant has a capacity of about 2,700 horsepower during the period of maximum flow of water. It is the intention to add 1,000 horsepower to the generating capacity of the plant and to install a steam generating reserve plant to feed into the system during the dry season.

Thornwell Mullally, assistant to the president of the United Railroads of San Francisco, says that the corporation has orders in for new construction and new rolling stock amounting to over $3,000,000. Over $2,000,000 has been set aside for 312 new cars, which have been ordered since April 18th. Sixty-two of the cars have been received and about 40 are in operation on the Sutter and Mission Street lines. He says that about 100 more cars are expected in January, as the St. Louis Car Works has promised to rush the work. It has been definitely decided by the officials of the company that it will be necessary to continue the use of cable cars on some of the lines running over the steepest hills of the city.

The Northern California Electric Power Company is credited with the intention of installing an electric power transmission plant on Montgomery Creek, Shasta County, California, where water appropriations have been secured.

The San Joaquin Electric Company, which has let contracts for work on its power plant in Crane Valley, Cal., expects to develop 12,000 horsepower. About 6,000 feet of tunneling is involved in the hydraulic work.

The Oakland Traction Consolidated of Oakland, Cal., is concentrating most of its energy on the reconstruction of the 12-mile electric line extending from Oakland to Haywards, via San Leandro, as a standard-gauge, double-track road. After considerable delay, rights-of-way were secured to double-track the road through the town of San Leandro. A small portion of the road already had double tracks, but 70-pound rails are now being laid the entire distance. The company will soon begin at its Emeryville shops the construction of 25 new electric cars for the San Leandro and Haywards service. Each car will be equipped with four 70-horsepower motors. Since last April 38 standard-type cars have been built here. These shops will build for the San Francisco, Oakland and San Jose Railway, known as the Key Route, 10 new heavy-duty passenger coaches, each equipped with two 66-horsepower motors.

The Key Route system, which is under practically the same management as the Oakland Traction Consolidated, is improving its electric train and ferry service between Oakland and Berkeley and San Francisco by the construction of a new fast steamer similar to the San Francisco. The Yerba Buena electric power station of the Key Route line is being enlarged to cover the additional steam-driven unit which was installed recently. This doubling of electric equipment has made the company more independent of the long-distance transmission lines of the Pacific Gas and Electric Company, which are subject to occasional short interruptions of service.

The interchange freight system of the Key Route, recently organized by Traffic Manager Alberger, is growing in importance. A freight shed has been erected near the beginning of the Fortieth Street mole, and more or less eastern freight is now being transferred to San Francisco. On the completion of the new boat one of the present ferries will be converted into a regular freight boat. An additional switching tower has been erected near the freight sheds equipped with 23 levers for handling the switches for the network of tracks near the approaches to the shops and piers. This betterment of the system costs about $15,000. The signal tower near the ferry depot on the mole contains 16 levers.

Work has been commenced on an electric road said to be affiliated with the Southern Pacific, connecting Mayfield, Cal., and Los Gatos. It is designed as a short cut to Los Gatos and the Santa Cruz Mountains. About eight miles will be saved by the new route, which is to be double-tracked, and will be about 20 miles in length. An extension to San Mateo is contemplated at some future time. A.

PERSONAL.

H. W. Irwin of Schenectady, N. Y., has succeeded S. S. Hough as manager of the Eveleth (Minn.) Electric Company.

F. B. Wright has been appointed assistant instructor in electrical engineering at the University of Vermont, vice H. C. Clement, resigned.

A. A. Anderson, general superintendent of the Indianapolis and Cincinnati Traction Company, has resigned to accept a similar position on the Indianapolis, Columbus and Southern Traction line. Mr. Anderson has spent much of his time in the management of electric-railway properties, and is regarded as one of the most efficient managers in the country. He will assume his new duties on October 15th.

Welcome I. Capen, superintendent at Chicago for the Postal Telegraph-cable Company, has been promoted to be general superintendent, succeeding E. J. Nally, promoted to the vice-presidency and removed to New York. Mr. Capen is a native of Vermont and has had an extended telegraph experience. Before coming to Chicago he was superintendent for the Postal company at Indianapolis. Previously he served both the Western Union and the Postal in Cincinnati.

Louis B. Marks of New York, president of the Illuminating Engineering Society, has been retained as consulting engineer in illumination for the new Carnegie Public Libraries of New York city by the advisory board of architects for Mr. Andrew Carnegie. This board consists of Carrere & Hastings, McKim, Mead & White and Babb, Cook & Willard. Mr. Marks' appointment shows the importance now attached to the professional services of the illuminating engineer by some of the leading architects of the country.

Allen Woodle, who has been acting manager of the Western Union Telegraph Company's Boston office since the death of W. A. Rudd, last January, has been appointed manager. He was born in Monroe, Wis., on February 12, 1868, and began telegraphy as operator and agent for the Chicago, Milwaukee and St. Paul Railroad Company in 1887. He entered the Western Union company's service in 1890. In 1903 he accepted the managership of the Portland (Maine) office, where he remained until he went to Boston.

In an editorial referring to the New York Central terminal electrification, the Chicago Daily News says: "A Chicago engineer, Bion J. Arnold, who is this city's adviser on traction-engineering problems, has been prominently identified with the work of electrifying the New York Central terminals. He helped to prepare the plans and has been a member of the supervising commission to oversee the work of construction. His experience should prove of great value to this city when the time comes for taking up the subject of electric power on Chicago's railroad terminals."

ELECTRIC LIGHTING.

St. Hilaire, Minn., contemplates having a light plant to cost $10,000.

C. F. Rains has asked the city of Mineral, Kan., for an electric-light franchise.

Oscar Nelson has asked the city of Essex, Iowa, for an electric-light franchise.

Clinton, Mo., will put in a municipal lighting plant which will cost about $30,000.

The citizens of Brookhaven, Miss., have voted to issue $15,000 in bonds for water and light plants.

The city of Minerva, Ohio, has under consideration the erection of a new electric-light plant to cost about $15,000.

The Windsor Light and Power Company of New Windsor, Colo., has been incorporated with a capital stock of $10,000.

The Dickinson County Light and Power Company of Chapman, Kan., has been incorporated with a capital stock of $25,000.

B. J. Claflin, vice-president of the electric-light company of Carthage, Mo., will establish an electric-light plant at Gravette, Ark.

Bids will be received October 15th for installing an electric-light system for the city of Rock Hill, S. C. J. B. Johnson is chairman of the committee.

The Merchants' Lighting Company of Ashtabula, Ohio, has been incorporated with a capital stock of $10,000, to generate and sell electricity for heating and lighting purposes.

The Village Council of Kelliher, Minn., has let the contracts for putting in waterworks and building and equipping an electric-light plant. The total cost of both, exclusive of wiring the village, will be $8,100.

The Mexia Light and Power Company of Mexia, Texas, has been incorporated with a capital stock of $100,000 for the purpose of supplying water, light and power to the public. E. M. Turner, Hillsboro, and Joseph Nussbaum are among the incorporators.

The charter for the Citizens' Light and Power Company has been filed at Austin, Mo. This is the company recently organized by John B. King and associates for the purpose of furnishing electric lights and power to consumers in Austin. The capital stock is $50,000.

The Electric Land and Development Company of Cadillac, Mich., proposes to erect an electric-light and power plant, and has made application to the supervisors of Wexford County for permission to construct a dam on the Manistee River to secure power. William H. Umlor is secretary of the company.

Sealed proposals will be received until October 20th by the town of Napoleonville, La., for the construction of an electric-light plant for the town. Plans and specifications will be furnished to all bidders upon application to H. D. Baringer, consulting engineer, at Cinclare postoffice, La., or to the mayor of Napoleonville. Bids will be opened at 2 o'clock p. m., October 20th. Philip H. Gilbert is mayor and chairman of the electric-light committee.

ELECTRIC RAILWAYS

H. P. Clark has received a franchise to operate an urban and suburban railway through Salt Lake City.

A trolley line from Bryan, Texas, to the Agricultural and Mechanical College will be constructed at a cost of $15,000.

The Intermountain Consolidated Railroad Company has applied for franchise for the use of city streets in Provo, Utah.

The Lawton (Okla.) Rapid Transit Company has been incorporated with a capital stock of $1,000,000. Neal S. Doran and E. H. Shauffer of Kansas City are directors.

The Aurora, DeKalb and Rockford Railway is to change its motive power from gasoline to electricity. A plan for building a central power house, either at Aurora or in Maple Park, has been considered.

The St. Bernard Traction Company has been organized to build an electric railway from New Orleans, La., to Bordenmouth, eight miles from the city. William J. Kelly and Henry P. Dart are among the incorporators.

The Claremore Railroad Company has been incorporated to build an electric railway from Jackson, Miss., west to Clinton, and thence to Coopers Well, 16 miles. The company is planning to

eventually extend the line to the Mississippi River, a total distance of 43 miles. Construction and equipment will cost about $1,200,000. The incorporators are R. K. Jayne, M. Culbertson of Jackson and M. Walker of Brandon, Miss.

The Citizens' Light and Transit Company of Pine Bluff, Ark., will soon begin to build a car line from Sixth and Main streets east on Sixth Avenue to the city limits. The line will connect with the present line at Sixth and Main.

The Aurora, DeKalb and Rockford Electric Railway Company has petitioned the City Council of Aurora, Ill., for a franchise to operate a street-car line in Aurora. The company wishes to operate on seven streets, and offers to build a $60,000 bridge if given a franchise.

It is said that the North Shore and Western Railway Company, incorporated by Chicago men a few days ago, with a capital stock of $50,000, proposes to build a cross-country electric railway from Evanston to Elgin, Ill., touching intervening towns. George P. Merrick and William A. Love are among the incorporators.

Sixty franchises held by the Rochester Street Railway Company of Rochester, N. Y., have been revoked by the court. The proceedings were brought in the name of the people of the State of New York with the City of Rochester as the only interested petitioner. New York capital interests, which hold stock in the local company, were represented by attorneys, but no defense was interposed.

The Connecticut Railway and Lighting Company of Bridgeport, Conn., a subsidiary company of the United Gas Improvement Company of Philadelphia, has placed an order, through the Philadelphia main offices, for a 26 and 54 by 54-inch Reynolds heavy-duty cross-compound engine, direct connected to a 1,200-kilowatt direct-current generator. The engine will be run at a speed of 90 revolutions per minute and a steam pressure of 150 pounds. The unit will be used for general power purposes. The engine will be built at the West Allis, Milwaukee, works.

The new electric road proposed to be built by the Minneapolis, Rochester and Dubuque Traction Company between Minneapolis, Minn., and Dubuque, Iowa, is reported as being practically assured. The proposed route shows that the backers of the line will reach some of the principal cities between the two terminals, including Faribault and Rochester, Minn., and Kendallville, Decorah and Elkader, Iowa. The route will provide a direct north and south connection to Minneapolis, and will afford local jobbers and manufacturers opportunity to cut into the new territory, which is said to be eagerly waiting the completion of the line.

POWER TRANSMISSION.

The Brainerd (Minn.) Hydro-electric Power Company has a proposition to furnish the city with electric power.

The North Georgia Electric Company of Gainesville, Ga., has filed a mortgage to secure an issue of $7,500,000, the money to be applied in equipping the general electrical business of the company, which will undertake the furnishing of power to private and municipal corporations. The company is now extending its transmission line from Gainesville to Atlanta. A. J. Warren of Gainesville, Ga., is president of the company.

PUBLICATIONS.

Bulletin No. 26 from the Henry D'Olier, Jr., Company, 119-121 South Eleventh Street, Philadelphia, is devoted to Universal sockets and shades. The bulletin shows the numerous styles of shades and illustrates some of the many applications.

A well illustrated booklet from the T. R. Almond Manufacturing Company, 83 Washington Street, Brooklyn, N. Y., is entitled "Light Right Where You Want It." The booklet suggests a way to improve lighting equipments and tells in detail of the great convenience and important applications of Almond flexible arms which bring the lamp rays "right where you want them."

In continuing its work of co-operation for the increase of business among the electrical interests, the Co-operative Electrical Development Association has published in pamphlet form the paper of S. M. Kennedy on the "Organization and Conduct of a New-business Department." Copies will be furnished for any use to which they can be put. The paper appeared in the Western Electrician of August 4th.

The Central Electric Company of Chicago is now distributing its new fixture catalogue No. 25. This catalogue contains 92 pages, is handsomely bound, with a color design on the cover, and shows a great variety of all that is new and pleasing to the eye in decorative electric-lighting fixtures. In connection with the fixture department of the Central Electric Company, this catalogue assures the buyer of obtaining the very latest in fixtures at reasonable prices and on short notice. It is suggested that anyone who has been overlooked in the distribution or contemplates the purchasing of fixtures soon write the company for a copy of the catalogue.

One of the latest publications of the Allis-Chalmers Company is Bulletin No. 1053. It goes thoroughly into the subject of railway motors and controllers and illustrates and describes all the parts of the Allis-Chalmers product. This company furnishes complete street and interurban-railway equipmeqnt, including prime movers and all electrical apparatus for power houses, sub-stations, cars and lines.

The Northern Electrical Manufacturing Company of Madison, Wis., has just issued Bulletin No. 50A, treating of Northern spherical machines, dynamos and motors, including back-geared motors, vertical motors, universal motors, etc., for industrial-plant service. The bulletin is well illustrated and contains lots of information. It is a reissue of Bulletin No. 50, with the addition of new illustrations and additional ratings of new frames.

The Proceedings of the American Society of Mechanical Engineers are hereafter to appear monthly except during July and August. The first number under the new arrangement is dated October, 1906, and is intelligently edited, well printed and clearly illustrated. An announcement on the title-page shows that the publication is published in Baltimore, although the editorial rooms remain at 12 West Thirty-first Street, New York city.

SOCIETIES AND SCHOOLS.

A special meeting of the Texas Electrical Contractors' Association is called to be held at Dallas on October 15th and 16th to consider applications, amendments to constitution, state and municipal legislation, and to take action on the adoption of universal symbols of electrical equipment. The state fair will be in session at the time, affording reduced railroad rates. On the fifteenth, Jupiter Day, the Sons of Jove will hold their annual meeting and rejuvenation. A good programme is prepared. D. L. Goble of Dallas is secretary.

About 70 active and associate members attended the fifth annual meeting of the Vermont Electrical Association recently held at St. Johnsbury, Vt. There were a number of good papers and plenty of entertainment, the latter including an informal reception at the home of Col. T. C. Fletcher, president of the St. Johnsbury Electric Company. The following-named officers were elected: President, George S. Haley of Rutland; vice-president, E. E. Larrabee of Bennington; secretary and treasurer, C. C. Wells of Middlebury; executive committee, Frank Collins of White River Junction, J. E. Davidson of Montpelier, E. D. Blackwell of Brandon, E. C. Parker of Vergennes, F. H. Foote of St. Albans. The next annual meeting will be held in St. Albans.

MISCELLANEOUS.

A dispatch from Seattle, Wash., says that Capt. Roald Amundsen, discoverer of the Northwest Passage, arrived from Sitka on October 4th on the steamship Humboldt. He went to the Alaskan city to verify his calculations regarding the location of the magnetic pole, and reports that his work was successful. He left Seattle on October 5th to join his sloop, the Gjoa, at San Francisco.

An account is given in the September issue of Stahl und Eisen of a 2,000-horsepower gas engine built by the Deutz Gas Motor Manufactory in Germany for the Horder Mining and Smelting Company. This engine is said to be remarkable on account of good design and powerful construction, great simplicity and faultless action. Two German tandem gas-blowing engines, each of 1,500 horsepower, built by the Alsacian Machine Construction Company at Mülhausen for the works at Differdingen are likewise described and illustrated. These engines are stated to work with exceptional smoothness and regularity. Details are likewise given of a 1,500-horsepower tandem gas engine built by the Märkischen Machine Factory of Wetter on the Ruhr, of a 1,200-horsepower gas dynamo built by Schüchtermann & Kremer of Dortmund and of many other large gas engines.

TRADE NEWS.

The King Electric Company of St. Louis has been succeeded in business by the General Service and Development Company.

The Lord Electric Company of Boston announces the removal of its headquarters and plant to New York city, its address after November 1st being Fuller Building, New York. The Boston office will be continued as a branch. Edwin M. Hamlin has resigned from the company, owing to the removal, but he nevertheless writes a pleasant letter commending the company to his friends in the trade.

The J. L. Mott Iron Works, New York city, announces the removal of its main offices and showrooms from the St. George Building, 84 to 90 Beekman Street, which it occupied for over 37 years, to its new building, Fifth Avenue and Seventeenth Street. The showrooms of modern plumbing fixtures at 110 Fifth Avenue, will be continued until the new showrooms are fitted up in their entirety.

The foreign commerce of Cuba, according to the latest returns received by the Bureau of Statistics of the Department of Commerce and Labor, aggregates practically $200,000,000 per annum, the imports being $95,000,000 and the exports $110,000,000. The population is in round numbers 1,500,000, and the area 43,000 miles, or about equal to that of the state of Virginia. Of the imports, 45 per cent. were in 1905 drawn from the United States, and of the exports 86 per cent. were sent to the United States.

The Electric Controller and Supply Company of Cleveland, Ohio, announces the opening of a Chicago office in the Merchants' Loan and Trust Building, 135 Adams Street, Chicago, Ill., with Mr. W. H. Connelly in charge. Mr. Connelly was connected with the electrical department of the Homestead Works of the Carnegie Steel Company for five years and resigned his position there to become electrical engineer of the Ensley plant of the Tennessee Coal, Iron and Railroad Company at Birmingham, Ala., which position he held for three years, and resigned to enter central-station work at Birmingham, Ala., and at Houston, Texas.

Crosby, Craft & Co., Cleveland, Ohio, have removed their offices from the Citizens' Building to 723 Williamson Building. Crosby, Craft & Co are the agents in Northern Ohio of the Switchboard Equipment Company, the Whitney Electrical Instrument Company, the Northwestern Manufacturing Company, the Fort Wayne Electric Works and the General Storage Battery Company. The firm reports that it has closed a contract with the Brown Hoisting Machinery Company, Cleveland, for 69 large-capacity circuit-breakers of the Switchboard Equipment Company's manufacture. The Brown Hoisting Machinery Company will use these in connection with an installation it is furnishing for the Carnegie Steel Company.

BUSINESS.

The Wagner Electric Manufacturing Company of St. Louis, in addition to its line of standard single-phase motors, is prepared to furnish vertical motors in all sizes up to 25 horsepower. This is a line manufactured solely by the Wagner company. Engineers, pump manufacturers, etc., who have been put to considerable inconvenience in laying out their plans on account of not being able to obtain single-phase vertical motors, will be glad to learn that this line of the Wagner company is complete.

The Cleveland Cliffs Iron Company of Ishpeming, Mich., will install at the Maas Mine, Marquette, a 14 by 24-inch Reliance Corliss duplex hoist, geared type, recently purchased from the Allis-Chalmers Company. The new outfit will have a capacity of 8½ tons at a speed of 700 feet per minute, with a steam pressure of 140 pounds. This hoisting engine, although comparatively small in size, combines many improvements made by this large manufacturer of hoisting engines.

The Westinghouse Electric and Manufacturing Company is being awarded an increased number of government contracts, largely owing to the undoubted reliabiilty and efficiency of its apparatus. A recent contract just closed calls for a large amount of electrical power-generating apparatus to be installed in the navy yard at Norfolk, Va. The contract totals $91,125 and consists of three-phase steam-turbine generating units, exciters, motor-generator sets and a switchboard, which will have 42 panels. A large amount of auxiliary apparatus is included in the contract.

Recent purchases of steam-turbine generator outfits of Allis-Chalmers manufacture include a number of units of capacities ranging from 500 to 750 kilowatts. Among others, the Flatbush Gas Company of Brooklyn will install in the Flatbush power station, Brooklyn, a 750-kilowatt turbo-generator set for operation at 1,800 revolutions per minute, 2,200 volts, 60 cycles, two-phase. The turbine will conform to the standard Allis-Chalmers construction, while the generator will be of the enclosed type, ventilated by means of air forced into the interior. The Savannah Lumber Company of Savannah, Ga., will install a 500-kilowatt set and a 15-kilowatt exciter driven from a high-speed engine. Hall & Co., owners of the Jamestown Worsted Mills, Jamestown, N. Y., have purchased, through their agents, W. S. Barstow & Co., a 500-kilowatt set, 480 volts, 60 cycles, three-phase.

That the Crocker-Wheeler Company of Ampere, N. J., is not confined to any one industrial line is shown by the following list of recent sales: Watervliet Arsenal, nine 25-horsepower motors; Shelby Steel Tube Company, Ellwood, Pa., four 12½-horsepower direct-current motors; Oxford Copper Company, Bayonne, N. J., four 300-kilowatt direct-current generators; Chicago, Indiana and Southern Railway Company, two 100-kilowatt alternating-current generators and two 6½-kilowatt direct-current generators as exciters; American Smelting and Refining Company, Pueblo plant, Pueblo, Colo., one 20-horsepower direct-current motor, one 45-horsepower direct-current motor;

Arkansas Valley plant, Leadville, Colo., one 45-horsepower direct-current motor; Eiler's Plant, Pueblo, Colo., one 45-horsepower direct-current motor; Globe Plant, Denver, Colo., two 20-horsepower direct-current motors, one 45-horsepower direct-current motor; Becker Bros., Chicago, Ill., 100 1¼ L motors driving bottle-washing machines; De La Vergne Machine Company, New York, one 110-kilowatt direct-current generator.

ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued (United States Patent Office) October 2, 1906.

832,035. Feeding Mechanism for Perforating Machines for Preparing Telegraphic Messages for Automatic Transmission. Charles L. Buckingham, New York, and Emil Germann, Brooklyn, N. Y.; said Germann assignor to said Buckingham. Application filed August 25, 1902.

This invention covers a device for feeding up to the perforator the paper or other surfaces used for automatic telegraphic transmission of messages. A feed wheel provided with a rigid stop for arresting it is operated by a shaft, being frictionally connected to it by a disk fixed to the shaft and carrying a disk of billiard-cloth or other suitable material, against which the feed wheel is tightly pressed. This enables the shaft to yield slightly and continue its rotation for a short space when the feed wheel is arrested. The motor shaft driving the feed-wheel shaft is spring-connected to the latter, the combination permitting the motor to continue its rotation when the feed-wheel shaft has been stopped from turning.

832,046. Automatic Weighing and Mixing Apparatus. Thomas A. Edison, Llewellyn Park, N. J. Application filed January 9, 1903.

An electric motor drives a conveyor supplying material to a bin supported on weighing beams. The rheostat controlling this motor has its arm controlled by an electromagnet holding it in position to operate the motor, while a second electromagnet holds clear a brake fitted to stop the motor armature. These operating parts are so connected that the descent of the weighing beams opens the circuit of the two electromagnets and thereby cuts out the motor and applies the brake. Evidently then when a predetermined weight of material has been run into the bin the supply stops, and this is the purpose sought after.

832,072. Regulator for Prime Movers. Lamar Lyndon, East Orange, N. J. Application filed June 26, 1905.

This invention, while applicable to any kind of prime mover operated by a working fluid, such as a gas engine, water turbine, etc., may be best described in its application to a steam engine driving a dynamo. Two solenoids are so connected with resistances and switches that the engine governor-throttle valve is moved to admit more or less steam as the case may require, if either the voltage between the generator terminals or the amperage of the current generated or the steam pressure vary beyond predetermined values, or in case it is desired to alter the supply by hand. For instance, if the voltage diminishes to an insufficient amount, the solenoid in the voltmeter circuit becoming energized pulls the governor wheel into gear with a miter wheel on the screwed governor spindle, which causes the throttle to open wider, thus driving the steam engine and generator faster. (See cut.)

832,084. Railway Signaling System. Benjamin F. Saurman, Philadelphia, Pa. Application filed November 15, 1905.

Semaphores erected on posts at the side of the railway are connected by linked rods to a system of blocks adjustably mounted in a guide rail close alongside of the inner side of one of the track rails. A roller, carried by an arm depending from the train, travels over the guide rail and is actuated by the blocks in case the latter are caused to protrude, which would correspond to the stop position of the semaphore arms. This arm movement is communicated to a disk having signals and controlling by suitable contacts two solenoid circuits. Steam cylinders, the valves of which are governed by these solenoids, operate in conjunction with a valve controlling the compressed air pressure to first slow-down, and then stops the train, presumably by putting on the air brakes and then throwing over the reverse lever, though the limited sketch and claims do not mention these features. A drum carrying a recording apparatus, actuated by closing the solenoid circuits, records the operation of the signal disks and of the train-controlling mechanism, while an electric bell, controlled by the same circuit, notifies the train personnel.

832,093. Service-box Closure. Benjamin F. Stoltzfus, Laurel, Miss. Aplication filed December 12, 1905.

A hinged casing cover is held down by a crossbar engaging in oppositely disposed longitudinal slots in the casing, being operated by a rotatably-mounted screw.

832,102. Automatic Weighing Machine. George F. Turner, Brooklyn, and Charles E. Vail, New York, N. Y. Application filed December 17, 1904.

This patent covers a duplex automatic weighing machine for measuring out definite amounts of material capable of flowing in a stream. A pair of load receivers, each pivoted on the poising side of its auxiliary scale beam, which in turn is pivoted on the poising side of its main scale beam, are loaded from a single stream-controlling member. An electric circuit, controlled by the auxiliary scale beams, operates an electromagnet to permit the streams to be turned on full force. When almost sufficient material has been admitted to make up the weight, the auxiliary scale beam trips sufficiently to cause the main supply to cease and to start a drip supply to fill up to the required weight, after which the entire supply is automatically cut off.

832,116. Thermostat. Frank E. Austin, Westbrook, Maine. Application filed December 26, 1905.

A latch comprising two parts, united by a fusible connection, is pivoted at one end of the thermostat housing so that it may be turned into and out of the path of the projecting end of a spring-actuated circuit closer which is mounted in the housing so that its upper end normally projects above the latter.

832,121. Telephone System. William W. Dean, Chicago, Ill., assignor to the Kellogg Switchboard and Supply Company, Chicago, Ill. Application filed December 23, 1902.

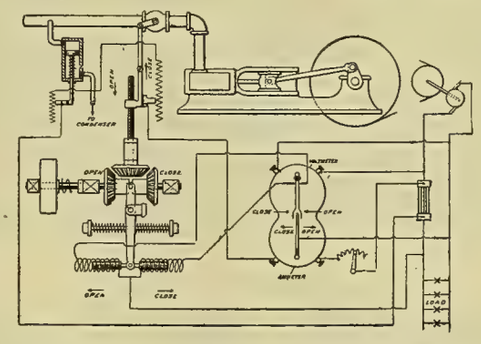
In the combination with a telephone line, a line signaling device has a high-resistance winding and a low-resistance winding, one in each side of the line circuit, while a cord circuit has a pair of supervisory relays associated with it, one of low resistance and the other of high resistance. A source of current is associated with these relays and has one pole connected directly thereto, and there are means for connecting the low-resistance relay in parallel with the high-resistance winding when a connection is established with the line, and the high-resistance relay in shunt with the line resistance and in series with said low-resistance winding is provided, so that the line signaling device is rendered inoperative when connection is established with the line.

832,135. Combined Telephone Receiver and Microphone. Carl E. Ljungman, Robert O. P. Berglund, and Walter A. W. E. Hjorth, Stockholm, Sweden. Application filed February 14, 1906.

A curved screen or disk is arranged between the diaphragms of the microphone and the receiver, which are combined in the same casing. The purpose of the disk is to functionally separate the two instruments.

832,137. Railway Switching and Signaling Apparatus. William Macomber, Buffalo, N. Y., assignor to the General Railway Signal Company, Buffalo, N. Y. Application filed February 20, 1905.

In combination with a source of electric energy there are a signal motor, a controller, an operating wire, an indicating wire, a common wire, a safety magnet, an indicating magnet, a cut-out magnet, means for shunting the current from the common wire to the indicating wire, an electric switch in the operating wire, a magnet governing the electric switch and connected with the indicating wire and the battery by a circuit. Means are provided for breaking the circuit of the magnet governing the switch as soon as the safety magnet is energized, and means for including the cut-out magnet in the indicating circuit when the safety magnets have been energized, in connection with means for maintaining the signal at reverse position in the event of a cross between any indicating wire of the system with any active wire eventuating in the opening of the operating common after the signal has been set at reverse, which means comprise contacts on the controller and wires connecting these contacts with the two poles of the source of energy outside of all other units, whereby the final throw of the controller brushes establishes the signal mechanism in circuit with the battery independently of all other units.



NO. 832,072.—REGULATOR FOR PRIME MOVERS.

832,138. Railway Switching Apparatus. William Macomber, Buffalo, N. Y., assignor to the General Railway Signal Company, Buffalo, N. Y. Application filed February 20, 1905.

This invention closely relates to the one described under patent No. 832,137. With the elements essentially as before described the switch-governing magnet is connected with the signal-indicating wire and the battery when the signal is at danger, in combination with an electromagnet device actuated by the operating current when the safety magnet is energized. A wire connects the signal-indicating wire with this electromagnetic device, which latter actuates a switch to connect this wire with the switch-indicating wire while current is on the safety magnet, and the switch is actuated to disconnect these wires as soon as current is cut off from the safety magnet.

832,139. Railway Switching Apparatus. William Macomber, Buffalo, N. Y., assignor to the General Railway Signal Company, Buffalo, N. Y. Application filed February 20, 1905.

While connected with the two preceding patents this invention relates particularly to the motor used for driving the mechanism moving the rail switch and to its control. There are provided means for reversing the direction of rotation of this motor corresponding to the alteration of function of the two wires, leading to the controller, and means for reversing the direction of rotation of this motor before the completion of a movement, comprising means for reversing the functions of the two wires, an electric switch including both of them, magnets for operating the electric switch, wires connecting each of the controller-wires alternately as operating and indicating wires through the magnets actuating this electric switch, a selector contact connecting these wires including their magnets with common return, reversing wires leading from the switch through the motor in reverse directions to common, and contacts on it for connecting the reverse operating wire with one of the reversing wires.

832,140. Railway Switching Apparatus. William Macomber, Buffalo, N. Y., assignor to the General Railway Signal Company, Buffalo, N. Y. Application filed February 20, 1905.

This invention, unitary with the preceding, relates to the means for moving the railway switch and their control. Indication depends upon the opening and closing of the circuit adjacent to the rail switch. There are provided means for moving the rail switch, comprising a segmental gear, a driven gear, a driving gear, dogs for locking the driven and segmental gears to mesh with this driving gear to move the rail switch and then unlocking these gears, an electric snap switch, springs, pins on the driven gear to set up one of these springs to throw the snap switch to open the circuit and to reëstablish the circuit after indication by the spring thus set up, moving the snap switch to close the circuit.

832,147. Rear-light Indicator for Automobiles. Leo F. Murphy, Detroit, Mich. Application filed September 5, 1905.

An electric lamp is fitted in connection with and operating a thermo-electric switch which closes an electric circuit when in one position, while a second circuit is connected so as to be closed by this switch when in another position, while an indicator lamp is provided for showing when the circuit is closed. The purpose is to enable the inmates of the vehicle to be sure of the burning of their rear light from within.

832,153. Electric Signaling Apparatus. Charles J. O'Neil, Washington, D. C. Application filed February 4, 1905.

A signal system for railways is covered by this invention, in which the switch controlling the circuit is movable to different positions to operate distinctive signals by the wheels of separate cars or trains, while the switch is arranged with a timing device so as not to be actuated by the successive cars of a single train.

832,165. Railway-switch Operating and Controlling Apparatus. Wilmer W. Salmon, Buffalo, N. Y., assignor to General Railway Signal Company, Buffalo, N. Y. Application filed July 15, 1901. Renewed May 17, 1906.

A series-wound motor having two independent field windings operates the track-switch mechanism and is controlled by an electric switch which closes the respective field windings off from the current source. An electric switch actuated by a polarized magnet governs this circuit. The controller is mechanically held against final movement until the railway switch is locked. The switch-locking mechanism is locked and released at the proper intervals by bolts, mechanically driven into lock, and electromagnets for retracting these bolts, such magnets being governed by the polarized magnet. These bolts move electric switches, which close the motor circuit when a bolt has been withdrawn from lock and close the motor in circuit with the controller magnets when the switch-rail movement is complete and locked.

832,166. Railway Switching and Signaling Apparatus. Wilmer W. Salmon and Frank L. Dodgson, Buffalo, N. Y., assignors to General Railway Signal Company, Buffalo, N. Y. Application filed January 6, 1906.

This invention relates to the means of signal communication and control in connection with the switch apparatus described in the preceding patent by the same inventor. A lock is provided for the switch and a controller with locking device as before. A single circuit connects the switch with the signal tower, while an indicating apparatus, in circuit with an annunciator, the switch locking device, the controller lock and a visual signal records each particular movement of these elements.

832,174. Railway Signaling Apparatus. John D. Taylor, Buffalo, N Y., assignor to General Railway Signal Company, Buffalo, N. Y. Application filed January 22, 1904.

This invention covers the combination with a slotted signal of an electromagnetically governed lever for connecting and disconnecting the rods of the slotted signal, a source of electric energy, a controller, operating and indicating wires, a motor, a brake magnet, a shunt circuit having a magnet governing the rod lever, a switch in the shunt circuit, with means for opening and closing it, and an indication magnet for the purpose of electromagnetically engaging the parts of the slotted signal by current through the shunt circuit, moving the signal by energizing the motor, returning the signal blade to normal by breaking this shunt circuit, returning its counterweight to normal by breaking the main operating circuit, producing dynamic indication through a closed circuit, including the motor with the indication magnet, and the controller by rotation of the motor, due to the fall of the counterweight.

832,175. Railway Switching Apparatus. John D. Taylor, Buffalo, N. Y., assignor to the General Railway Signal Company, Buffalo, N. Y. Application filed January 22, 1904. Renewed February 3, 1906.

This invention is cognate to No. 832,174, and specializes the leads. It covers, in combination with the essential parts above described, a wire leading from one pole of the source of energy to the motor, a wire leading from the opposite pole to the opposite pole of the motor, a pole-changing switch for reversing the electrical connections with the motor, a controller in these circuits, an indication circuit and an electromagnetic switch energized through the operating circuit to establish the proper indication circuit on each movement of the controller and prior to the dynamic indication from the motor.

832,181. Electromagnetic Device. William W. Dean, Chicago, Ill., assignor to Kellogg Switchboard & Supply Company, Chicago, Ill. Application filed June 19, 1903.

A metallic bar has a series of sockets or holes into which electromagnet coils are fitted. A thin metallic strip covering the holes provides a complete metallic circuit for each electromagnet, in which circuit the metallic bar is included. Suitable lugs are fitted at the ends of the bar for securing it in any desired position.

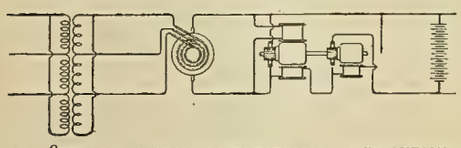
832,185. Right-angle Adjustable Crossing for Electric Railways. Edward E. Gilmore, Philadelphia, Pa. Application filed September 27, 1905.

There is shown an overhead crossing for electric-trolley systems comprising crossarms, one of which is provided with a raised portion adapted to form a bearing seat, a plate upon the other crossarm pivotally secured to revolve upon the seat and a saddle connected to each of the crossarms adapted to brace them throughout their movement of adjustment.

832,189. Magnetic Ignition Device for Explosion Engines. Heinrich W. Hellmann, Berlin, Germany. Application filed November 14, 1902

An electric igniter for explosive engines having in combination with fixed and movable electrodes an electromagnet arranged in circuit with the electrodes, an armature for engaging the movable electrode, means for varying the actuation of this armature, means for adjusting the length of the spark gap and independent means for regulating the force with which the armature engages the movable electrode.

832,192. Railway Switching and Signaling Apparatus. Winthrop K. Howe, Buffalo, N. Y. Application filed August 29, 1905.



NO. 832,357.—SYSTEM OF ELECTRICAL DISTRIBUTION.

832,193. Railway Signaling Apparatus. Winthrop K. Howe, Buffalo, N. Y., assignor to General Railway Signaling Company, Buffalo, N. Y. Application filed November 27, 1905.

These two patents cover the combination with the insulated rails of a block section of releasing magnets, manually-operated generators at both ends of the block, circuits including said rails for connecting each generator with the releasing magnet at the opposite end of the block, an electric switch at both ends of said block controlling both of the circuits and so arranged that both electric switches must be moved to establish the circuit of either generator and its respective releasing magnet.

832,194. Railway Signaling Apparatus. Winthrop K. Howe, Buffalo, N. Y. Application filed May 17, 1906.

A motor having a home-signal filed winding and a distant-signal field winding is so arranged that a home-signal cushion circuit through the distant-signal field winding is closed just as the home signal goes to the proceed position, and that the distant-signal operating circuit is actuated and the distant-signal cushion circuit is closed through the home-signal field winding just as the distant signal goes to the proceed position. An indicating device in a common wire of the cushion circuits indicates such movements.

832,195. Railway Signaling Apparatus. Winthrop K. Howe, Buffalo, N. Y., assignor to General Railway Signal Company, Buffalo, N. Y. Application filed July 20, 1903. Renewed May 17, 1906.

An electrically operated and controlled antifriction screw, driving a nut, controls a set of visual signals in combination with selector magnets operated by selector circuits.

832,236. Weighing Apparatus. Edwin A. Carmichael, Omaha, Neb. Application filed August 9, 1905.

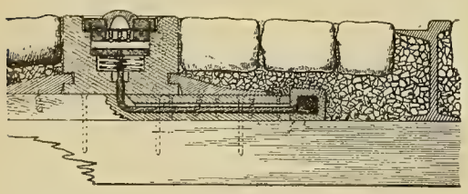
A solenoid, governed by the scale beam, controls the rotary valve which governs the discharge of material from the container. The solenoid core has a non-magnetic tip at one end, which strikes against an adjustable stop when the core arrives at the extreme of its movement in one direction.

832,293. Thermostat. Lyman C. Byce, Petaluma, Cal. Application field May 19, 1905.

Pairs of metallic disks, corrugated in concentric lines and separated by sleeves from each other, are rigidly connected. A nipple carried by one of the disks has an internally threaded orifice communicating with the chamber inclosed by the disks, while its outer end is provided with a permanently attached coating of soft compressible metal. A screw plug, fitting the nipple orifice and seating on the metallic coating, is freely removable.

832,297. Safety Device for Electric Signals. Fred B. Corey, Schenectady, N. Y., assignor to General Electric Company, Schenectady, N. Y. Application filed June 16, 1904.

A semaphore signal is lighted by an electric lamp provided with a magnet winding in series with it, which is adapted to be engaged by a passing train and in so doing actuates an alarm device. When there is a failure of current in the lamp the alarm device is electrically released to permit it to move to danger position.



NO. 832,416.—SURFACE-CONTACT RAILWAY.

832,302. Method of Sealing Metal into Glass or Other Vitreous Material. Carl A. Ernst, Schenectady, N. Y., assignor to General Electric Company, Schenectady, N. Y. Application filed June 12, 1903.

Means are patented for covering with a uniformly thick coating of glass a metal wire from which occluded gases have been removed and which, in intimate contact with the wire, forms a gas-tight joint therewith.

832,303. Automatic Reminder for Telegraph Operators. Samuel F. Estell, Los Angeles, Cal. Application filed May 31, 1906.

A manually-controlled lever for opening the telegraph circuit is in combination with an automatic reminder signal. A detent is provided for holding the signal out of indicating position and is operatively connected with the lever.

832,312. Section Insulator for Electric Railways. Edward E. Gilmore, Philadelphia, Pa. Application filed September 27, 1905.

The trolley wires lead in from opposite sides of the section insulator, so that the parts holding the wires may be cast interchangeable with sinuous grooves into which the wires are pressed by clamping plates.

832,314. Coin-controlled Mechanism. Rudolph W. Goeb, St. Louis, Mo., assignor to The Controller Company of America, St. Louis, Mo. Application filed February 13, 1903.

The mechanisms for operating a locking device and a coin-delivering device are electrically controlled by the combination of a single current source with two terminals, each of which is electrically connected with one of the mechanisms above mentioned; operation being effected by moving a switch adapted to put either of these terminals in circuit with the current source. The purpose is to lock the vender and return the coin if the latter is not what it should be.

832,354. Magneto-electric Generator. Joseph A. Williams, Cleveland, Ohio. Application filed May 14, 1906.

This patent covers a magneto-electric generator whose frame is provided with annular flanges concentric with the bearings of the armature shaft, and which is supported in a frame in which these annular flanges are mounted. The support is such that the generator cannot turn on its supporting standard.

832,357. System of Electrical Distribution. Ernst J. Berg, Schenectady, N. Y., assignor to General Electric Company, Schenectady, N. Y. Application filed April 25, 1900.

Mains extending from a source of direct current supply a current-consuming apparatus. One of the mains is connected in series with the armature of a generator so that its voltage is combined with that impressed upon the mains, and a motor mechanically coupled to the generator has a field winding in shunt to these mains and another field winding in series with one of them. The direct current is supplied by a storage battery and is opposed by the generator electromotive force. The combination involves means for driving the generator at a speed varying automatically with the load. (See cut.)

832,363. Vapor-tube-starting Device. Theodore Bodde, New York, N. Y., assignor to Louis B. Marks, New York, N. Y. Application filed March 16, 1904.

A vapor tube with a positive and a liquid negative terminal is filled with a stationary solid auxiliary terminal normally in contact with the liquid terminal, and with means for supplying a current through the auxiliary terminal and means whereby the passage of this current will vaporize the liquid terminal and thereby break the contact. This invention applies to the mercury lamp.

832,416. Electric Railway. Leon W. Pullen, Camden, N. J. Application filed May 18, 1905.

A circuit-closing contact block is shown, consisting of a hollow block of insulating material open at the top, combined with a compound plate structure, sealing the opening at the top, and from a part of which current is wiped by the collector on the car. Switch devices are comprised which control the current supply. (See cut.)

832,425. Intercommunicating Telephone. Lambert Schmidt, Weehawken, N. J. Application filed September 16, 1905.

This patent covers a station indicator, comprising a name plate or dial, displaying openly the various stations and having a pointer above the dial for selecting the stations. One push button for all the stations passes through the dial and through the pointer, which latter is so arranged as to be laterally actuated when the push button is turned and remaining stationary when it is depressed.

832,438. Station Indicator for Railways. Daniel F. Whitcomb, Cleveland, Ohio, assignor of one-half to Albert J. Kohne, Toledo, Ohio. Application filed March 31, 1905.

A solenoid core, connected to racks gearing with pinions on the axles of two winding drums, controls the movement of these drums.

832,443. Telephone System. Paul Arnheim, Hamburg, Germany, assignor to the firm of Telephon-Fabrik Actiengesellschaft, vorm. J. Berliner, Hanover, Germany. Application filed June 25, 1902.

This invention is characterized by the combination with a party line of a source of current for the party line and subscribers' stations connected to the line; of a central station, a switch to connect the subscriber called to the line, means to send current to set the switch to connect the subscriber called and send current through the subscriber's signal, and means to simultaneously and automatically cut out all the calling circuits of the other substations on the line during the signaling by the central station.

832,462. Automatic Electric Brake. Augustus L. Duwelius, Cincinnati, Ohio. Application filed May 7, 1904.

An electric generator, driven from the vehicle axle, is connected by a controller to an electric translating device. A hand-operated brake staff for operating the brake rigging is operated and the brake locked when the latter is set by the translating device.

832,508 and 832,509. Combined Box for Molding and Iron-armored Conduit. Silas D. Slocum, Alexandria, Va., assignor to Leon W. Bossert, Utica, N. Y. Application filed September 18, 1905.

These inventions cover an outlet box for molding and iron-armored conduit, having a cut-away portion in the bottom of one of the sides to receive a molding, and a plate having a recess formed therein, adapted to fit about a molding and designed to be adjustably held upon the cut-away side of the box. This box has a series of disk sections partially cut from the walls thereof along diagonal lines, with the upper portions of the disks cut entirely through the wall and along diagonal lines, with uncut integral portions at the lower portion of the disk adjacent to the angle formed between the bottom and side of the box, the lower part of the diagonal severed part of the disks terminating substantially at the center of the wall.

832,511. Electric Furnace. Edwin A. Storey, Newark, N. J. Application filed September 13, 1905.

In this dielectric furnace duplicate conductors extending through the furnace walls support a resistor which is adapted to contact with an additional conductor supported by the furnace and movable in a plane at right angles to that of the first conductors.

832,548. System of Railway Signaling. Harry L. Johnson, Topeka, Kan. Application filed April 29, 1905.

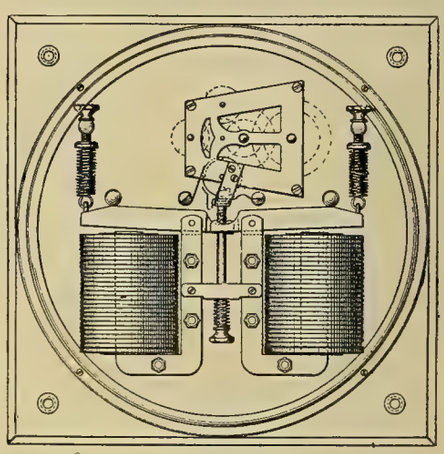
A block-signal system for railways has a trackway consisting of alined long and short sections arranged alternately and insulated from each other, and a pair of contacts held yieldingly together with one electrically connected to one of the long sections and the other to the long section at the opposite end of the short section.

832,562. Telephone Call Box. Anthony Van Wagenen, Sioux City, Iowa. Application filed July 30, 1903. Renewed March 3, 1906.

A contact member capable of motion with respect to an indicator is adapted for continuous rotation in one direction and provided with locking means independent of the indicator. The contact member may be locked in any position and subsequently released.

832,568. Electric Time Switch. William S. Andrews, Schenectady, N. Y., assignor to General Electric Company, Schenectady, N. Y. Application filed December 15, 1903.

The winding handle of the time-piece operates a device for closing an electric switch when the mechanism is wound, and is automatically returned to its original position when the mechanism is unwound, tripping the switch as it returns.



NO. 832,577.—TIME-LIMIT CIRCUIT-BREAKER.

832,577. Time-limit Circuit Breaker. Edward M. Hewlett, Schenectady, N. Y., assignor to General Electric Company, Schenectady, N. Y. Application filed February 11, 1899. Renewed October 18, 1901.

This invention relates to circuit breakers included in each of the lines of a polyphase alternating-current system for the purpose of breaking all the phases in case a predetermined variation of the load from normal has persisted a definite interval of time and also capable of acting without delay in case of a greater or excessive variation of load. (See cut.)

PATENTS THAT HAVE EXPIRED.

Following is a list of electrical patents (issued by the United States Patent Office) that expired on October 8, 1906:

412,234. Sound Transmitter. R. Blake, Cornish, Me.
412,323. Method of Electrolytically Reducing Plates for Secondary Batteries. S. C. C. Currie, Philadelphia, Pa.
412,332. Electrically Controlled Speed-governor Mechanism for Elevators. W. P. Gibson, New York, N. Y.
412,333. Electrically Controlled Valve-operating Mechanism for Elevators. W. P. Gibson, New York, N. Y.
412,345. Frame for Secondary Battery Plates. W. F. Smith, Philadelphia, Pa.
412,346. Connector for Batteries. W. F. Smith, Philadelphia, Pa.
412,347. Connecting Device for Electric Battries. W. F. Smith, Philadelphia, Pa.
412,349. Dynamo-electric Machine. C. F. Winkler, Hoosick Falls, N. Y.
412,350. Commutator. C. F. Winkler, Hoosick Falls, N. Y.
412,351. Dynamo-electric Machine. C. F. Winkler, Hoosick Falls, N. Y.
412,352. Dynamo-electric Machine. C. F. Winkler, Hoosick Falls, N. Y.
412,353. Dynamo-electric Machine or Motor. C. F. Winkler, Hoosick Falls, N. Y.
412,354. Electric-current Indicator. J. J. Wood, Brooklyn, N. Y.
412,361. Ceiling Block for Incandescent Lights. S. Bergmann, New York, N. Y.
412,449. Artificial Resistance for Electric Circuits. C. B. Askew, Chicago, Ill.
412,460. Circuit Closer for Signaling Apparatus. G. D. Burton, New Ipswich, N. H.
412,464. Electric-igniting Device for Lamps. M. Carranza, Guatemala, Guatemala, and Jose M. Tinoco, San Francisco, Cal.
412,476. Electric Conduit. J. P. Cushing, Beverly, Mass.
412,528. Electric Motor for Railway Cars. W. M. McDougall, East Orange, N. J.
412,529. Electric-motion Controller. G. S. Neu, New York, N. Y.
412,530. Electric-signal Controller. G. S. Neu, New York, N. Y.
412,563. Electrical Door Alarm. D. H. Streeter, Norristown, Pa.
412,579. Microphonic Transmitter. B. Abdank-Abakanowicz, Paris, France.
412,580. Telephone-station Apparatus. B. Abdank-Abakanowicz, Paris, France.
412,599. Process of Electric Welding. C. L. Coffin, Detroit, Mich.
412,605. Electric Railway. L. Daft, Plainfield, N. J.
412,639. Secondary Battery. F. M. Lyte, London, England.
412,666. Electric-railway Conduit and Current Plow. J. W. Reno, Denver, Colo.
412,669. Thermo-electric Generator. W. S. DeL. Roberts and J. S. Mollison, Sydney, New South Wales.
412,700. Regulator for Dynamo-electric Machines. W. H. Elkins, Cambridge, Mass.
412,713. Fitting and Hoisting Gear for Electric Lamps. W. B. Sayers, Lisbon, Portugal, and W. H. Sturge, Birmingham, England.

WESTERN ELECTRICIAN

EVERY SATURDAY

Vol. XXXIX. CHICAGO, OCTOBER 20, 1906 No. 16

Producer Gas Plant for Electric Drive in a Modern Factory.

Among the multitude of manufacturing establishments in Chicago few are supplied with more interesting power and lighting equipment than the factory of the Seng Company on Dayton Street. This concern makes hardware specialties for the furniture trade, and it is alert and progressive. It occupies a recently constructed re-enforced concrete building 150 by 130 feet and three stories high. This factory is equipped with all the latest electrical appliances adaptable to the needs of the establishment, including electric stoves for the cooking of the noon-day meal, which is served to the office help, Cooper Hewitt mercury-vapor lamps and machine tools driven by individual motors.

The Cooper Hewitt lamps were tried in the punch-press department, where groups of machines are driven by motors, but did not prove satisfactory owing to the heavy shadows cast by the belts and shafting. In the die-makers' department, where the machines are individually driven, the mercury-vapor lamps have proved most satisfactory, the cost of operation and maintenance being slight, and the light proving less trying to the eyes on fine work than other forms of illumination. Two of these lamps can be seen in Fig. 4 on page 309.

The power plant consists of a suction gas-producing apparatus made by R. D. Wood & Co. of Philadelphia. Two Rathbun gas engines, manufactured by the S. M. Jones Company of Toledo, Ohio, are direct-connected to two direct-current General Electric generators of 55 and 35 kilowatts' capacity, respectively. A 60-ampere-hour storage battery, made by the Electric Storage Battery Company, furnishes current for night lights.

Fig. 2 shows the suction gas generating plant. This type of gas plant gets the title "suction" from the fact that the entire system is below atmospheric pressure, due to the suction stroke of the engine.

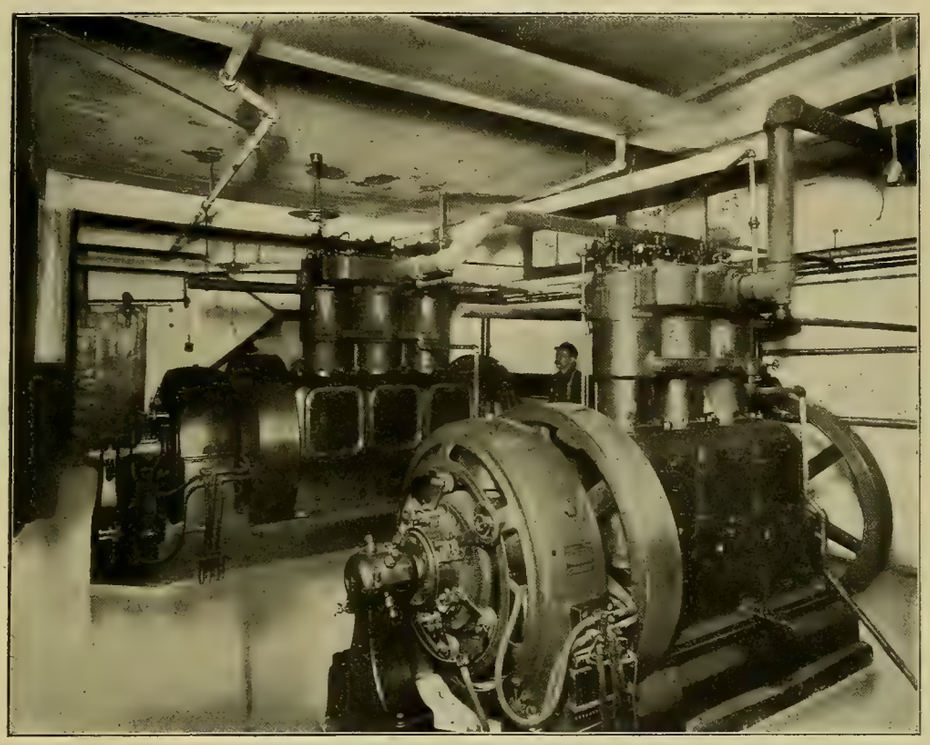


Fig. 1. The Two Gas-engine Units in Power Plant.

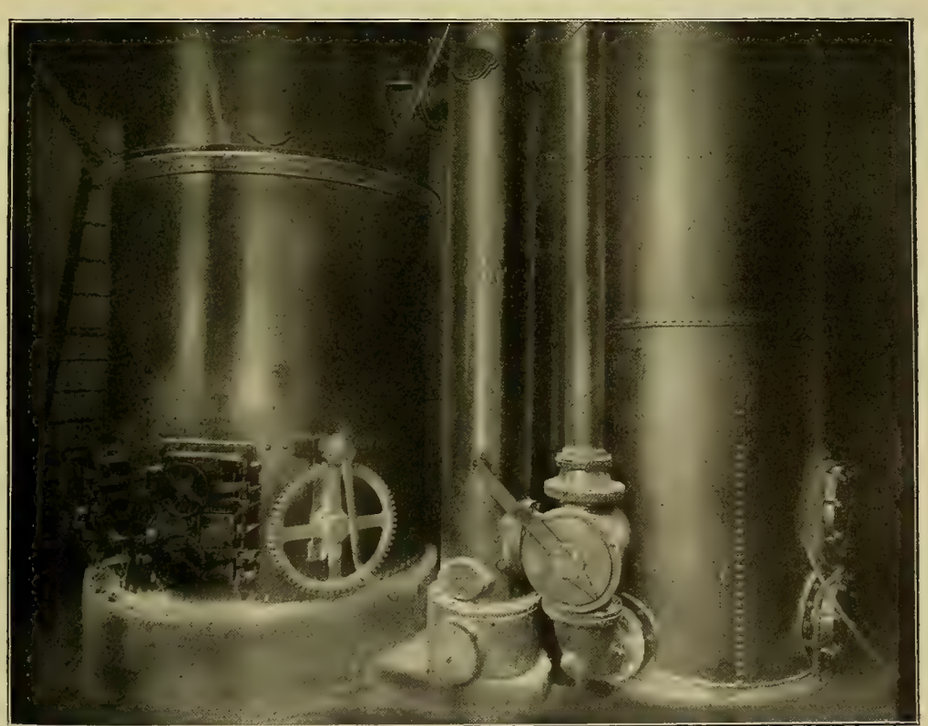


Fig. 2. The Suction Producer Gas Plant.

PRODUCER-GAS PLANT FOR ELECTRIC DRIVE IN A MODERN FACTORY.

The large tank to the left is the generator; the smaller one in the center is the preheater, and the one to the right the scrubber. Air is drawn in at the bottom of the preheater and on its way upward through the air chamber absorbs a portion of the sensible heat of the gas which is passing downward through another chamber, thereby cooling the gas and raising its own temperature. From the preheater the air passes into the upper part of the water jacket of the generator.

The generator is a cylindrical shell about six feet in diameter by ten feet high with a revolving grate at the bottom and lined part way up with fire brick. This is the fire and fuel zone. Above this is the gas zone, from which the hot gas is drawn by the suction of the engine. This section of the generator is surrounded by a water jacket in which steam at atmospheric pressure is generated and from which it is sucked together with heated air to the grate of the generator.

A fire is built on the grate and completely covered with fresh fuel, which consists of anthracite coal, commonly known as No. 2 chestnut. The combustion is carried on by means of the oxygen in the admitted air and also that in the steam which has been decomposed into hydrogen and oxygen. The steam serves the three-fold purpose of:

1. Increasing the calorific power of the gas by adding hydrogen thereto.
2. Obviating the introduction of large quantities of inert nitrogen, which would be the case if air alone were depended upon to furnish the oxygen to carry on combustion.
3. Retarding clinkering by keeping down the temperature of the fire.

The combination of the oxygen with the carbon of the fuel forms carbon dioxide (a non-combustible gas). As this gas, and any oxygen which may remain uncombined, passes upward through the bed of hot unburned fuel, a further combination with carbon takes place, resulting in the formation of combustible carbon monoxide. The gas as it finally passes out of the generator has approximately the following chemical composition by volume:

H (hydrogen)	12.0
CH_4 (methane or marsh gas)	1.5
CO (carbon monoxide)	27.0
CO_2 (carbon dioxide)	5.5
O (oxygen)	1.0
N (nitrogen)	53.0
	100.0

This gives a heating value of 140 British thermal units per cubic foot. Only the first three of these gases are useful in the production of power.

After passing through the preheater the gas enters at the bottom of the scrubber, a cylindrical tank four feet in diameter by 15 feet in height and filled with coke, over which cold water is continually flowing. On its way upward the gas is cooled and cleaned and passes from the top of the scrubber to the engine. The two engines of 85 and 40 horsepower, respectively, shown in Fig. 1, are of the three-cylinder, vertical, single-acting, four-cycle type, running at speeds of 280 and 300 revolutions per minute. The cylinders of the large one are 12 inches in diameter by 13-inch stroke, and of the smaller, nine by 10-inch stroke. The governing is effected by throttling both gas and air, the mixture being maintained in constant proportions at different loads.

With the engine running at full load, the compression is 165 pounds absolute. As the load is reduced, the compression pressure decreases, thereby decreasing the rate of combustion of the mixture in the cylinder. Under these conditions, to obtain

maximum temperature and pressure at the very beginning of the power stroke (which is another way of saying to obtain good fuel economy) the time of ignition should be advanced as compared with that at full load. In the Rathbun engine this is automatically taken care of by an auxiliary device on the governor. Fig. 6 illustrates this point. The diagrams were taken from a 60-horsepower engine, with loads of 10, 60 and and 80 horsepower, respectively, without making any manual adjustment of the ignition.

For starting an S. M. Jones air compressor is provided with the engine, and this is driven with a six-horsepower gasoline cylinder arranged in tandem with the air cylinder. The apparatus forces air into three tanks, one of which is shown in the background in Fig. 3, at 200 pounds pressure, which is admitted to one of the gas-engine cylinders while the other two are run as gas cylinders. After one or two revolutions the gas cylinders will take up the load, so that the air can be shut off and the first cylinder operated on gas.

Ignition current for the engines is furnished by Remy low-tension magnetos geared to the secondary shaft, with a small storage battery as an auxiliary source of current.

Cooling water is supplied from the city mains. The hot water from the engine jackets is utilized in the producer, while that from the igniters and exhaust valves (both of which are water cooled) is discharged into the exhaust.

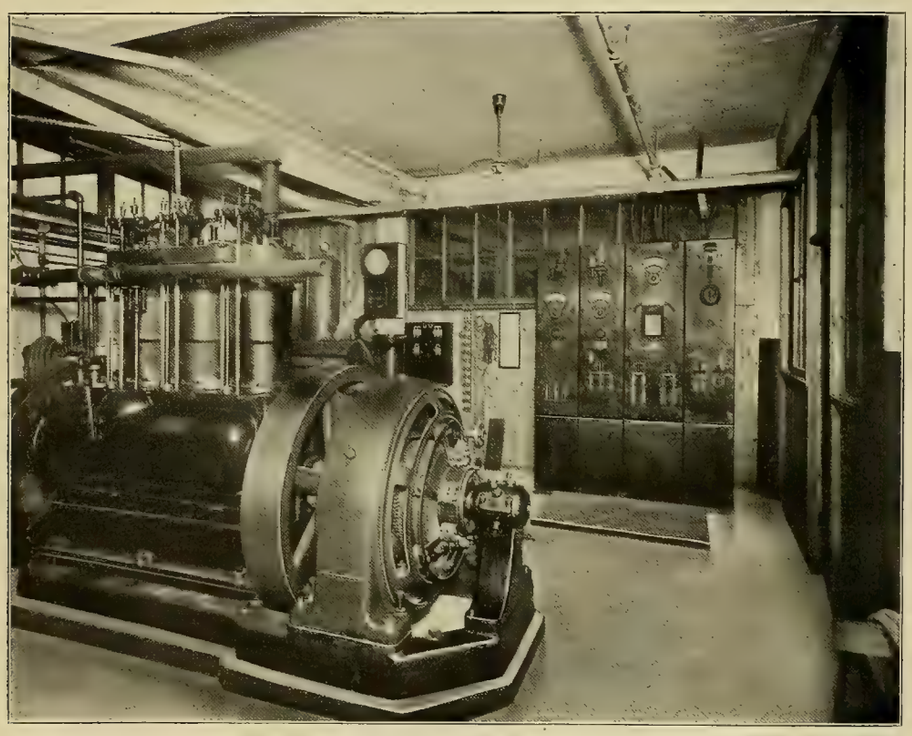


FIG. 3. GAS-ENGINE PLANT IN A MODERN FACTORY.—VIEW SHOWING SWITCHBOARD AND COMPRESSED-AIR TANKS FOR STARTING.

Fig. 3 shows the switchboard containing two generator, one feeder and one storage-battery panel furnished by the General Electric Company.

The average efficiency of a producer gas plant may be taken at about 84 per cent. Assuming the calorific value of medium-grade anthracite coal as 13,000 British thermal units per pound, the heat available at the engine is 10,920 British thermal units. Approximately 10,400 British thermal units should be expended in producing one brake horsepower per hour in a well-designed engine. The gas plant should therefore give a duty of 1.05 brake horsepower per pound of coal, or a brake horsepower per hour on less than one pound of coal with the plant running at its rated capacity. The Seng Company's plant at present is delivering an average of 75 horsepower, with a coal consumption of 1.4 pounds of coal per horsepower-hour. With the plant running at its full capacity, it will undoubtedly secure results of one pound per horsepower-hour.

The building is heated by a low-pressure vacuum system; and one man runs the entire power plant and also fires the boilers for the heating system.

Current is used for light, power and heat, as stated. Fig. 4 shows a motor-driven, 18-inch lathe, a motor-driven No. 2 plain milling machine and a motor-driven press drill. In Fig. 5 a triplex pump direct-driven by a four-horsepower motor is shown at the right. This pump raises the water to the roof tank to supply the high-pressure fire sprinkler system. The smaller one at the left is a direct-driven, two-cylinder air pump which serves to put the fire system under a pressure of about 75 pounds.

The engineering and installation of the plant was done by Mr. C. A. Barton, Jr., a Chicago consulting engineer who is specializing in producer-gas and gas-engine work.

Dynamos Driven by Windmills.

While the utilization of elemental forces for the production of electrical energy is making wonderful strides in the case of hydro-electric development, engineering progress has been very slow in the field of generating electricity by the use of one of the oldest, if not the oldest, of the world's prime movers—windmills.

This is a subject of much practical interest to many thousands of Americans, for throughout the farming and suburban regions of the country countless windmills of an efficient type are rendering only partial service for lack of something to do. The great drawback to their use in driving dynamos is the intermittent nature of their operation owing to irregular wind supply. Storage batteries may be used, of course, but the average farmer is not sufficiently desirous of electric power to spend the money for an expensive plant. But perhaps no machine so far invented requires as little attention and as low a cost for repairs as the windmill, so that if the reserve power for calms could be obtained from the windmill itself by some ingenious accessories, a great desideratum would be attained.

In the Western Electrician of September 15th one attempt at solving the problem on these lines was described. When the wind blows the mill can furnish more power than is needed to drive the dynamo. This power should be stored up somewhere and somehow. In the case referred to the surplus power is used to store up potential in water by lifting it. An objection would seem to be the great size of accumulator necessary to store up sufficient power for use during a long period of calms. To meet this the inventor has provided a storage battery, which in this case can be made small enough to escape the objection of excessive first cost. What success this arrangement has met in practice does not appear, but whatever mechanical application may prove successful the principle of letting the windmill do the work is to be preferred, obviously, to the use of accessory prime movers.

A novel method of solving this problem has been originated by a Chicago inventor. He does not drive the dynamo by the windmill directly but interposes a motor driven by compressed air which is pumped into tanks by a wind-actuated pump. A spring-loaded valve starts the air-pumping operation whenever the tank pressure falls below a predetermined amount. Driving the dynamo by a governed air motor of constant speed should secure remarkable improvement in light service over the direct windmill drive, owing to necessary irregularity of the latter. At the same time the use of air as storage medium obviates the necessity of making the reservoir unduly large. For generating four horsepower this inventor uses a three-cylinder recipro-rotating air motor of 2½-inch diameter by 1½-inch stroke, turning at 746 revolutions per minute and having two per cent. clearance. Such a motor would use 9.72 cubic feet of air per minute, or 5,832 in 10 hours, the extreme limit of probable running per day, if one considers the plant to be on a farm. Compressing to 139.92 pounds absolute or 125.22 pounds per gauge, a tank having a capacity of 1,166 cubic feet would run this air motor and dynamo for 10 hours and leave a working pressure of 53 pounds absolute in the tank. This is based on the assumption that no wind strong enough to turn the mill blew during this day, which is quite unusual. It may readily be seen that by using a storage battery of relatively low cost the tank capacity could be reduced to that of a cylinder 10 feet long by eight feet in diameter, while providing for all contingencies reasonably to be expected. As the temperature of compression to 139.92 pounds absolute is 245 degrees F., an extension of this invention might be the production of a heating system by using the compressor jacket water. It is not contemplated to produce the pressure mentioned in less than two stages of compression.

In connection with this subject the results of two years' experience in operating the windmill-driven electric plant at Askov, Denmark, described in the Western Electrician of May 20, 1905, will be of interest.

Professor P. LaCour, of the Askov Popular Academy, who designed many novel features of this plant, states that the installation supplies 450 incandescent lamps as well as some arc lamps and a few motors. The capital cost of the plant is given at $4,412.88. Expenditures are as follows: Supervision, lubrication and running expenses of windmill, $53.46; running of oil engine (30 days out of the year), $31.59; fuel for engine, $53.46; lubrication, $19.44; aggregating $157.95. As the receipts amounted to about $680, the profit was nearly 12 per cent. on the investment.

With a small windmill of 129 square feet of sail area, measurements taken with the wind blowing at 19.7 feet per second showed the theoretical output of about two horsepower was reduced by 14 per cent. in practice owing to frictional resistance, inefficiency of sail area and internal losses.

To provide for calms it is necessary to have some kind of reserve. Prof. LaCour recommends the use of an interal-combustion engine for this purpose, in preference to accumulators, as those large enough to meet all possible cases are too expensive. Technically, Professor LaCour considers the mill of four sails preferable. He uses the plane-surface type of sail, so common in Europe and long ago replaced in this country by the sails or wings made up of a number of blades, resulting in a decidedly greater effective wind-pressure area for equal diameters. Encouraging as the results of the Danish experiments are, no doubt a higher efficiency would have been obtained by the use of the American type of windmill.

Reduced Light and Power Rates in San Francisco.

Improvement is reported in the gas and electric service of the San Francisco Gas and Electric Company under the new holding company known as the Pacific Gas and Electric Company. The growing competition of the San Francisco Coke and Gas Company's service resulted in the cutting of gas rates to 85 cents a thousand by the big company, provided the consumer uses at least 10,000 cubic feet per month. The San Francisco Gas and Electric Company has now announced a graduated scale of reduced rates to large consumers of gas, making the rate practically 60 cents a thousand when over 75,000 cubic feet of gas is consumed monthly.

A reduction has also been made on electric current by the same company, which now has practically a monopoly of commercial electric light and power in San Francisco. By these recent reductions the company has cut below the established municipal rate in both electricity and gas in certain quantities. On electric lights the municipal fixed rate ranges from nine to 5.4 cents per kilowatt-hour. The new electric lighting rates are, according to gross quantity used, as follows: Upon the monthly consumption of from 375 to 649 kilowatt-hours, 5¼ cents per kilowatt-hour; from 650 to 924, five cents; from 925 to 1,199, 4¾ cents; from 1,200 to 1,474, 4½ cents; from 1,475 to 1,749, 4¼ cents; and from 1,750 upward, four cents.

On electric power the reduced rates are as follows: Upon a monthly consumption of from 375 to 449 kilowatt-hours, 5¼ cents per kilowatt-hour; from 450 to 549, five cents; from 550 to 1,099, 4½ cents, and from 1,100 upward, four cents.

Brilliancy of Lighting Units.

In a paper entitled "Data on Indoor Illumination," by Mr. J. E. Woodwell of Washington, D. C., read before the Illuminating Engineering Society in New York on October 12, the author said:

In the following table the intrinsic brilliancy of a number of common light sources is shown in candlepower per square inch on the assumption of a uniform light intensity over the surfaces considered:

Moore tube	¼	to	1½
Gas arc lamp	1	to	2—alabaster globe.
Candle	3	to	4
Cooper Hewitt lamp	3	to	6—approximate.
Incandescent, frosted	2	to	8—depending upon efficiency and style of bulb.
Kerosene-oil lamp	3	to	8
Mantle burner	20	to	25—unshaded
Acetylene flame	75	to	120
Enclosed arc	100	to	200—depending upon globe used.
Incandescent lamp	100	to	300—bare.
Nernst lamp	800	to	1,000—bare.

A test made at the Electrical Testing Laboratories using Lummer-Brodhun and Bunsen photometers and a 100-candlepower standard incandescent lamp, mounted at the same distance from the photometer as the mercury-vapor tube (type H) with a luminous length or 21 inches, gave the following result:

Distance.	Candlepower of Tube.
12 feet	178
8 feet	169
4 feet	164

While this test is not exhaustive, it serves to show that the candlepower emitted from the tube at distances over four feet from its center and along a line perpendicular to its length does not vary materially from the photometric law.

As a brilliancy in excess of five or six candlepower per square inch produces retinal fatigue and irritation, it will be seen that the most common illuminants require shades or enclosing globes if placed within the field of vision. Even where illuminants of great brilliancy are located out of the field of vision, care must be taken to avoid regular reflection from objects to the eye, as light of comparatively low intensity entering the eye at an unusual angle is quite as detrimental as excessive brilliancy in the direct line of vision.

Two practical methods are available for reducing the injurious direct and indirect effects of an illuminant of great brilliancy. The light source or sources may be enclosed in an opal or ground glass globe of proper size to reduce the intrinsic brilliancy to a safe amount, or in the case of incandescent electric lamps the result may be accomplished by frosting and by the subdivision of the lighting units into those of small candlepower. The other method consists in placing the light source entirely out of range of direct vision and securing the desired illumination by diffuse reflection from a ceiling or cove. Both of these methods result in a loss of efficiency, but may be justified by an actual increase in effective illumination.

In the discussion which followed this paper Mr. L. B. Marks of New York said: "I would suggest that somebody obtain data to add to this table upon the actual intrinsic brilliancy of daily illumination. I think you will find it is very much less than any of the data given in the paper. The lowest figure which Mr. Woodwell gives in the latter part of his paper is one-ninth candlepower per square inch. I think it will be found that in a well-illuminated room in the day time, with ground-glass windows, you will have as low as a fiftieth to a one-hundredth candlepower per square inch, and that is what we want to get to. Our sources of illumination are entirely too bright. Even in the best-designed layouts, the intrinsic illumination does not come anywhere near the figure which we obtain in the measurement of an ordinary ground-glass window in good daylight. I may say that I have made quite a number of such measurements myself, but I am not prepared to give them now as guaranteed, not having the calculations here; but I presume they are as nearly correct as those in the paper given."

The Current Transformer.[1]

By Kenneth L. Curtis.

This apparatus is not to be mistaken for the appliance used to step up or down the voltage in transmission lines. The current transformer here discussed is the instrument used as a meter auxiliary in connection with alternating-current ammeters and wattmeters. Its use becomes absolutely necessary in either of the following cases: First, when the voltage of the circuit is so high as to render it unsafe to connect the instrument directly into the circuit; second, when the current to be measured is greater than the capacity of the instrument, and conditions prevent the use of a shunt. In the first instance the transformer insulation is made sufficient to protect the instrument from the high-voltage circuit. In the second case the ratio of turns is made such that the current through the instrument is within its capacity. In nearly all cases of alternating-current measurements one or both of these conditions are met with.

The current transformer, like all other transformers, consists of an iron magnetic circuit interlinked with two electric circuits. The primary is connected in series with the line, the current of which is to be measured, and the secondary is connected to the instrument terminals by leads of low resistance.

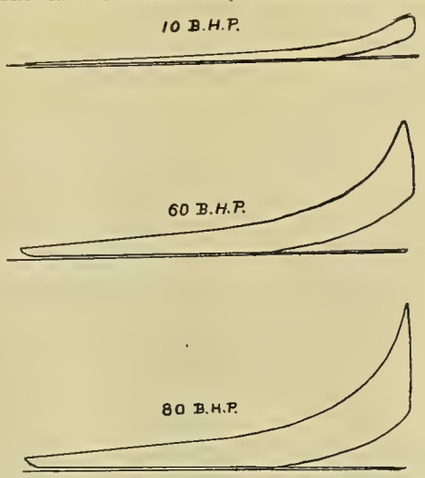


FIG. 6. INDICATOR DIAGRAMS FROM 60-HORSEPOWER GAS ENGINE AT VARYING LOADS.

In order to predetermine the behavior of a transformer it is in general necessary to know, first, the resistances and reactances of the primary and secondary windings of the transformer and of the external secondary or load circuit; second, the amount and power factor of the exciting current at the various operating flux densities in the transformer core.

The author demonstrates mathematically that the behavior of the transformer may be predetermined by the determination of the resistance and reactance of the secondary current, and of the amount of the two parts of the exciting current—the wattless component and the power component due to hysteresis and eddy currents. He gives ingenious methods of arriving at the value of these quantities. Strikingly novel is the method of determining the reactance of the secondary circuit by the use of a hot-wire voltmeter of extremely low range. This value was obtained for several instruments and is here given in volts per ampere.

Five-ampere indicating ammeter.....x = 0.0390
Three-ampere recording wattmeter.....x = 0.0842
Two-ampere indicating wattmeter.....x = 0.1205
Three-ampere indicating wattmeter.....x = 0.2140
Two-ampere indicating ammeter.....x = 0.2930

As conclusions of this investigation we may say that the factor which prevents a constant ratio of secondary to primary current for all loads is the exciting ampere-turns. The smaller these are in proportion to the total ampere-turns of the transformer and the lower the power factor of the exciting current the more nearly will we approach a constant ratio.

Assuming the secondary to have as low resistance and reactance as is practicable, to obtain the best results we must make the magnetic circuit so as to have as low values of reluctance, hysteresis and eddy currents as possible. That is to say, if the secondary has as low resistance and reactance as is practicable the best current transformer will be the one containing the most iron of the best quality in the form of the thinnest laminations.

Discussion.

Louis T. Robinson of Schenectady stated that in the recent practice of the General Electric Company the exciting current and the internal losses in the current transformer are determined directly by means of sensitive alternating dynamos. He connected this subject with that of Dr. Bedell and Mr. Tuttle's paper (see Western Electrician of October 6, 1906, page 269) by showing that the measurements were seriously affected by wave distortion and explained a practical method of deducing the existing current from the ratio of currents and the phase angle between the primary and secondary, using sensitive dynamometers and a phase-shifting device. He emphasized the importance of securing good iron for the core, which must be of very low density, and cited a transformer recently made by the General Electric Company to meet some special conditions. Using this transformer between one-tenth load and full load, the maximum deviation from the marked value was hardly more than one-half of one per cent. and between limits somewhat greater than this the deviation has been one per cent.

Mr. Robinson brought out the fact that by properly arranging the power factor of the secondary load it was possible to bring the phase angle between the primary and secondary currents into actual coincidence, and showed the importance of this relation in many cases where very accurate work must be done with these transformers.

1. Summarized from a paper read and discussed at the meeting of the American Institute of Electrical Engineers, New York, September 28, 1906. The author is instructor in Stafford University.

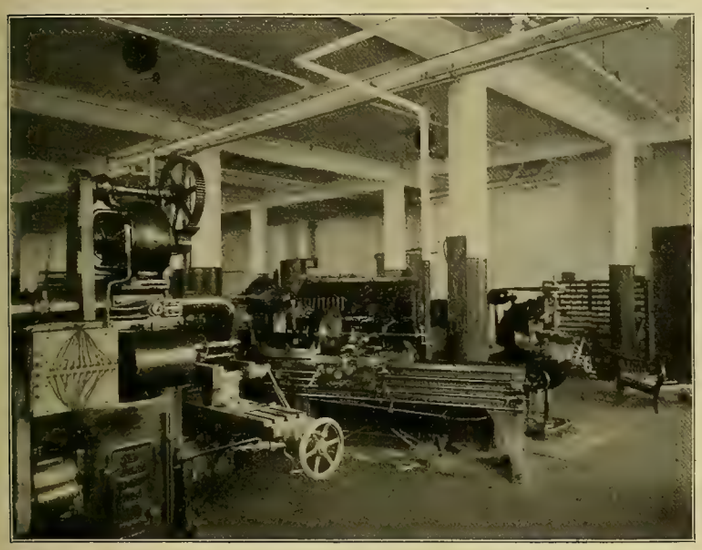


Fig. 4. Milling Machine, Lathe and Drill Electrically Driven.

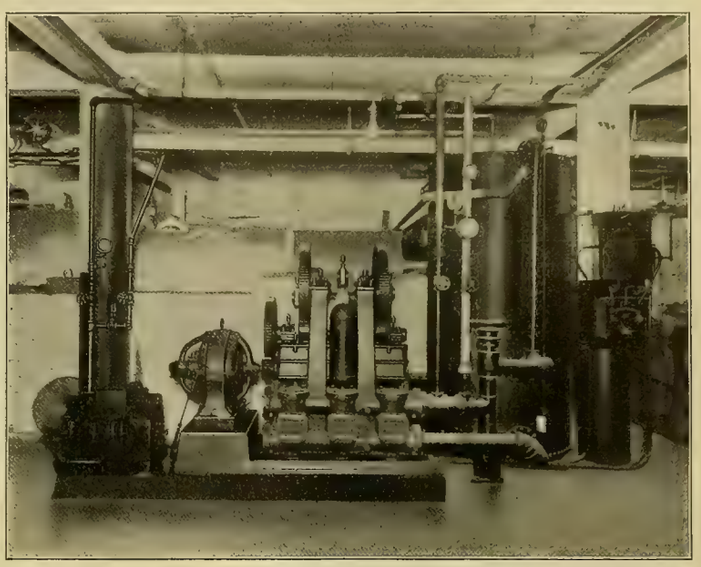


Fig. 5. Motor-driven Triplex Fire Pump.

ELECTRIC DRIVE IN A MODERN FACTORY WITH PRODUCER-GAS PLANT.

Municipal Trading Blunder.

A newspaper dispatch dated at London, October 11th, says: "The Marylebone Borough Council was fined £60 yesterday under its own electric-lighting ordinance. It appears that the municipality, after acquiring its lighting powers through a bad bargain, is unable to administer them within the terms of the law. The Pall Mall Gazette says to-day: 'Municipal trading has always shown a list in the direction of bankruptcy, but it is the crowning touch when it cannot escape the jurisdiction of a police magistrate.'"

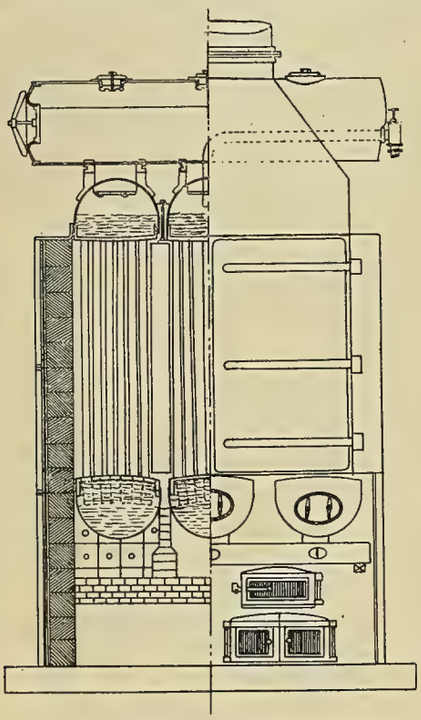
Engineering and Machinery Exhibition in London.

[From the London correspondent of the Western Electrician.]

London, October 3.—The engineering and machinery exhibition now being held in London calls attention in a more marked degree, singularly enough, than did the purely electrical show last year, to the application of electrical driving to machine tools, while there is also a greater amount of heavy machinery of an electrical and allied character. In fact, the latter element was almost entirely absent from the electrical exhibition of 1905. The presence, also, of a number of American machine tools lends additional interest, although, from the national point of view, some satisfaction is gained from the circumstance that the greatest novelty in this direction is a home product.

Electric Drive.

The exhibition gives further evidence of the possibilities of chain driving, where a suitable noiseless medium with the minimum of friction can be procured, there being several examples of the application of the Westinghouse Company's Morse chain to such heavy machinery as joist shears, angle and T-bevel croppers and notching machines. The size of individual motors for driving single machines ranges up to 60 horsepower, this latter being applied



NEW WATER-TUBE BOILER EXHIBITED IN LONDON.

to an 18-inch center lathe, which will admit 10 feet between centers, the motor being of the three-to-one variable-speed type. The lathe is capable of taking a cut 1¼ inches deep by one-fourth inch traverse at 30 feet per minute, the speeds varying, with the cuts, from 30 to 400 feet per minute.

A New Water-tube Boiler.

Before mentioning the most novel machine tool on view reference may be made to a new water-tube boiler which is shown at work supplying steam to a 220-kilowatt, 220-volt generating set which meets the wants of the exhibitors for lighting booths and driving working exhibits. This boiler, shown in the diagram, consists of vertical straight tubes built up in pairs of semi-cylindrical top and bottom half drums, which are united by a number of tubes of suitable diameter and length, varying according to the heating surface and horsepower required, the nature of fuel to be used and the method of stoking. The bottom drums form the roof of the furnace, the upper drums forming the roof of the tube chamber, with a steam receiver above. The boiler is slightly raised at the back and a brick-lined combustion chamber is provided at the rear of the furnace. There are no external downcomer tubes. About two-thirds, or half, of the back-end tubes act as the upcast, and the other third or half act as downcomers, according to the rate of working.

Between the elements of the boiler are inserted, horizontally, superheater tubes extending to about three-fourths of the length of the tube chamber. The feed heater, or economizer, is placed in the smokebox below the base of the funnel. The travel of the gases is similar to that in the dry-back or marine type of boiler. The furnace being below the lower drums, the gases therefrom pass over the bridge and into the brick-lined combustion chamber, where they are mixed with hot air conveyed through the hollow fire bars. In this way it is asserted that complete combustion of the gases is insured before entering the tube chamber. The boiler shown measures seven feet across the base, nine feet nine inches long and is 13 feet six inches high, being capable of evaporating 8,000 pounds of water per hour. The efficiency is given at over 86 per cent. One test carried out by Mr. W. H. Booth gives an over-all efficiency of boiler, economizer and superheater of 86.342 per cent.

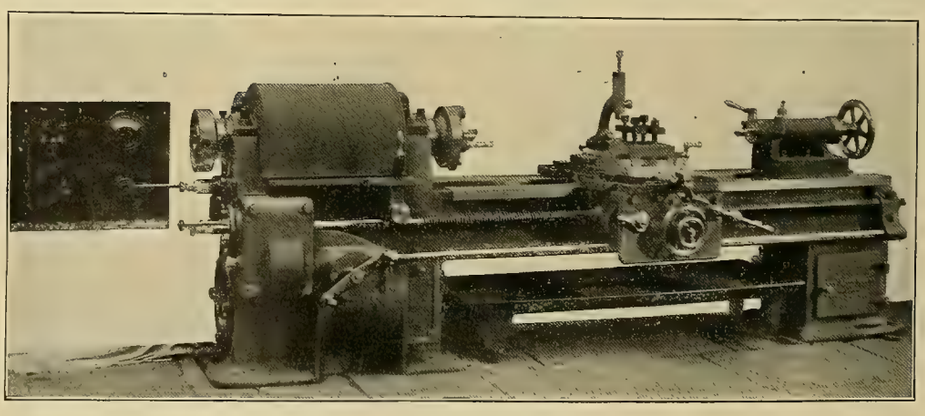
High-speed Electrically Driven Lathe

As stated before, the greatest departure in machine-tool design, electrically speaking, is to be seen at the stand of a British firm, J. Sterk & Co. of Halifax, their exhibit consisting of an eight-inch high-speed lathe, a 30-inch boring and turning mill and a six-inch slotting machine, all fitted with a patent electric drive. The illustration shows the lathe. In this case there is a 7½-horsepower motor, combined with the box end, running at any speed between 400 and 1,200 revolutions per minute. The motor has a three-to-one speed variation, shunt regulation alone being employed. The controlling apparatus, as is seen, is mounted close at hand, one rod connected with the switch having also a connection with a hand-wheel on the slide rest, so that the speed can be varied at once without the trouble of the workman leaving the lathe for the switch panel. The boring and turning mill and the slotting machine have motors fitted into the backs of their upright frames. Chain drive is used in all cases, but is invisible.

The interest in the remaining machine tools is chiefly in their mechanical design, the electric drive being universally by separate motors bolted close to the machine, and either driving through gearing or through a chain.

Electric Fountain and Air Circulator.

Reference has already been made in my weekly notes to the patent fountain of light and air circulator at the exhibition. This is 33 feet in height and hexagonal at the base. Surrounding the fountain arrangements, including an internal tank cadiameter, and immediately above this are the fountain arrangements, including an internal tank capable of holding 400 gallons of water. The water is circulated to the top of the fountain by means of an electrically driven pump in the base, and through the domes at the rate of 1,500 gallons per minute, and is there formed into a solid cylinder of water four feet in diameter and about 12 or 14 feet in length. Jets from below merge into the solid ring of falling water, and the air, which the installation handles, after being washed and cooled, is afterward blown out again. Immediately behind the main cylinder of water is a series of colored electric lights which at night-time heighten the pleasing effect of the falling water by continual change of hue. At the top of the fountain, also, are 11 large colored hanging globes, with one large circular globe at the apex.

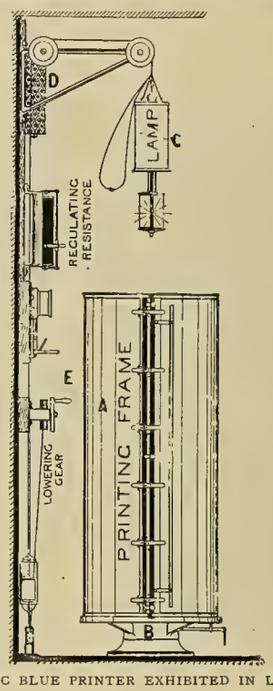


HIGH-SPEED ELECTRIC LATHE EXHIBITED IN LONDON.

In the pedestal of the fountain are six 18-inch electric fans which assist in the ventilation work generally, drawing in air through grids near the floor level, expelling it at the rate of 20,000 to 22,000 cubic feet per minute.

Automatic Electric Elevator.

Another piece of machinery which, curiously enough, did not make its appearance at the electrical exhibition last autumn is an improved automatic electric elevator of the Richmond-Carey type. Although some reticence is shown in giving exact detailed information, it is certain that great improvements have been made over older types. The company makes passenger elevators, combined freight and passenger elevators and freight elevators. In the two first named the connections are so arranged that the elevator can be brought to any desired floor from the outside by a would-be passenger and then controlled from the inside, while in the case of the freight elevator the action of pressing a certain button sends the elevator to the required floor without



ELECTRIC BLUE PRINTER EXHIBITED IN LONDON.

attendance. For the passenger elevator the chief advantage claimed it that since the circuit = opening device is upon the elevator itself, and the contact piece at each floor, the cage must always stop approximately where required, and is independent of any stretching of the ropes. In all three types the action has now been made the same, the difference being in the number and location of the push buttons.

Originally, the freight elevator was controlled by means of a contact arm moving over a series of fixed contacts. Now, however, all the buttons on the several floors are connected in series with relays. The pressing of a button feeds current to the reversing "up" or "down" solenoid, reversing switches being fixed at each floor, and when the button is released the relay maintains the circuit belonging to the desired floor to which the elevator is to be brought, and opens the reversing switch when the elevator arrives there. The whole point of the system is, of course, to arrange the connection so that the elevator will not be interfered with in any way by pressing of another button while it is in motion, and that this has been accomplished is amply proved by ocular demonstration both on the models and in the numerous installations that are in practical operation.

Electric Blue-printer.

The copying of engineering drawings and tracings has received much attention in England of late years, and electricity has been largely called into requisition. With all systems of blue-printing and similar copying there has existed the difficulty that distortion and shrinkage occur, thus rendering the resultant print hardly true to scale. New systems called "velography" and "ordoverax" have been evolved which, it is said, avoid these shortcomings and have

the further advantage that the prints may be made upon a wide range of papers or linens. There are also several "rotary" or continuous photo-printing systems on show, the machines only having to be fed continuously, the lowering and raising, automatically, of the arc lamp giving the requisite exposure. In one such there is a specially constructed arc lamp furnishd with a circuit resistance up to 200 volts continuous current.

The accompanying diagram shows a piece of apparatus which, although not of the "rotary" type, takes practically all the ordinarily sized prints. The machine consists of a cylindrical glass frame (A), mounted on stand (B). The tracings are wrapped around the outside of the cylinder and contact is obtained by means of suitable covers provided with eyelets to slip on to pins projecting from a vertical steel rod, by revolving which the covers are drawn tightly around the glass. The arc lamp (C) is suspended by wire ropes passing over the pulley (D), and is gradually lowered throughout the cylinder, either by stages of about eight inches at a time, with an interval of rest between, or by means of the patent automatic gear (E). This latter has pendulum adjustment, or a silent-running fan escapement gear, the speed being regulated by adjusting the vanes of the fan.

One of the continuous copiers is driven by an electric motor which is adjustable to the various speeds necessitated by the various processes. G.

Electric Plants and Line Construction for the Simplon Tunnel.

By A. de Courcy.

Electric trains have been running in the Simplon Tunnel and upon the adjoining sections since the 1st of August, and the line may now be considered as in practical operation. It will be remembered that the trains are taken over this section by a type of three-phase locomotive (previously described in the Western Electrician) furnished by Brown, Boveri & Co., using 3,000-volt current from a double overhead wire. The total length of the tunnel is about 12.5 miles, and current for the line is supplied at present from two hydraulic stations, one of these lying at Brigue, on the Swiss side, and the second at Iselle, on the Italian side of the tunnel.

For the hydro-electric station of Brigue, the dam which is erected across the Rhone at this point gives a head of 150 feet. Leading from the canal is a penstock having 5.2 feet inside diameter, which supplies the wheels located in the turbine house. The turbine outfit in this case consists of two separate wheels of the Escher-Wyss pattern, coupled together upon a common shaft, the total capacity of the turbines being 1,200 horsepower. A long shaft passes from the turbine room into the dynamo room through an opening in the wall, and upon the outer end is mounted the main alternator of the station. This machine is of the revolving internal-field type. At the normal speed the alternator works at 3,000 volts and 15 cycles.

In the Brigue plant the turbines are not provided with an automatic speed-regulating device, so that in order to take up the full power of the turbines the alternators are run upon a liquid resistance which is placed in parallel upon the terminals. By varying this resistance an artificial load is provided which keeps the whole load on the machine at a constant value. The liquid resistance which is used here consists of a water tank containing a set of iron plates, arranged so that the plates can be raised or lowered in the tank.

On the Italian side of the tunnel, at Iselle, is located a second hydraulic plant, which corresponds in many respects to the former. In this case the Diveria River furnishes the power. Like the Brigue plant, the station, at least the hydraulic part, was erected during the work upon the Simplon Tunnel. At present it has been transformed into a generating plant for the electric road by the addition of a set of machines, including Swiss-built turbines and a three-phase alternator. The latter machine is designed to give 1,500 horsepower, and it operates at 960 revolutions per minute as a standard speed.

Coming to the track construction within the tunnel, and the method of installing the overhead line for the three-phase locomotives, which are supplied at 3,000 volts taken off the line by a double-frame trolley, I may mention that the track of the road upon the section lying between Brigue and Iselle is built of rails varying in weight, but on the average having near 60 square centimeters section. The method of rail joint which is used here consists in smoothing off the ends of the rails and cleaning them where the fish-plate is to be bolted on. The surface is coated at these ends with a specially-prepared metallic paste, after which the fish-plates are fixed in place. It is said by the Brown-Boveri Company, which has adopted this system, that it answers as well as a rail bond, and when once in place it will hold up well, and thus avoid having to look after the rail bonds in the part within the tunnel.

Above each track are mounted two line wires, while the rail serves as the third conductor. Fig. 1 shows a view of the tunnel and the appearance of the track and the overhead system. In the tunnel

FIG. 1. OVERHEAD CONSTRUCTION IN SIMPLON TUNNEL, SHOWING AUTOMATIC SWITCH.

the road is single track, except at a specially arranged point in the middle, where there is a double track section of short length to allow the trains to pass. As will be remembered, it is the intention to use a double tunnel through the Simplon. At present there is but a single tunnel finished, but the parallel side galley occupies the place which will ultimately be taken for the second tunnel. In the middle portion this galley has been enlarged to the standard section, so as to give room for the second track, as above mentioned. In Fig. 1 the overhead construction represents a special device for disconnecting the overhead line, and the standard line construction is not seen. The latter consists of a steel cross wire held at each side of the tunnel by an insulating support fixed in the wall. The cross wire is coated with copper in order to preserve it from rusting, and

FIG. 2. YARDS OF SIMPLON TUNNEL ELECTRIC RAILWAY AT BRIGUE, SWITZERLAND, SHOWING OVERHEAD CONSTRUCTION.

like precautions are taken with the other metal pieces. Two special insulating supports are hung from the cross wire in order to hold the trolley line, and the latter is suspended at 4.80 meters above the rail level within the tunnel. On the sections outside of the tunnel the height of the trolley wire varies from five to 5.2 meters. In all cases the distance between the two trolley lines is one meter.

In the sections lying outside the tunnel the trolley wire is held in about the same way from a steel cross wire, but the latter is stretched between supports which are formed of gas pipe. (See Fig. 2.) For the side poles two lengths of pipe, and sometimes three, are mounted so as to form a tapering pole, being imbedded in a foundation of beton. On these sections of the road there are usually a number of parallel tracks, so that one such pole is placed between each track, and the whole row of six or more poles is braced across by a continuous line of piping of the same section, so as to make a solid construction. Steel guy ropes are also used to brace the whole. Such an arrangement has the advantage of taking up but a small space upon the track, and it does not obstruct the view of the signals.

The feeders, at 3,000 volts, which lead from each of the hydraulic stations in order to supply the overhead line, consist of concentric cables within the tunnel, and of bare wire for the outside sections. In the view of the tunnel the feeders are at the left, being mounted upon porcelain insulators fitted upon wall brackets. The concentric cable has two conductors of 100 square millimeters each.

In general, the system of feeders lying between the two stations and including the tunnel portion is arranged in sections so that the different parts can be fed from either of the two stations independently or by the two plants running in parallel.

Electric Plant for a Group of Michigan Mines.

A large electric plant designed to furnish motive power for the operation of its mines and stamp mills on the South Range, near Hancock, Mich., is planned by the Cooper Range Consolidated Mining Company. It will be located in the vicinity of Portage Lake and will represent an expenditure of $500,000. Engineers are now at work on the plans and specifications, and it is expected that construction will be undertaken at an early date. The mines which it is proposed to run by the new plant are the Baltic, Trimountain, Champion and Globe, and corresponding changes will be made at the stamp mills at Freda, Beacon Hill and Redridge.

Flow of Water in Drainage Canal.

Various commercial organizations are joining with the trustees of the Chicago Drainage Canal in offering resolutions and protests against the recommendation of the International Waterways Commission to limit the flow of water in the canal to 10,000 cubic feet a second. The commission met in Chicago on Tuesday and Wednesday of this week and heard Chicago's case presented by Robert R. McCormick, president of the board; Isham Randolph, chief engineer of the canal; Erasmus C. Lindley, attorney for the Sanitary District, and B. A. Eckhart, chairman of a joint committee appointed recently by several organizations to formulate an appeal.

Plaster of Paris as a Light Reflector.

At a recent meeting of the Illuminating Engineering Society Mr. A. H. Elliott made the following rather interesting statement:

"Some years ago I had a good deal of work to do in conjunction with photographic work and colors, and I was very much struck by the researches of some of the German workers who determined the amount of light reflected from certain surfaces. It may be well known to you; but the thing that struck me most forcibly was the fact that plaster of paris, pure plaster of paris, clean, would reflect 80 per cent. of light that fell on its surface. Now, if that is true, that seems to me a means of distributing light uniformly, without losing very much of it. In other words, it would be better to let the light strike a white plaster of paris surface, and then be distributed, rather than to have an intense point of light that we take a great deal of trouble to tone down by a series of glasses that cut out anywhere from 15 to 50 per cent. of the light that we have taken the greatest trouble to produce."

WESTERN ELECTRICIAN

EVERY SATURDAY.

PUBLICATION OFFICES:

507 Marquette Building, - CHICAGO.

TELEPHONE, MAIN 1746.

Eastern Office, 150 Nassau Street, New York.

Telephone, 8220 Beekman.

Trade Supplied by Western News Co.

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SUBSCRIPTION, in advance, postage prepaid, $3.00 for a full year of 52 numbers; in clubs of four or more, $2.50, with free extra copy for eight subscriptions; foreign countries, $5.00 a year; single copies, 10 cents. When change of address is requested, the **old address** as well as the new should be given.

CORRESPONDENCE relating to electricity or any of its practical applications is cordially invited, and the co-operation of all electrical thinkers and workers earnestly desired. Clear, concise, well written articles are especially welcome; and communications, views, news items, local newspaper clippings, or any information likely to interest electricians, will be thankfully received and cheerfully acknowledged.

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REMITTANCES.—All checks, drafts and other remittances should be made payable to the order of the publishers, the **Electrician Publishing Company,** and addressed to the offices of publication, Suite 507, Marquette Building (204 Dearborn Street), Chicago, Illinois, U. S. A.

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A STRUGGLE between financial magnates is reported to be under way for the control of the Illinois Central Railroad. Let us hope that whoever wins will be possessed of sufficient wisdom to delay no longer the greatly needed electrification of the suburban service in Chicago.

A FACTORY plant employing not only individual electric motors to drive the machines, but mercury-vapor lamps, electric cooking apparatus for use in preparing luncheon for the office help and a producer-gas plant for the gas engines driving the electric generators, is certainly out of the ordinary and entitled to be described by the over-worked expression "up-to-date." An installation having this interesting combination of apparatus is briefly described in the first-page article in this issue. Producer gas-engine plants are attracting much attention at the present time, but there are not many of them in medium-sized factories of the character described, and in the present instance the plant has been designed and installed with particular care, the resulting fuel economy being apparently very satisfactory.

EXPORTS of electrical machinery from the United States to Japan are decreasing, as expected, and similar exports to the Chinese Empire have not yet assumed large proportions. For the eight months ended with August, 1906, the total value of electrical machinery exported to Japan was $503,523, against $992,860 for the corresponding period of 1905. China, however, shows an increase, but the empire is only a small importer of electrical machinery at present, and, as the people are just now making more rapid strides in the use of modern machinery and appliances, a steady increase in this trade is hoped for. The exports of electrical machinery to the Chinese Empire for the period mentioned were valued at $20,873 in 1906 and $8,484 in 1905. To Hongkong, however, the great entering port for Southern China, although a British crown colony, the exports of electrical machinery fell off from $11,000 for the first eight months of 1905 to $8,000 for the corresponding period in 1906.

While the increase in American electrical machinery exports to China is not large actually, relatively it is conspicuously so, being 250 per cent. If this rate can be kept up, nothing more can be desired. The growth is more notable, too, in that the total value of merchandise exported to China in the eight months ended with August, 1906, is but $22,000,000, against $42,000,000 in the corresponding months of 1905. Thus the electrical exports, although small, show a noteworthy growth, while the volume of all exports exhibits a serious decline. American electrical manufacturers should study the Chinese market carefully.

AN unusual method of subduing the glare of direct sunlight was related by Mr. W. J. Thompson at a recent meeting of the Illuminating Engineering Society in New York. He said that, with four windows facing the south, it was difficult to arrange to secure the proper light in his office. He had much trouble with his eyes; the light was too intense or the dark spots too deep, more remarkably so by the contrast. Mr. Thompson continues: "For a year or two I endeavored to get the proper illumination. I tried all kinds of ways—screens, awnings, shades of different thickness. At last I struck upon the idea, accidentally, of hanging a large sheet of tracing cloth over one of the windows, and shaded the light by double shades from the other ones. The light coming through this tracing cloth was apparently as bright as the direct sunlight. Tracing cloth does not cut out very much light. There is practically as much light on my desk as before; but, in addition to there being an enormous quantity, there was absolutely a perfect diffusion, better than by ordinary skylight."

This hint may be of much value in artificial lighting. Unquestionably our methods in this direction have been crude and haphazard—too many bright points of light, too many deep contrasting shadows, too little diffusion, too little consideration for the long-suffering eyes. The new Illuminating Engineering Society can do, and in fact has begun, a great work in acquiring and disseminating information on this very important subject. No doubt, in more enlightened days—and nights—to come, we shall look back with wonder on the empirical, wasteful and eye-wearying methods of interior illumination that prevailed prior to the opening years of the twentieth century.

SOME APPREHENSION has been expressed lest the probable advent of incandescent and other electric lamps of much higher efficiency than those at present employed have an adverse effect on the central-station business, inasmuch as the station will furnish less current for a given light consumption and thus apparently cut down its revenue. The subject was brought up at the Atlantic City convention of the National Electric Light Association and also touched upon at the meeting of the New York section of the Illuminating Engineering Society last week. It has also excited some attention in England, and it is very curious and instructive to observe the attitude toward it assumed on each side of the Atlantic. First consider this jeremiad from the London Times Engineering Supplement:

A curious silence has been observed, not only by the whole technical press, but by engineers in conference, on the subject of the commercial effect of improvements now being developed in metallic-filament lamps. Yet it must be obvious that when the market in these high-efficiency lamps is open to the ordinary electric lighting consumer—that is to say, when their price is such as to make a heavy reduction in the sale of the incandescent lamp commonly used to-day, there should be very important modifications in the policy, and perhaps serious disturbance of the business, of the supply authorities. With an efficiency represented by a consumption of one watt per candlepower, as compared with 3.5 watts, which is now taken as the standard, it is clear that the householder's quarterly bill can only amount to less than one-third of the present average. The revenue of no electric-lighting station can bear any such reduction without disaster. It may be argued that there will be a great development of new business, but as this can only take place among the smaller houses and shops, consuming very little current, there is no salvation to be looked for in that direction, because it is well known already that the payments of many of these consumers do not justify the cost of connection, and when their quarterly total of units is reduced by two-thirds there will be a distinct loss in every case at the present charges per unit. In our own opinion, the coming of the metallic-filament lamp will lead to the abandonment of all meter systems of charging, and a fixed quarterly payment will be demanded per lamp installed, with certain checks upon wanton waste, such as are imposed by water-supply authorities.

This is the gloomy, give-up-in-advance, ultra-conservative attitude. On this side, we believe, while the significance of the apparently impending change is recognized, there is a greater tendency to consider the situation as an inevitable result of the law of progress and to meet it in an equally progressive spirit and with boldness. For instance, at the meeting of the Illuminating Engineers last week Dr. Clayton H. Sharp said:

The question has been raised by the gas-lighting people, from the introduction of the mantle burners, which give much higher illumination with the same consumption of gas, or the same illumination with a smaller consumption of gas. This question is the same as the question which to a certain extent confronts the electric-lighting people of the present day, when electric lamps of higher efficiency are being produced; and it is this: What is the effect of introducing these more efficient lamps? What will the effect be upon the revenue of our company? The gas people have found the effect of introducing a lamp which will give more light for the same amount of gas has been that they have sold more gas. The revenue was increased. That is to say, the public has taken the value of its money, not in decreased bills, but in increased light, and the result has been largely increased illumination. And that is likely to be the effect also of the introduction of the higher efficiency in incandescent lamps, and it is only another indication of this constant toning up of the average scale of our illumination.

This is, then, the central-station manager's answer to the prophets of evil: More light! more light! always more light in the dark places! More light will be given for the same current consumption; the consumer will benefit greatly; but by a campaign of education and publicity of which only a beginning has been made the public will come to consider more plentiful light, greater brightness and cheerfulness, as a necessity. Not only should cheaper light actually increase the consumption of current, but there are always the great possibilities of increasing the day load. Electrical men have succeeded by urging improved methods of doing things, by being alert, progressive, quick to seize opportunity. They will make of the high-efficiency incandescent lamp a valued tool for further advancement.

Michigan Electric Association.

The third annual meeting of the Michigan Electric Association was held in Grand Rapids last week, opening Wednesday and closing Friday. The association shows an increase of 12 members during the year and now numbers 58. There was an attendance of about 75 active and associate members and representatives of electrical-supply houses. The headquarters of the association were at the Livingston Hotel, where the meetings were held, and the halls and corridors were hung with multi-colored electric lights and placarded with the names of the firms exhibiting. The displays were attractive.

Thomas F. Bechtel, secretary and treasurer of the Grand Rapids Edison Company, was chairman of a reception committee composed of representatives of the Edison company, the Grand Rapids-Muskegon Power Company, the General Electric Company and the Fort Wayne Electric Works. The guests who arrived Tuesday evening were entertained with a theater party at the Majestic.

The first session of the association was held Wednesday morning, when President William Chandler of Sault Ste. Marie delivered his annual address. He spoke of the necessity of increasing the membership of the organization. He urged the members to work to bring about a reduction of the insurance rates on electric plants, and urged the necessity of keeping properties in good condition. Concerning the destruction of trees in stringing wires he said that if it become necessary to trim a tree, let it be done with the consent and assistance of the owner. If results cannot be accomplished without trimming to ruination, let some other means be adopted, even at considerable expense, but save the tree.

J. Robert Crouse of Cleveland read a paper on "Profitable Commercial Co-operation." D. B. Smith's paper on "New Business and Advertising" was followed by an interesting discussion in which most of the members favored the liberal use of newspaper space, a policy which has the enthusiastic endorsement of President Chandler.

H. J. Mauger of Schenectady, N. Y., read a paper on Thursday morning on the "Commercial Status of Electrical Heating and Cooking Devices." He emphasized the necessity of educating the people to the use of the various electrical devices on the market.

"The Importance of Making a Good Impression on the Public" was the subject of a paper by R. W. Hemphill of Ann Arbor, in which he took the stand that the light companies must consider themselves servants of the public rather than autocrats and dictators, and must strive to satisfy the public.

Charles A. Parker of Detroit gave a paper on the results obtained by "Direct-by-Mail Advertising of Central-station Current." "Does It Pay to Construct and Modernize Plants in Small Towns?" was the subject handled by F. A. Beard of Flint, in which he took the stand that it could be done profitably if the work was done in a business-like manner and with an eye to efficiency and economy.

F. W. Wilcox of Harrison, N. J., gave a talk on "New Developments in Incandescent Lamps." In the evening the members attended a boxing exhibition at Reed's Lake.

The chief topic of Friday was a talk on "Water-power Development," by Prof. Gardner S. Williams of the engineering department of the University of Michigan. The talk was of particular interest to Michigan electricians in view of the enormous development of power of Michigan rivers that is now going on, and dealt particularly with the work and the possibilities in Michigan.

Election of officers resulted as follows:

President—William Chandler, Sault Ste. Marie.

Vice-president—A. F. Walker, Grand Rapids.

Secretary and Treasurer—A. F. Marshal, Port Huron.

Executive Committee—Alex Dow, Detroit; F. A. Beard, Flint; T. F. Bechtel, Grand Rapids. President Chandler is chairman of the committee.

Finance Committee—O. S. Wood, Ionia; E. F. Phillips, Detroit; A. E. Palmer, Kalkaska.

The fixing of the time and place of holding the next annual meeting was left to the executive committee. It will probably be held at Sault Ste. Marie and earlier in the year. While this meeting was designated as the third annual session, it was only the second deliberative gathering of the association.

The names of members and exhibitors registered are as follows:

William Chandler, Sault Ste. Marie; Thomas F. Bechtel, Grand Rapids; A. F. Walker, Grand Rapids; E. F. Phillips, Detroit; R. W. Hemphill, Jr., Ann Arbor; W. S. Donaldson, Mt. Clemens; J. R. Cravath, Chicago; A. C. Marshall, Port Huron; Alexander Jacobi, Mt. Clemens; J. Robert Crouse, Cleveland; Fred W. Godfrey, Bryan-Marsh Company, Chicago; Waldo Francisco, Grand Rapids; J. Scribner, S. F. Dibble, T. M. Page and E. T. Callahan, General Electric Company, Chicago; H. A. Chase, Hart; W. B. Thompson, Detroit; James W. Bishop, Detroit; W. C. Miller, Rogue River Power Company; D. B. South, Sault Ste. Marie; A. J. Bemis, Grand Rapids; Fred E. Benson, Detroit; J. T. Young, Muskegon; Lawrence Moore, Westinghouse Electric and Manufacturing Company; James B. Coate, Columbia Incandescent Lamp Company; Robert J. Thorne, M. B. Austin & Co., Chicago; C. J. Lester, Illinois Electric Company, Chicago; T. M. McAdams, Westinghouse Electric and Manufacturing Company; R. L. Kimball, Central Electric Company, Chicago; A. L. Pond, Fort Wayne Electric Works, Chicago; H. L. Searles, Grand Rapids; W. J. Trott, Fostoria Incandescent Lamp Company, Grand Rapids; Fred L. Reynolds, Grand Rapids; A. A. Serva, Fort Wayne Electric Works, Fort Wayne; Mark F. Walker, F. Bissell Company, Toledo; R. S. Landon, T. J. Alderson, V. L. Crawford, E. R. Field, W. P. Upham, Electrical Appliance Company, Chicago; T. F. King, Fort Wayne Electric Works; James P. Robison and wife, Detroit; A. P. Briggs, Detroit; A. H. Betwee, Oxford; H. J. Mauger, General Electric Company, Schenectady; G. A. Hayes, Nernst Lamp Company, Pittsburg; George B. Craven, Cleveland; A. S. Wood, Ionia; C. H. Gallmeyer, Grand Rapids; J. W. Warner, Grand Rapids; J. M. London, Boyne City Electric Light and Power Company, Traverse City; Louis C. Towner, Grand Rapids; Charles A. Parker, Detroit; M. F. King, Detroit; F. R. Bryant, Central Electric Company, Chicago; F. M. Van Auken, Allegan; Frank J. McMahon, municipal light and power plant, Lowell; D. A. Beardsley, Citizens' Electric Company, Battle Creek; F. A. Beard, Flint Light and Power Company, J. E. Dunham, Jr., Flint Light and Power Company, Flint; R. A. Rathbone, Westinghouse Electric and Manufacturing Company, Detroit; E. J. Kulas, Brilliant Electric Company, Cleveland; R. S. Jackson, Brilliant Electric Company, Cleveland; R. T. Hamilton, Banne Electric Company, Youngstown, Ohio; William Love, Shelby Electric Light Company, Shelby, Ohio; Louis B. Schneider, Tecumseh; John Leslie, Lapeer; A. E. Palmer, Kalkaska; W. J. Campbell, Kalkaska; Henri Richardi, Bellaire; Jacob Glerum, Grand Haven.

Columbus Street-railway Conventions.

[Special dispatch to the Western Electrician.]

Columbus, Ohio, October 16.—The word "congress" would better henceforth be substituted for "convention" in all future reference to the yearly gathering of the street and interurban railway people of America. It goes without saying that the American Street and Interurban Railways Association is a large and important organization, including, as it does, its three other large subsidiary organizations. It was to be expected, therefore, that the Columbus gathering would probably excel those of previous years, but few realized how total would be the eclipse.

The exhibits at any electrical or mechanical gathering are a very fair index of the progress of that business. The exhibit booths in Columbus at the fair grounds this year number in all 195 spaces and occupy six buildings, each one of which could worthily be characterized as a splendid exposition in itself, and each exhibit represents an important factory property. All this is coupled with the fact that the attendance of street-railway people directly intereted in, and so many possessing purchasing power for, the machinery displayed, exclusive of local visitors, which numbered among the thousands, ran up by badge-button count Tuesday afternoon to over 200 persons. With weather ideally autumnal, and practically every exhibitor with booth ready for visitors by Monday afternoon, and Columbus packed and jammed with visitors, the meeting of 1906 started in "stunning" fashion.

It had been decided this year that all decorations should be with red, white and blue, the national colors, and the brilliant effect of this color scheme may readily be imagined. Not only are all the exhibits in the six exhibition buildings handsomely decorated to produce various effects in the colors named, but the city of Columbus has come nobly to the front with its street-arch lighting system, and at night, as well as during the day at the fair grounds, the streets of Columbus are brilliant with colored incandescent lamps.

Too much praise cannot be given to citizens of Columbus for their hospitality. It had been generally believed all along that as the street-railway convention had now grown to such a large size, a city with Columbus' hotel facilities, although these are of the best, would nevertheless be unable to handle the crowd. Everyone seems to have been well taken care of, however. Many of Columbus' public-spirited citizens have come to the rescue, and rooms in private apartments have been freely placed at the disposal of the guests. Few complaints have been heard.

Every modern facility for the transaction of business at the fair grounds has been provided. A local postoffice has been established; a telegraph office and a private branch telephone exchange giving free service have been installed at the grounds. Both the Central Union and United States telephone companies in the evening extend to the delegates not only free local but free long-distance telephone privileges. There is, too, on the grounds, a well-equipped dining hall; also free street-railway transportation has been extended to those wearing badges.

The hotels are all in gala attire and decorated with national colors. The Hartman Hotel has an attraction in a miniature electric railroad in full operation which runs along the partition surrounding the bookkeeper's office.

It is estimated that there are as many as 300 Canadian street-railway people here. Local papers estimate 19,000 persons attending the fair grounds yesterday, and it is figured that the ground space taken up by exhibits is about twice as large as that occupied at Philadelphia last year.

Rumor has it that John I. Beggs is the probable man for president next year of the American association, and H. H. Adams, probably, for president of the Engineering association.

The convention opened with a meeting of the Engineering Association at 10 a. m. yesterday. E. C. Spring of West Milton, Ohio, gave the welcoming address, followed by addresses by W. Caryl Ely, president of the American Association, and Prof. Bernard V. Swenson, secretary and treasurer of the same organization. President Adams of the Engineering Association then gave his address. Then followed the routine business, and at 2 p. m. the discussion of papers and reports was taken up. Besides special committees, the following committees reported: "Maintenance and Inspection of Electrical Equipment," "Control Apparatus," "Way Matters." A paper on "Ballast" was read by Charles H. Clark of Cleveland and one on "Ties, Poles and Posts" by C. A. Alderman of Cincinnati.

The Claim Agents' Association met at 2 p. m. yesterday. B. B. Davis of Columbus welcomed the delegates, and President Ely and Secretary Swenson of the American association addressed the convention. The address of President S. L. Rhodes of the claim agents was then heard. After hearing the reports of officers the meeting was adjourned at 12:30 to convene again to-day.

Attendance at both meetings yesterday was large. The reception planned at the Southern Hotel last night was not carried out as planned; instead there was a large informal gathering of men in the rotunda.

There was so much interest by local people that the 5,000 admission tickets printed for the entire week were used up last night. It is the general opinion that the exhibits constitute the greatest industrial show ever given in connection with a convention in the United States. F. L. P.

Illuminating Engineering Society.

At the meeting of the Illuminating Engineering Society held at 44 West Twenty-seventh Street, New York city, on October 12th, President L. B. Marks was in the chair. Some routine business was transacted. A committee was appointed on constitution and by-laws. It consists of W. D. Weaver, W. R. Addicks and the chairmen of the local sections. The treasurer's report showed a balance on hand of $526.32. The total membership is now 750.

The New York section was organized with these officers: Chairman, A. E. Forstall; vice-chairman, Frank A. Pattison; second vice-chairman, Dr. F. Schieman; secretary, Preston S. Millar.

Two papers were presented—one by Ernest C. White of Winnipeg and the other by J. E. Woodwell of Washington. Both related to "Data of Indoor Illumination." They were discussed by Dr. Clayton H. Sharp, E. L. Elliott, A. H. Elliott, Mr. Litle, Mr. Gardner, R. M. Searles, Mr. Seabrook, Mr. Thompson, Mr. Marks and others.

The same papers were presented at a meeting of the Chicago section of the society, held on October 16th, at which Mr. George C. Keech, temporary president, presided. Mr. Hemphill read Mr. White's paper and Mr. Van Rensselaer Lansingh followed with that of Mr. Woodwell, with illuminating comments of his own and blackboard demonstrations. Harold Almert opened the discussion, and Mr. Lansingh exhibited some new drawing paper designed to lighten the burdens of the illuminating engineer in making his calculations and drawings. J. R. Cravath spoke of the desirability of small units, without sharp shadows, in illumination. Mr. Richardson of the Chicago Federal Building said the illuminating engineer should control the location of the fixtures in planning new buildings. Mercury-vapor lamps should be hung well up toward the ceiling. C. R. Gilman of Milwaukee spoke of car lighting, which, he said, had been neglected. Mr. Lansingh said that bare flames or lights are now hidden in the best car lighting. Mr. Keech, Mr. Chapman and others also took part in the discussion.

Cleveland Street-railway Situation.

With the decision of the City Council of Cleveland to submit the propositions of the two street-railway companies to a referendum vote of the people, the situation is becoming interesting. The trouble is that such a vote will merely ascertain the feelings of the people and will not be binding upon the City Council. It is believed that the state officials will rule against anything that does not accomplish some result through the vote taken, and that the laws regarding elections do not anticipate anything of the kind. Should this be true, a special election could be held, as the Cleveland Electric Railway Company has offered to bear its share of the expenses, or the entire cost if necessary, in order that the question may be settled at an early date. The curious proposition of a company urging people to vote for a plan that will mean a loss of more than $3,000 a day to the company is here presented, but at the same time it must be remembered that an extension of franchises goes with the settlement of the fare question.

The Cleveland Electric Railway Company has announced its intention to bid on the 12 routes which the City Council has mapped out for new car lines at the request of the Forest City Railway Company. This is rather a surprise, since the latter will no doubt place its fare at three cents. By some it has been said that the Cleveland Tramways Company, incorporated a week or so ago, is being organized for the purpose of making "straw bids" on these lines.

THE SMALL CENTRAL STATION.

Practical Hints on Its Construction and Operation.

CHAPTER XIV.

DISTRIBUTION.

In the erection of stations operating upwards of 5,000 incandescent lamps it is good practice to employ feeders of a sufficient size to keep, at all times, the loss in the line below 10 per cent. of the power delivered. Stations of the above capacity, and larger, are always liable to a material increase in the demand for current, and the possibility of supplying this demand without extra line cost will represent a net profit not to be realized where poor judgment has been displayed in the sizes of copper used in the overhead circuits.

Again, stations of the above-mentioned size will, as a rule, employ polyphase machinery, with the possibility of supplying power. This immediately necessitates the use of regulators in order that the pressures carried on the circuits, operated from different phases of the generator, may be held at the same point. This is worthy of due consideration, if the central-station man hopes to retain customers. Different loads on different phases of a machine produce different pressures. The heavy-loaded phase must be kept up to the pressure required by lamps and motors on the circuits operated from that phase, and to do this means to raise the potential of the lighter-loaded phases above economical point of lamp operation and consequently materially to reduce the life of the lamps.

The more satisfactory results to customers due to the uniform potential which will be maintained in the lamps through the medium of the regulators is an advantage well worth the necessary outlay for potential regulators, which in reality is a small item.

Where single-phase apparatus alone is employed, the possibility of supplying power in considerable quantity is greatly impaired, since single-phase motors take too large starting currents to admit of their use in numbers or in large sizes on lighting circuits. They destroy the possibility of regulation in line potential.

With a proper amount of copper in the line there should be little variation in pressure at the lamps. There is no condition of balanced load to be met as in the case of polyphase generators, and consequently little excuse for fluctuation in the light of lamps. In fact, there is hardly any condition under which the single-phase alternating-current system can be installed which would justify appreciable loss in the feeders. This statement is made without qualification, except as it might apply to stations where 25,000 or more lamps are operated, and in many cases stations of that size should be so installed.

These remarks apply only where ordinary conditions exist, and in all cases it is better that problems of unusual character be left to experienced electrical engineers to determine, by the surrounding conditions, what is best.

Feeders for transmitting from units of from 2,000 to 5,000 lights should usually be no larger than No. 3 Brown & Sharpe gauge, and where the carrying capacity of this size wire is insufficient it is better to use two circuits of this size for the feeder than the equivalent in sectional area in one pair of wires.

The loss in an alternating circuit from the dynamo to the lamp under average load with a good equipment should be:

Loss in Circuit at Full Load.	Average Loss Per Hour.				
	450 Lights.	750 Lights.	1,200 Lights.	1,500 Lights.	2,000 Lights.
	H.P.	H.P.	H.P.	H.P.	H.P.
2 per cent....	3	6	8	10	12
5 per cent....	5	8	12	14	17
10 per cent....	6	10	17	21	28
15 per cent....	8	14	22	30	38
Average loss shown from reports as actually existing.....	10	15	26	34	40

Under light load the loss in line decreases; the loss in transformer increases. With heavy load the loss increases in the line and decreases in the transformer. The average loss as shown in operating plants is due not only to poor insulation and loss in the current, but to leakage in the transformer. It is three times greater than necessary. Cheap circuits and transformers are a false economy.

The use of the 2,000-volt primary current will reduce the weight of the copper required to one-fourth of that necessary with the 1,000-volt current; at the same time the maintenance is considerably increased because the number of burned-out lamps will be greater, the insulation will be more expensive to buy and maintain as it should have four times the stability, while the liability of having grounds, burn-outs, blown fuses, and consequent rebates, is in the same ratio. The question is whether to pay for the copper and get it back in increased profits or curtail the present expenditure and lessen the profits.

Some of the reports clearly show that the arc dynamos are greatly overloaded because the attempt is made to run up to standard candlepower more arc lamps than the rated capacity of the dynamos and over a circuit of No. 6 wire several miles in length.

An arc circuit of No. 4 wire loses one-fifth horsepower per mile. An arc circuit of No. 5 wire loses one-fourth horsepower per mile. An arc circuit of No. 6 wire loses one-third horsepower per mile.

This loss occurs in well-built lines where all joints are soldered and taped, connections perfectly made and the line kept clear of grounds, and is due to the inherent resistance of the wire itself. Where joints are not soldered but become oxidized or the line allowed to become grounded the loss must be greater than the horsepower given, sometimes even reaching 50 per cent. of the output of the dynamo.

An efficient 60-light dynamo "pulling" 60 2,000-candlepower arc lamps over a 20-mile circuit of No. 6 wire properly erected, and requiring seven-tenths horsepower per lamp, really "pulls" 70 lamps.

The cost of copper for the direct-current power generator, 500-volt circuit, will be as follows:

TABLE SHOWING COST OF COPPER AND LOSS IN LINE IN THE TRANSMISSION OF 100 HORSEPOWER FOR VARYING DISTANCES.

Distance.	Initial Voltage.	Voltage at Motors.	Amperes.	H.-P. Supplied to Motors.	H.-P. Output of Dynamos.	H.-P. Output of Motors.	Per Cent Loss on Line.	Commercial Efficiency.	Cost of Copper Delivered.	Weight of Copper in Lbs.	No. Wire B. & S. Gauge.
mile											
½	600	500	165	110	135	100	17	75	$ 160	800	2
½	700	500	165	110	100	100	30	65	80	400	5
1	630	500	165	110	140	100	20	72	800	4,000	00
1	830	500	165	110	185	100	40	55	320	1,600	3
2	660	500	165	110	150	100	25	68	2,560	12,800	0000
2	830	500	165	110	185	100	40	55	1,280	6,400	0
3	745	500	165	110	165	100	33	60	3,840	19,200	000
3	810	500	165	110	180	100	40	55	3,040	15,200	00

For reliability of service and safe handling of the apparatus it is usually desirable to use step-up and step-down transformers where the pressure exceeds 2,000 volts, using a 1,000-volt generator at the power-house, raising the pressure with step-up transformers, then lowering the pressure at the other end of the line with step-down transformers, after which the current is distributed in the regular transformers exactly as if the step-down transformer house was the generator.

The same rules regarding construction of arc and incandescent circuits will apply to power circuits with the additional safeguard of oil insulators for high pressures. The loss is enough in any event without the useless waste of additional power in poor construction.

PRIMARY WIRING TABLE, 1,000 VOLTS.

Percentage of Loss.									Current in Amperes.																
									Number of 16 Candle-Power Lamps.																
									A 2	4	5	8	10	12	14	16	18	20	22½	25	30	37½	50
									L 40	80	120	160	200	240	280	320	360	400	450	500	600	750	1,000
									Distance in Feet to Center of Distribution.														
Sizes of Wire required (B. & S. Gauge). Nothing smaller than No. 3.	2	2½	3	4	5	6	8	10															
	...	...	...	...	...	...	...	4-3	500,000	250,000	170,000	120,000	100,000	80,000	70,000	60,000	55,000	50,000	45,000	40,000	33,000	26,000	20,000
	...	...	...	...	...	...	4-3	3-3	400,000	200,000	130,000	100,000	80,000	65,000	55,000	50,000	45,000	40,000	35,000	30,000	26,000	21,000	16,000
	...	...	...	...	...	4-3	3-3	4-5	300,000	160,000	100,000	80,000	60,000	50,000	45,000	40,000	35,000	30,000	28,000	25,000	20,500	17,000	13,000
	...	...	...	...	4-3	3-3	4-5	2-3	250,000	120,000	80,000	60,000	50,000	40,000	35,000	30,000	28,000	25,000	22,000	20,000	17,000	13,000	10,000
	...	...	4-3	3-3	3-3	4-5	2-3	2-4	200,000	100,000	68,000	50,000	40,000	32,000	27,000	25,000	22,000	20,000	18,000	16,000	13,000	10,000	8,000
	...	4-3	3-3	3-3	4-5	2-3	2-4	2-5	160,000	80,000	50,000	40,000	30,000	25,000	22,000	20,000	18,000	16,000	13,000	13,000	12,000	8,000	6,100
	4-3	3-3	4-5	2-3	2-4	2-5	3	4	120,000	64,000	40,000	30,000	25,000	20,000	18,000	16,000	14,000	12,000	11,000	10,000	8,000	6,500	5,000
	3-3	4-5	2-3	2-4	2-5	3	4	5	100,000	50,000	30,000	25,000	20,000	16,000	14,000	12,000	11,000	10,000	9,000	8,000	7,000	5,500	4,000
	4-5	2-3	2-4	2-5	3	4	5	6	80,000	40,000	25,000	20,000	16,000	13,000	11,000	10,000	8,500	8,000	7,000	6,000	5,000	4,200	3,000
	2-3	2-4	2-5	3	4	5	6	6	60,000	30,000	20,000	15,000	12,000	10,000	9,000	7,600	7,000	6,000	5,600	5,000	4,000	3,400	2,500
	2-4	2-5	3	4	5	6	6	8	50,000	25,000	16,000	12,000	10,000	8,000	7,000	6,000	5,400	5,000	4,500	4,000	3,300	2,700	2,000
	2	3	4	5	6	6	8	8	40,000	20,000	13,000	10,000	8,000	6,000	5,500	5,000	4,300	4,000	3,600	3,000	2,600	2,230	1,600
	3	4	5	6	6	8	8	10	30,000	16,000	10,000	7,600	6,000	5,000	4,400	3,800	3,500	3 000	3,800	2,500	2,000	1,700	1,300
	4	5	6	6	8	8	10	10	25,000	12,000	8,000	6,000	5,000	4,000	3,400	3,000	2,700	2,500	2,200	2,000	1,600	1,400	1,000
	5	6	6	8	8	10	10	12	20,000	10,000	6,000	5,000	4,000	3,200	2,800	2,500	2,200	2,000	1,800	1,600	1,300	1,000	800
	6	6	8	8	10	10	12	12	15,000	8,000	5,000	3,800	3,000	2,500	2,200	1,900	1,700	1,500	1,300	1,200	1,000	850	600
	6	8	8	10	10	12	12	14	12,000	6,000	4,000	3,000	2,500	2,000	1,800	1,500	1,400	1,200	1,100	1,000	800	700	500
	8	8	10	10	12	12	14	...	10,000	5,000	3,000	2,500	2,000	1,600	1,400	1,200	1,100	1,000	900	800	600	550	400
	8	10	10	12	12	14	...	...	7,600	4,000	2,500	1,900	1,500	1,300	1,100	950	850	760	700	600	500	440	300
	10	10	12	12	14	...	...	...	6,000	3,000	2,000	1,500	1,200	1,000	900	750	700	600	540	500	400	340	250
	10	12	12	14	...	...	...	...	5,000	2,500	1,600	1,200	1,000	800	700	600	550	500	450	400			
	10	12	12	14	...	...	...	...	4,000	2,000	1,300	950	760	600	540	450	440	380	350	300	10 c.p. lamp=.035 Amp.		
	12	12	14	...	...	...	...	...	3,000	1,500	1,000	750	600	500	430	350	370	300	270	250	16 c.p. lamp=.050 Amp.		
	12	14	...	...	...	...	...	...	2,500	1,200	800	600	500	400	340	300	270	250	230	200	25 c.p. lamp=.075 Amp.		
																					50 c.p. lamp=.15 Amp.		
																					150 c.p. lamp=.45 Amp.		

One Ampere in Primary Circuit equals 20 Amperes in the Secondary Circuits. Carrying Capacity one Ampere in Primary Circuit equals 20 16 Candle-power Lamps.

PRIMARY WIRING TABLE, 2,000 VOLTS.

Per Cent Loss at 2,000 Volts.									Current in Amperes.														
									Number of 16 Candle-Power Lamps.														
	2	2½	3	4	5	6	8	10	A 2	3	4	5	6	7	8	9	10	12½	15	20	30	40	50
									L 80	120	180	200	240	280	320	360	400	500	600	800	1,200	1,600	2,000
Sizes of Wire in B. & S. Gauge.	...	...	...	...	...	...	...	3	244,500	163,000	122,000	97,800	81,500	69,800	61,000	54,300	48,900	39,000	32,600	24,450	16,300	12,220	9,780
	...	...	...	...	...	...	3	4	194,000	129,000	97,000	77,500	64,500	55,300	48,500	43,000	38,700	31,000	25,830	19,400	12,910	9,700	7,750
	...	...	...	...	...	3	4	5	154,000	102,000	77,000	61,600	51,300	44,000	38,500	34,200	30,800	24,600	20,500	15,400	10,260	7,700	6,160
	...	...	...	...	3	4	5	6	122,000	81,000	61,000	48,900	40,700	34,900	30,500	27,000	24,400	19,500	16,300	12,220	8,150	6,110	4,890
	...	...	...	3	4	5	6	7	97,000	65,000	48,600	38,900	32,400	27,700	24,300	21,600	19,400	15,500	12,960	9,720	6,480	4,860	3,890
	...	...	3	4	5	6	7	8	77,000	52,000	38,600	30,900	25,700	22,000	19,300	17,000	15,400	12,300	10,300	7,720	5,150	3,860	3.090
	...	3	4	5	6	7	8	9	61,000	41,000	30,600	24,500	20,400	17,500	15,300	13,600	12,200	9,800	8,100	6,120	4,080	3,060	2,450
	3	4	5	6	7	8	9	10	48,000	32,000	24,000	19,400	16,000	13,800	12,000	10,800	9 700	7,700	6,460	4,850	3,230	2,420	1,940
	4	5	6	7	8	9	10	10	38,000	25,000	19,000	15,400	12,800	11,000	9,600	8,500	7,700	6,100	5,130	3,850	2,570	1,930	1,540
	5	6	7	8	9	10	10	12	30,000	20,000	15,000	12,200	10,000	8,700	7,600	6,800	6,100	4,800	4,000	3,040	2,030	1,520	1,220
	6	7	8	9	10	10	12	12	24,000	16,000	12,000	9,700	8,000	6,900	6,000	5,400	4,800	3,800	3,230	2,420	1,610	1,210	970
	7	8	9	10	10	12	12	14	19,000	13,000	9,600	7,600	6,400	5,500	4,800	4,200	3,800	3,000	2,563	1,920	1,280	960	769
	8	9	10	10	12	12	14	14	15,000	10,000	7,600	6,000	5,000	4,300	3,800	3,300	3,000	2,400	2,030	1,520	1,010	760	610
	9	10	10	12	12	14	14	16	12,000	8,000	6,000	4,800	4,000	3,400	3,000	2,600	2,400	1,900	1,610	1,210	800	600	480
	10	10	12	12	14	14	16	...	9,600	6,400	4,800	3,800	3,000	2,700	2,400	2,000	1,900	1,500	1,280	960	640	480	.....
	10	12	12	14	14	16	...	...	7,600	5,000	3,800	3,000	2,500	2,200	.....	.....	.....	.....	.....	.....	.....	.....	.....
	12	12	14	14	16	...	...	...	6,020	4,000	3,000	2,400	2,000	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
	12	14	14	16	...	...	...	...	4,800	3,200	2,400	1,900	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
	14	14	16	...	...	...	...	...	3,800	2,500	1,900	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
	14	16	...	...	...	...	...	...	3,000	2,000	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....

Primary Current at 1,000 Volts for Standard Lamps.
10 c. p..... .018 Amp.
16 c. p..... .025 Amp.
25 c. p..... .038 Amp.
50 c. p..... .075 Amp.
150 c. p..... .225 Amp.

One Ampere in Primary Circuit equals 40 Amperes in Secondary Circuit. Carrying Capacity one Ampere in Primary Circuit equals 40 16 Candle-power Lamps.

Wire Table.—The following table gives the circular mils of each size wire commonly used in wiring construction:

Wire No.		Wire No.	
0000 = 211,600	circular mils.	9 = 13,594	circular mils.
000 = 167,805	circular mils.	10 = 10,381	circular mils.
00 = 133,079	circular mils.	11 = 8,234	circular mils.
0 = 105,592	circular mils.	12 = 6,529	circular mils.
1 = 83,694	circular mils.	13 = 5,178	circular mils.
2 = 66,373	circular mils.	14 = 4,106	circular mils.
3 = 52,634	circular mils.	15 = 3,256	circular mils.
4 = 41,742	circular mils.	16 = 2,582	circular mils.
5 = 33,102	circular mils.	17 = 2,048	circular mils.
6 = 26,250	circular mils.	18 = 1,624	circular mils.
7 = 20,816	circular mils.	19 = 1,252	circular mils.
8 = 16,509	circular mils.	20 = 1,021	circular mils.

Simple Wiring Formulas.—To find the size of wire necessary for 1,000-volt primary circuit, using 50-volt transformers, to center of distribution.

Let D represent single distance in feet.

Let L represent the number of 16-candlepower lamps.

$\frac{D \times L}{20}$ = circular mils of required wire, at two per cent. loss.

SECONDARY WIRING TABLE FOR 50-VOLT LAMPS.
TWO PER CENT LOSS.

No. of 16 C.-P. Lamps.	DISTANCE IN FEET TO CENTER OF DISTRIBUTION.													B. & S. WIRE GAUGE.
	20	30	40	50	60	70	80	90	100	120	140	160	180	200	
1	16	16	16	16	16	16	16	16	16	16	14	14	14	12	
2	16	16	16	16	16	14	14	14	12	12	12	12	10	10	
3	16	16	16	14	14	12	12	12	12	10	10	10	8	8	
4	16	16	14	12	12	12	10	10	10	10	8	8	8	6	
5	16	14	12	12	12	10	10	10	10	8	8	8	6	6	
6	16	14	12	12	10	10	10	10	8	8	8	6	6	6	
7	14	12	12	10	10	10	8	8	8	8	6	6	6	4	
8	14	12	12	10	10	8	8	8	8	6	6	6	4	4	
9	14	12	10	10	8	8	8	8	6	6	6	4	4	4	
10	14	12	10	10	8	8	8	6	6	6	4	4	4	4	
12	12	10	10	8	8	8	6	6	6	4	4	4	4	3	
14	12	10	8	8	6	6	6	6	4	4	4	3	3	2-5	
16	12	10	8	8	6	6	6	4	4	4	3	3	2-5	2-5	
18	10	8	8	6	6	6	4	4	4	3	3	2	2-5	2-4	
20	10	8	8	6	6	4	4	4	4	3	2-5	2-5	2-4	2-4	
25	10	8	6	6	4	4	4	3	3	2-5	2-4	2-4	2-3	....	
30	8	8	6	4	4	4	3	3	2-5	2-5	2-4	2-3	....	....	
40	8	6	4	4	3	2-5	2-5	2-4	2-4	2-3	....	....	....	....	
50	6	4	4	3	2-5	2-4	2-4	2-3	2-3	....	....	....	....	....	
60	5	4	3	2-5	2-4	2-3	2-3	....	....	....	....	....	....	....	
70	4	4	2-5	2-4	2-4	2-3	....	....	....	....	....	....	....	....	
80	3	3	2-5	2-4	2-3	....	....	....	....	....	....	....	....	....	
90	3	2-5	2-4	2-3	....	....	....	....	....	....	....	....	....	....	
100	2-5	2-4	2-3	....	....	....	....	....	....	....	....	....	....	....	

No odd sizes of wire are given smaller than No. 4, as stations usually carry the even numbers.

SECONDARY WIRING TABLE FOR 100-VOLT LAMPS.
TWO PER CENT LOSS.

No. of 16 C.-P. Lamps.	DISTANCE IN FEET TO CENTER OF DISTRIBUTION.													B. & S. WIRE GAUGE.
	20	30	40	50	60	70	80	90	100	120	140	160	180	200	
1	16	16	16	16	16	16	16	16	16	16	16	16	16	16	
2	16	16	16	16	16	16	16	16	16	16	16	16	16	16	
3	16	16	14	16	16	16	16	16	16	16	14	14	14	14	
4	16	16	16	16	16	16	15	16	16	14	14	14	12	12	
5	16	16	16	16	16	16	16	14	14	14	12	12	12	12	
6	16	16	16	16	16	14	14	14	14	14	12	12	10	10	
7	16	16	16	14	14	14	14	14	12	12	12	10	10	10	
8	16	16	14	14	14	14	14	12	12	12	10	10	10	8	
9	16	16	14	14	14	14	12	12	12	10	10	10	10	8	
10	14	14	14	12	12	12	12	12	12	10	10	10	8	6	
12	14	14	14	12	12	12	12	10	10	10	10	8	8	6	
14	14	14	12	12	12	12	10	10	10	10	8	8	6	6	
16	14	14	12	12	12	10	10	10	8	8	8	6	6	5	
18	12	12	12	12	10	10	10	10	8	8	6	6	5	4	
20	12	12	12	10	10	10	10	8	8	6	6	5	4	3	
25	12	12	10	10	8	8	8	6	6	5	4	4	3	2-5	
30	10	10	10	10	8	8	6	5	5	4	4	3	2-5	2-4	
40	10	10	8	8	6	5	5	4	4	3	3	3-5	2-5	2-3	
50	8	8	6	6	5	4	4	3	3	2-5	2-5	2-4	2-3	2-3	
60	8	8	6	5	4	3	3	....	2-5	2-5	2-4	2-3	2-3	....	
70	8	6	5	4	4	3	2-5	2-5	2-4	2-4	2-3	2-3	....	....	
80	6	6	5	4	3	2-5	2-5	2-4	2-4	2-3	2-3	....	....	....	
90	6	5	4	3	2-5	2-5	2-4	2-4	2-3	2-3	....	....	....	....	
100	5	4	4	3	2-5	2-4	2-4	2-3	2-3	....	....	....	....	....	

$\frac{D \times L}{50}$ = Circular mils of required wire, at five per cent. loss.

The constant for any loss is obtained by multiplying the percentage by 10.

Where 100-volt transformers are used the formula becomes:

$\frac{D \times L}{17}$ = Circular mils at two per cent. loss.

$\frac{D \times L}{42}$ = Circular mils at five per cent. loss.

For 2,000-volt primary, reducing to 50-volt secondary, the formula is:

$\frac{D \times L}{80}$ = Circular mils at two per cent. (40 volts) loss.

$\frac{D \times L}{200}$ = Circular mils at five per cent. (100 volts) loss.

For secondary wiring from 50-volt transformers: $20 \times D \times L$ = Circular mils at two per cent. (one volt) loss.

For 100 to 110-volt transformers: $6 \times D \times L$ = Circular mils at two per cent. (two volts) loss.

The usual rule for calculating the necessary size of wire to carry a given number of amperes any distance at any desired loss in voltage is to multiply the amperes by the single distance in feet by 21 and divide the product by the loss in volts. This will give the cross-section in circular mils of the wire to be used.

$\frac{\text{Amperes} \times \text{Distance} \times 21}{\text{Loss in volts.}}$ = Circular mils.

These rules apply to carrying the current to a center of distribution, that is, without tapping the line between the dynamos and center of distribution. When the lamps (or motors) are evenly distributed, or nearly so, the loss is reduced 50 per cent. and a wire half the circular mils will be sufficient, but this applies to cases where the total loss in voltage does not exceed three per cent. for lamp circuits and 10 per cent. for motor circuits. Where the loss is greater and the load widely distributed a number of centers of distribution become advisable, the object of the center of distribution being to maintain a practically uniform voltage or pressure throughout the system of wiring at any condition of load. This explains why we frequently find feeders running from the dynamos to a center of distribution, and lamps even in close proximity to the station are fed from mains carried back from the center of distribution.

In case of not having the proper size wire on hand the following table gives its equivalent in wire of smaller sizes:

0000 = 2	No.	0 = 4	No.	3 = 8	No.	6	
000 = 2	"	1 = 4	"	4 = 8	"	7	
00 = 2	"	2 = 4	"	5 = 8	"	8	
0 = 2	"	3 = 4	"	6 = 8	"	9	
1 = 2	"	4 = 4	"	7 = 8	"	10	
2 = 2	"	5 = 4	"	8 = 8	"	11	
3 = 2	"	6 = 4	"	9 = 8	"	12	
4 = 2	"	7 = 4	"	10 = 8	"	13	
5 = 2	"	8 = 4	"	11 = 8	"	14	
6 = 2	"	9 = 4	"	12 = 8	"	15	
7 = 2	"	10 = 4	"	13 = 8	"	16	
8 = 2	"	11 = 4	"	14 = 8	"	17	
9 = 2	"	12 = 4	"	15 = 8	"	18	
10 = 2	"	13 = 4	"	16 = 8	"	19	
11 = 2	"	14 = 4	"	17 = 8	"	20	
12 = 2	"	15 = 4	"	18 = 8	"	21	
13 = 2	"	16 = 4	"	19 = 8	"	22	
14 = 2	"	17 = 4	"	20 = 8	"	23	

Take, for instance, No. 0 wire is required. There is plenty of No. 6, but no other size on hand. Four lengths of the No. 6 wire will fill the place of one length of No. 0.

The current is carried on a pole line equally well by two No. 6 wires instead of one No. 3 wire.

When calculating more than 1,000 lamps (see primary wiring table for 1,000 volts) find the size of wire required for the additional number, reduce to circular mils, and add together, and take the size wire whose circular mils comes nearest the product.

Thus 1,000 lamps, five per cent. loss, 2,000 feet, require a No. 4 wire or 41,742 circular mils; 600 lamps require a No. 6 wire or 26,250 circular mils; 1,600 lamps require 41,742 + 26,250 or 67,992 circular mils, or No. 2 wire. As the impedance is too great in this size, it should be split in two, and two No. 5 wires used.

AMPERES PER MOTOR.

Horse-power.	Kilo-watts.	Pr. Ct. Effi-ciency.	110 Volts.	115 Volts.	220 Volts.	250 Volts.	500 Volts.
1	1.15	65	10.4	10.0	5.2	4.6	2.3
2	2.29	65	20.8	20.0	10.5	9.2	4.6
3½	3.45	75	31.6	30.3	15.8	13.9	7.0
5	4.66	80	42.4	40.5	21.2	18.6	9.3
7½	6.99	80	63.6	60.8	31.8	28.0	14.0
10	8.78	85	79.8	76.3	39.9	35.1	17.6
15	13.16	85	120.0	114.0	59.8	52.6	26.3
20	16.58	90	151.0	144.0	75.4	66.3	33.2
25	20.72	90	188.0	180.0	94.2	82.9	41.4
30	24.87	90	226.0	216.0	113.0	99.4	49.7
40	33.16	90	301.0	288.0	151.0	133.0	66.3
50	41.44	90	377.0	360.0	188.0	166.0	82.9

The above table shows the horsepower being developed by a direct-current motor using a given number of amperes of current.

[To be continued.]

Frank W. Mahin, consul at Nottingham, England, reports that the tin and copper trades are remarkably buoyant, and the highest prices for many years are just recorded. Tin, in fact, has broken the price record. Its high price is partly due to its relative scarcity.

American Electrochemical Society.

A local meeting of the American Electrochemical Society was held in New York city on October 8th and 9th. It was not well attended, probably because of the unsettled plan of holding meetings. Formerly the society has held two large meetings each year, and many of the members have been of the opinion that one would prove more satisfactory and profitable. As a compromise it was decided to hold a general meeting each spring at a place to be determined annually, and a local meeting in New York city each fall.

Discussion of papers for the meeting just closed was taken up in Havemeyer Hall, Columbia University, the society being welcomed by Prof. C. F. Chandler of Columbia. The first paper presented was that of Prof. Henry S. Carhart, entitled "Formula for the Helmholtz Concentration Cell." It was discussed by W. D. Bancroft, who read the paper, and Carl Hering.

"Visible Migration of Particles Between Electrodes" was the subject of a paper read by Carl Hering, president of the society. This paper presented the result of microscopic researches made by the author in conjunction with Dr. E. E. Northrup. The paper was discussed by Prof. Bancroft, C. A. Acker and E. A. Sperry.

In the absence of the author Prof. Bancroft read a paper on "Copper Cathodes in Nitric Acid," by J. W. Terrentine. S. S. Sadtler gave a description and convenient appliances for of some simple laboratory work.

A paper prepared by G. H. Cole and H. T. Barnes, entitled "An Aluminum and Magnesium Cell," was read by Prof. Bancroft. Dr. M. Loeb discussed the subject. S. S. Sadtler read the paper of Francis B. Pyne on "Melting Points of Some Cryolite-Alumina Mixtures." He also read the paper of P. B. Sadtler and W. H. Walker on "Double Decomposition of Zinc Sulphate and Sodium Chloride." The paper of H. E. Patten on "Some Factors Affecting the Distribution Law" was read by Mr. Sadtler.

The subject of pyrometry was quite thoroughly considered. Dr. E. F. Roeber was the first to speak on the subject. He was followed by F. F. Schuetz, who read a paper entitled "A Thermo-electric Pyrometer for General Industrial Applications." The paper described recent forms of Bristol pyrometers. R. S. Whipple spoke on the subject as regards its development in Europe. Other speakers were Messrs. Molduke, Brown, Sadtler and Wilson.

Prof. F. B. Crocker read a paper entitled "The Decker Primary Cell." Messrs. Tucker and Sperry discussed the paper.

In the way of entertainment the members were given an opportunity to visit many plants of interest. On Saturday evening preceding the meeting many of the members attended a dinner to Sir William Perkin, given by the chemists of the United States at Delmonico's. An informal dinner was given at Liederkranz Hall on Monday evening. On Monday afternoon the members visited the College of the City of New York, where they heard the lecture by Dr. Charles Baskerville on "The Use of Ultra-Violet Light in the Laboratory and in Practice."

Alcohol from Corncobs.

The Department of Agriculture is developing a possible new industry in the production of alcohol from corncobs, which, the Department says, promises to be of much commercial value. Investigations are being made at Hoopeston, Ill., and have proved that the large quantities of corncobs which every year go to waste can be made to produce alcohol in sufficient quantities to justify the erection of a distilling plant in connection with a corn cannery.

So far the Department has succeeded by simple methods of fermentation in getting a yield of 11 gallons of alcohol from a ton of green cobs, and, by similar methods, in getting six gallons of alcohol from a ton of green cornstalks. A Department official says that these tests show that there are 240 pounds of fermentable substance in a ton of green field cornstalks, which will yield about half of their weight in absolute alcohol. In round numbers a ton of stalks will produce 100 pounds of alcohol or 200 pounds of proof spirits. As a gallon of alcohol weighs nearly seven pounds, there should be 15 gallons of alcohol in a ton of stalks.

The Series Luminous Arc Rectifier System.[1]

By N. R. Birge.

Central-station men are already familiar in a general way with recent developments in arc lighting both from papers read before various societies and from discussions printed in the technical press. The new luminous arc rectifier system which is the practical embodiment of these developments represents a great advance in the art of illumination. The energy economy, the brilliancy of illumination, and the character of distribution of the light are the marked advantages of this system.

The essential features of the new system are the luminous arc lamp (Figs. 1 and 2) with absolute cutout on the line, and the mercury arc rectifier set in the station. The rectifier is supplied with alternating current and furnishes direct current to the lamps, which are designed to operate on direct-current circuits at four amperes with 75 to 80 volts at terminals.

The Luminous Arc Lamp.

Construction.—The main frame of the lamp consists of a single large tube which acts as a chimney for carrying away the fumes of the arc. At the top of the lamp are wind shields which prevent downward drafts into the tube.

The electrodes of the luminous arc lamp differ entirely from ordinary carbon arc-lamp electrodes. The upper electrode consists of a bar of hard drawn coper suported by iron wings. The lower electrode is made of specially prepared composition contained in an iron tube ⅝ inch in diameter by 8 inches long.

A horizontal reflector is placed inside the globe and in close proximity to the arc and serves to throw an ample volume of light below the lamp without interfering with the main distribution of light in the horizontal direction. (See Fig. 2.)

The casing is made of solid copper with oxidized finish and supports a closed base outer globe (Fig. 1), the lower part of which is frosted to ensure an even distribution of the light directly beneath the lamp.

Operation.—Referring to Fig. 3, the operation of the lamp is as follows:

The mechanism is without floating parts and when the lamp is out of circuit its electrodes are separated with the lower electrode carrier detained by a stop which holds the tip of the lower electrode at a fixed distance from the upper electrode. When the current is thrown on, the pickup by the starting magnet brings the lower electrode into contact with the upper electrode. This operation allows the current to flow through the series magnet thereby opening the circuit of the starting magnet, at the cut-out contact allowing the lower electrode to fall, striking an arc. The lamp is then burning with the lower electrode carrier resting on its stop and with the series magnet holding the cut-out contact open. As the lower electrode is consumed the voltage across the arc rises, the shunt magnet (which is bridged across the arc) lifts its armature, closing the cut-out contact when the arc voltage has reached a predetermined limit. The closing of this contact cuts the starting magnet again into circuit, thereby picking up the lower electrode and starting the arc as before with the correct length of arc for proper operation.

The series magnet is of low resistance and causes a drop of only a volt or two between the terminals of the lamp and arc when the lamp is in operation. The lamp is so designed that only two single adjustments are necessary; the adjustment of the shunt armature to feed the lamp at the proper arc voltage, and the setting of the stop for the lower clutch to determine the proper length of arc.

The switch which has been ordinarily used with series lamp has been omitted as it has become common practice to install an absolute cut-out with each series lamp, thus making a lamp switch unnecessary.

Advantages of the Luminous Arc Lamp.—The luminous arc lamp possesses qualities of such importance, that its introduction undoubtedly means a revolution in street lighting. This lamp is superior to other lamps used for commercial purposes in respect to efficiency, distribution of light, color of light and low maintenance cost. Its principal feature is its high efficiency, which even without its other advantages would undoubtedly soon establish for this lamp an important position in street lighting.

Efficiency.—Readings made with the luminometer show that a luminous lamp consuming 310 watts at the terminals gives the same intensity of illumination at a distance of 309 feet that the 480-watt direct-current series enclosed arc lamp gives at a distance of 275 feet and that the 480-watt alternating-current enclosed series lamp gives at 247 feet.

Distribution.—In the direct-current open-carbon arc the positive (upper) carbon forms a crater of small area which emits over 90 per cent. of the light. The axis of maximum light distribution is at an angle of about 45 degrees with the horizontal, and the intrinsic brilliancy is unduly high. The well-known disadvantages of the open arc are:

1. Poor diffusion resulting in the casting of hard black shadows from nearby objects.
2. Wide variation in illumination due to the wandering of the arc.
3. Intense illumination in the vicinity of the lamp with greatly decreased illumination at the light intersecting point between poles.

The enclosed arc lamp effects considerable improvement in these particulars. Its distribution and diffusion of the light are better because of the longer arc and the blunter ends of the carbon points.

The luminious arc lamp, however, effects still greater improvement by the possession of qualities of distribution and diffusion that render this lamp ideal for street lighting. All the light comes from the arc which is exceedingly long, a feature which gives a nearly horizontal axis of maximum distribution and at the same time eliminates heavy shadows and contrasts. Moreover, the maximum and minimum luminometer readings differ but slightly, for the electrodes offer practically no obstruction to the light and the distribution is not disturbed by the wandering of the arc.

Color.—The color of the luminous arc light is pleasant for street illumination. The light has a spectrum which is practically the same as that of sunlight and as white as any artificial light in commercial service to-day.

Low Maintenance Cost.—The maintenance cost of the luminous arc lamp is very low. The upper electrode is copper and the arc burns at a comparatively low temperature which results in an average life of about 4,500 hours for this electrode and a practically negligible cost for renewal. The lower electrode has a burning life of 150 to 175 hours which allows one man to take care of and trim a much greater number of lamps than is possible with open or enclosed carbon arc lamps. This long burning feature and the fact that only one electrode must be renewed gives marked economy in maintenance.

The Series Rectifier Outfit.

The station end of the series luminous arc rectifier system includes a constant current transformer connected to the alternating-current source and the series mercury arc rectifier panel with its accessories.

Constant-Current Transformer.—The constant-current transformers used with the rectifier outfit have the same general appearance and characteristics as those used with the series alternating arc-lighting system.

The primary windings of the transformer (see Fig. 4) are connected to an alternating-current supply of practically any voltage. The secondaries are connected through small reactances to the anodes or alternating-current terminals of the rectifier tube. A tap at the middle of the secondary connects the transformer with one end of the direct-current circuit on which the lamps operate.

The proper adjustment for current in the lighting circuit is obtained by small weights attached to the rocker arms which support the movable coils of the transformer. The transformer will regulate from full load to slightly below one-half load with constant secondary current.

The constant current transformers for outfits of under 50 lights capacity are air cooled, while the 50-light and larger sizes are oil cooled.

Reactances. The small reactive coils already referred to are enclosed in a common case and protect the secondary from inductive kicks or high-frequency oscillations which may be caused by disturbances on the line circuit.

Another reactive coil is inserted in the direct-current side of the rectifier circuit in series with the lamps in order to reduce the pulsations of the rectified current.

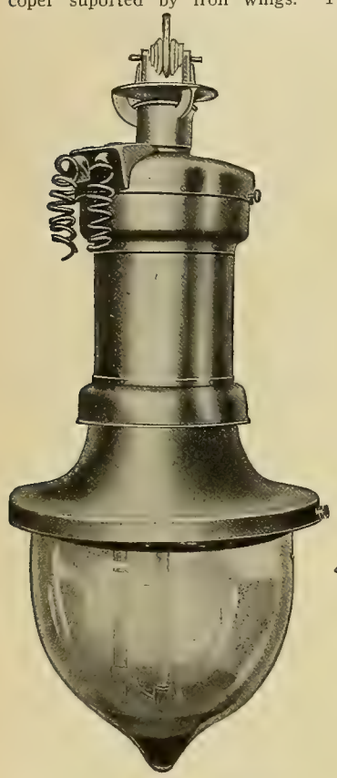


Fig. 1. Luminous Arc Lamp Complete.

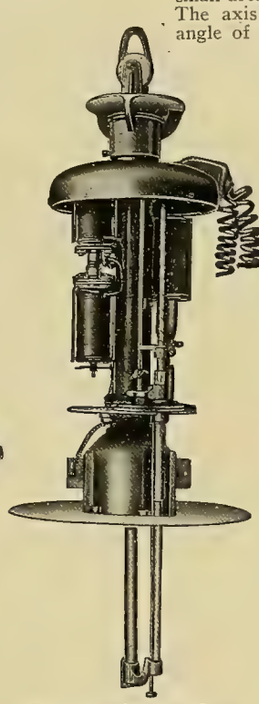


Fig. 2. Luminous Arc Lamp with Casing Removed.

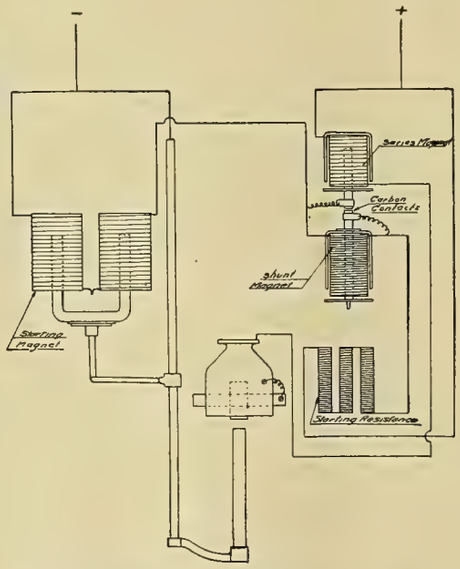


Fig. 3. Connections of Series Luminous Arc Lamp.

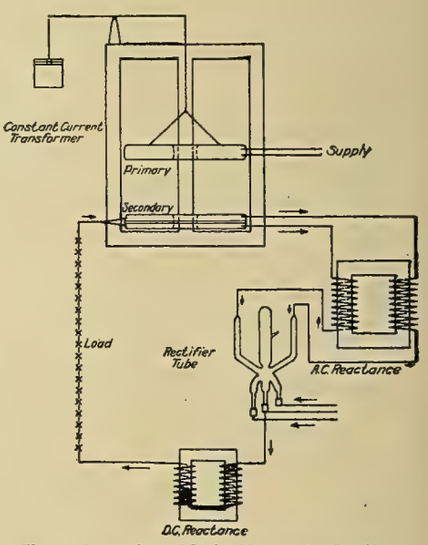


Fig. 4. Connections of Series Mercury Arc Rectifier.

THE SERIES LUMINOUS ARC RECTIFIER SYSTEM.

Rectifier Tube.—The rectifier tube is the means by which the alternating constant current is changed to direct current for the series circuit. It consists of an exhausted glass vessel (Fig. 5), containing one carbon anode or positive terminal in each of the two upper side arms, two mercury starting anodes and the mercury cathode or negative terminal at the bottom of the tube.

The rectifier tube is supported on the panel in a movable wooden holder. The tube is put into operation by shaking it slightly, which causes a flow of mercury between the mercury starting anodes and the mercury cathode, thereby bridging the circuit and permitting a flow of current from the low voltage exciting circuit connected to the starting electrodes. The breaking of this bridge causes the formation of a small arc at the bottom of the tube between the starting anodes and the cathode. With this small arc in operation the main arc can be established by closing the primary switch of the constant-current transformer, which throws the secondary of the transformer in circuit with the operating anodes of the tube.

With the tube operating at four amperes there is a drop equivalent to about 25 volts or a loss of 100 watts which is constant at all loads. Under normal operating condition the average life of the tubes on 25, 50 and 75-light circuits is over 400 hours. Reports from commercial installations show that the maximum life reported is over 1,200 hours. Following is a quotation from a paper read by W. S. Barstow before the National Electric Light Association at its convention held at Atlantic City in June, 1906:

"There have now been in operation in Portland for several months over 800 lamps with rectifiers, and the installation is being rapidly increased as fast as deliveries can be made. The system has

1. A paper read before the Ohio Electric Light Association at Put-in-Bay, Ohio, August 23, 1906.

proved successful and has fulfilled expectations. Considerable difficulty in the form of static discharges and short life was at first experienced with the tubes. The tubes, which were of small size, were subjected to very rigid requirements on account of the alternating-current pressure of 18,000 volts, a pressure which was very much higher than anything yet attempted with mercury arc rectifiers. The tubes have now averaged over 650 hours and several have exceeded 730 hours, 500 hours being the economical requirement, and anything above this being in the nature of a gain in the original calculated efficiency of the system."

Capacity.—The standard sets are designed for 12, 25 and 50 lights, although outfits of larger capacity can be furnished if required.

Frequency.—One of the most important advantages in connection with this system is the readiness with which it can be adapted to circuits of any frequency from 25 to 140 cycles. The standard sets are designed for 60 cycles, but outfits have been designed for and are in operation on circuits of 25, 33 and 40 cycles.

Efficiency and Power Factor.—The efficiency of the rectifier sets when operated at full load with rated primary voltage and frequency varies from 85 to 90 per cent, depending upon the capacity of the set. Under the same conditions the power factor varies from 65 to 70 per cent.

Switchboards.—The switchboard consists of a

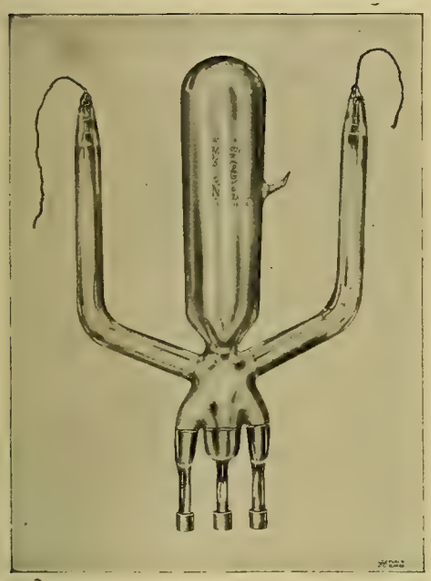


FIG. 5. SERIES MERCURY ARC RECTIFIER.

single piece of blue Vermont marble 62 by 24 by 2 inches, supported on a pipe frame eight feet high. These boards are designed for installation immediately in front of the constant-current transformer and are not a portion of a complete switchboard.

The following equipment is mounted on each board: One mercury rectifier tube, one tube holder, one handle for starting tube, one ammeter in protecting case, two open-circuiting plug switches, one short-circuiting plug switch, two primary plug switches (double-throw switches are furnished with 50 light sets), one starting switch, one blower motor switch.

Blower.—A blower for cooling the rectifier tubes is furnished with each set. This blower is direct-connected to a small horsepower motor operated from either a single-phase or a three-phase circuit. If several sets are installed, one larger blower with the proper system of distributing the air can be used for cooling all the tubes.

Installation.—The series rectifier system was first introduced about one year ago, and since its introduction orders have been received for over 80 sets with a total capacity of 4,500 luminous arc lamps, the largest installation being at Portland, Ore., where a system of 1,200 lights capacity has recently been installed.

Platinum $34 an Ounce.

The year 1905 saw a phenomenal rise in the price of platinum and a greatly increased production in the United States. The annual report of the United States Geological Survey on the production of platinum, prepared this year by Mr. F. W. Horton, contains details of exceptional interest. It shows that early in March, 1905, the price of ingot platinum advanced from $19.50 an ounce to $21 an ounce, surpassing gold in value. On April 1, 1905, the price fell to $20.50 and remained firm at this quotation until February 1, 1906, when it jumped to $25 an ounce, where it remained until September 1, 1906, when it leaped to the unprecedented value of $34 an ounce. Mr. Horton's report also shows that the production of platinum in the United States increased from 200 ounces in 1904 to 318 ounces in 1905. This report is published as an advance chapter of the annual volume, "Mineral Resources of the United States, 1905," and is distributed free of charge, on application to the United States Geological Survey.

Storage Batteries and Battery Plates.

By George P. Hutchins.

The advantages of a properly designed, properly installed storage battery appear in three distinct phases—first, mechanical, as maintaining virtually uniform loads upon generating equipment, enabling engines to be operated at the point of highest efficiency; second, electrical, as maintaining electrical pressures over long lines, despite fluctuations, and likewise as preventing electrical losses due to carrying large volumes of current over limited conductors, and third, financial, as a result of the other two gains, showing as a smaller investment and lower cost of kilowatt output.

The storage battery is to-day an important and essential part of a complete power plant.

Batteries for general power service are of three distinct types—the regulating battery, the floating or line battery (as used chiefly on street-railway lines) and the booster line battery.

The regulating battery is always installed in connection with a booster through which all current flows, both on charge and discharge. The essential function of the booster battery is to neutralize fluctuations, charging when the current demand is light, discharging when the current demand increases above a predetermined point, thus maintaining a practically uniform load upon the generating equipment. During hours of very light load the engines may be entirely shut down and the battery furnish all power required.

The line or floating battery has no booster or other charging equipment. It is simply connected across the circuit at points distant from the power house where the pressure drop under fluctuations is considerable. When the current demand is light the electromotive force of the line exceeds that of the battery, and current is absorbed. When the current demand causes the line pressure to drop below the electromotive force of the battery, discharge takes place, so that voltage fluctuations are minimized. The booster line battery as used on long lines entails the erection of a separate feeder line direct to the battery, the voltage of which is raised by a booster in the power station to any necessary extent above the line voltage to compensate for drop. This provides one auxiliary service of supply to the battery.

There are two distinct economies in line batteries—first, the saving on cost per kilowatt delivered, due to the elimination of large voltage losses on a given amount of current transmitted; second, the smaller investment in copper conductors required to transmit the extreme ampere demand within the limits of allowable voltage drop. It is a fact too little appreciated that the first cost of a line battery is often very much less than of copper feeders sufficient to secure anything like equivalent effect. As evidence of the extent of these economies it may be stated that the line batteries installed by the Gould Storage Battery Company have frequently saved their entire cost in less than 18 months.

Requirements of lead storage-battery plate, as given by Lamar Lyndon, M. E., in "Storage Battery Engineering," are substantially as follows:

1. Uniform resistance throughout grid to secure even current flow through active material.
2. Allowance for expansion and contraction of active material during discharge and charge.
3. Close electrical contact between active material and support plate.
4. Freedom from local or secondary action.
5. Provision for ample circulation of acid electrolyte.
6. Large surface of active material exposed to electrolyte.

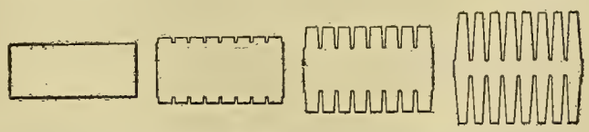


Fig. 1. From Blank to Battery Plate.

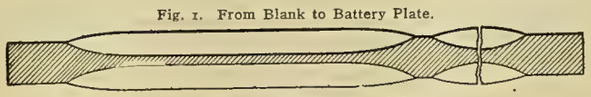


Fig. 2. Longitudinal Section of Fragment of Plate.

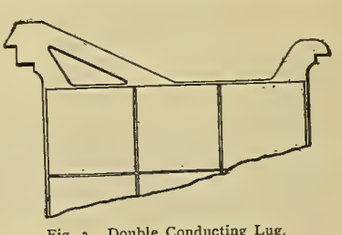


Fig. 3. Double Conducting Lug.

STORAGE-BATTERY PLATES.

The following brief description of the Gould battery plate and the accompanying illustrations serve to explain to how great a degree this plate fulfills the theoretical requirements as set forth above.

The Gould plate is of the Planté type, so called, in which the active material, lead peroxide for the positive and spongy lead for the negative, is formed electrochemically out of the lead composing the support plate or contact surface.

Fig. 1 is a fragment of a Gould plate illustrating the manner in which the large contact surface for active material is developed out of a sheet of rolled lead cut to the size and shape of tne plate. This "blank" is placed between two shafts on which are mounted sets of rapidly revolving steel discs with spacing washers. These discs are pressed against the plate and moved to and fro, working into the lead further and further and spinning the metal between the knives up into thin parallel ribs.

Fig. 2 is a longitudinal section of a fragment of a plate, and shows the web of metal left as a central conductor and also the diamond-shaped cross conductors and current-distributing bars.

Fig. 4 is a perspective drawing of a small fragment of finished plate and clearly indicates the character of the construction. The active material is formed out of the lead composing the contact surface between the ribs, filling the spaces with closely packed but highly porous active material. Expansion and contraction cannot cause loosening or falling out of the active elements, and the closest electrical contact is preserved.

Fig. 3 shows the double-conducting lug by means of which better distribution of current is secured.

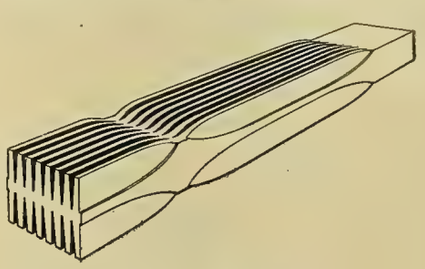


FIG. 4. SMALL PORTION OF FINISHED BATTERY PLATE.

Only chemically pure, densely rolled lead is used, so that secondary actions leading to "self-discharge" are impossible. The plate is absolutely integral; no lead is removed or added in making the plate—the blank is merely changed in form. There is ample provision for circulation of electrolyte and large contact surface for securing high efficiency and long life. In addition to batteries for power purposes the Gould company is manufacturing types for telephone, telegraph and signal service, for train lighting and for electric vehicles.

More Electrical Equipment for the New "Steel City" at Gary, Ind.

As readers of the Western Electrician know, there is being constructed by the United States Steel Corporation at Gary, Ind., a large plant for the manufacture of steel. Along with the completion of the various buildings of the new plant an entirely new city is going up. The principal features of this interesting "steel city" and steel plant have been given in the Western Electrician. The gases from the blast furnaces, as far as possible, are to be used for the generation of the electric power.

One of the first buildings to be equipped will be the rail mill, and the induction motors which will be used are not only of interest because of their size, but because of the special method of control. This will be the first steel mill in this country to operate its rolls by induction motors. Six General Electric three-phase induction motors, ranging in capacity from 2,000 to 6,000 horsepower, will be used to drive the main rolls. These motors are reversible and are specially controlled. Due to the heavy overloads to which the machines are necessarily subjected, each motor is provided with a heavy flywheel, which, with the system of control, stores up energy when running normally and returns it to the rolls when subjected to a heavy overload. In addition to the heavy flywheels, each induction motor has an overload capacity of 50 per cent. for one hour. Thus, three of the motors having a normal rating of 6,000 horsepower can each deliver 9,000 horsepower for one hour when called upon to do so. Mechanically, these motors are of unusually sturdy construction, being built heavy and rigid to withstand the shocks to which they will be necessarily subjected. At the same time the construction is as simple as is consistent with reliability. The heavy bearings and general massive appearance of the motors is quite in keeping with the powerful rolls which they drive.

The method of control was specially designed by the General Electric Company for this service. A master controller is used, from which the main-line oil switch can be opened or closed, the reversing switch thrown in either position, or the resistance cut in and out of the rotor circuit in successive steps by means of electrically operated switches or contactors. The main-line switch is a triple-pole, single-throw, electrically operated oil switch, and the current passing through this is led through the reversing switch, a double-pole double-throw electrically operated oil switch. Special precautions have been taken to insure the automatic protection of the control system. It is impossible

to operate the reversing switch unless the main-line switch has been previously opened, and if the main line switch has been opened by the overload trip it cannot be closed without first bringing the controller to the off position.

As has been stated, a special arrangement is used to assist the flywheel in restoring energy to the motor. So-called "slip relays" are provided in which the actuating coil carries the current of the motor. Whenever the motors are subjected to overloads the slip relays operate, cutting a small portion of the resistance into each phase of the rotor circuit, causing the motor to slow down gradually and the flywheel to give up a portion of its energy. When the load is taken off the motor, the reverse operation takes place and the motor speeds up, returning the energy to the flywheel.

Testing High-power Alternating Machines in the Shop.

When alternating-current machines reach sizes as large as that of the 8,000-horsepower Bullock frequency-changer recently built by the Allis-Chalmers Company and installed at the Shawinigan Water and Power Company's plant, near Montreal,

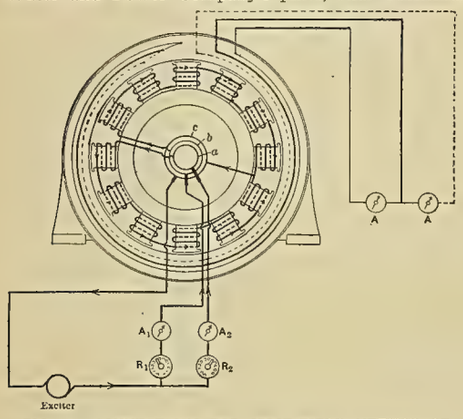


FIG. 1. CONNECTIONS FOR SPLIT-FIELD METHOD OF TESTING.

it becomes very difficult and sometimes quite impossible to run them under actual full-load conditions before they leave the shop, owing to lack of driving power. Yet means must be devised to test these machines under conditions such as lead to full losses in the core and the coils of the machine. One solution of this problem is the split-field method originated and patented by Mr. B. A. Behrend, chief electrical engineer of Allis-Chalmers Company. It is especially adapted to testing polyphase machines of the revolving field type.

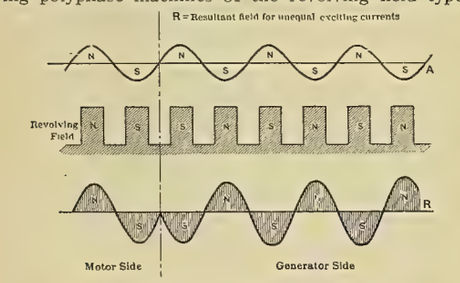


FIG. 2. DIAGRAM SHOWING EFFECTS OF ARMATURE CURRENTS IN SPLIT-FIELD TESTING.

In this method use is made of the property of alternating currents of being able to store energy during one-quarter of a period and return it during the next quarter, allowing the flow of large amounts of apparent energy in the form of so-called wattless currents. The field is split into two sections of an equal number of poles, which are excited with different field currents, the arrangement being such as is shown in Figure 1.

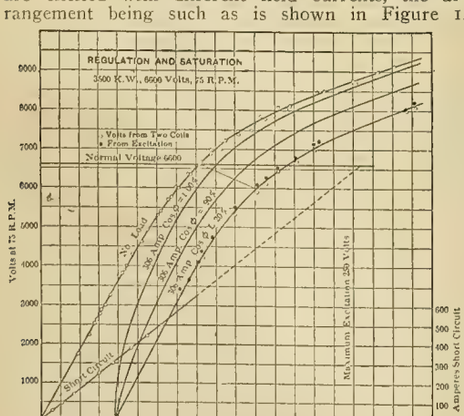


FIG. 3. CURVES OF REGULATION AND SATURATION AS OBTAINED BY SPLIT-FIELD TESTING.

In Fig. 2, which shows the effect of the armature reaction on the poles, the wavy line (A) represents the field produced by the armature current alone, and the wavy line (R) represents the resultant magnetic field.

Fig. 3 shows the regulation curves of a 3,500-kilowatt, 40-pole, 25-cycle generator, forming a part of the unit known as the "Big Reliable," which supplied power and lighting current to the World's Fair at St. Louis. The terminal voltage corresponding to the conditions under which the machine is operating in the test can be determined by measuring the volts on a set of coils per pole multiplied by the total number of coils, or by adding to the excitation on the motor fields the excitation required to drive the armature current through the armature winding. Both methods have invariably given the same results.

Numerous tests have been made to ascertain the actual losses in operating the machine in the manner described by splitting the field. Fig. 4 shows the comparison between the core loss of the machine, as determined in open circuit run, and losses as obtained in the split-field test; one set of readings is shown by the open dots, the other by the dark ones. These tests were carried out on a 1,000-kilowatt, 25-cycle, 32-pole generator.

The heat runs obtained by this method on the machine above mentioned, and on a 3,200-kilowatt machine, at full normal load, in kilovolt-amperes and power-factor zero, yielded the following results:

HEATING TESTS.

		3,500-Kilowatt.	3,200-Kilowatt.
Volts		6,600	4,500
R. P. M.		75	75
Frequency		25	60
Hours		18	23
Loads K. V. A.		3,500	3,870
Temperature Rise, Degrees Centigrade	Armature Surface	30°	27.5°
	Armature Coils	34°	31.5°
	Field Coils	34°	31.5°

It is hard to imagine a simpler method of testing than the new method described. The course of evolution in engineering has always been from the complex towards the simple. It has

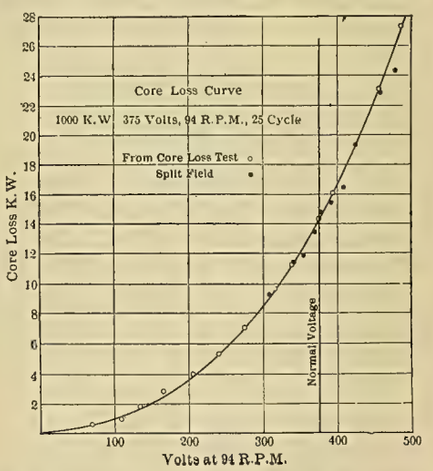


FIG. 4. CURVE SHOWING CORE LOSS AS OBTAINED BY SPLIT-FIELD TESTING.

taken many years to evolve this method of testing which enables one to obtain with comparative ease the most important data of the performance of alternating-current generators. The only drawback of the method consists in the fact that it is applicable only to machines having a comparatively large number of poles. It has not been successfully applied to machines having fewer than eight poles. The application of this method is confined to machines of the slow-speed type, and with the advent of the steam turbine generator, new methods will have to be devised to produce artificially full-load losses without the expenditure of full-load power.

Annual Meeting of Boston Edison Company.

The Edison Electric Illuminating Company of Boston held its annual meeting on October 9th, at which the directors were re-elected. The following-named officers were also re-elected: President, Charles L. Edgar; vice-president, Walter C. Baylies; treasurer, Henry B. Cabot; clerk, J. Otis Wardwell; executive committee, Walter C. Baylies, I. Tucker Burr, George Dexter and C. Minot Weld. The directors' report noted that aside from new business acquired in the purchase of other companies' properties, the increase of the company's business was the largest of any year in its history, and hinted that the company would increase its capital during the coming year. During the year the company bought the properties of the Medfield, Mass., Electric Light and Power Company and the Medway, Mass., Electric Light and Power Company; it put a new price list into effect, which materially reduces the income from present customers, but which the directors believe will be more than made up by new customers; steam apparatus in Natick and Somerville, Mass., has been sold; and the city of Boston settled a long-standing land damage case by which the company obtained $390,000. The report shows the following comparative figures for the years ended June 30th in each case:

	1906.	1905.	1904.
Gross earnings	$3,780,911	$3,346,027	$3,125,517
Operating expenses	1,964,976	1,776,656	1,697,601
Net earnings	$1,815,935	$1,569,371	$1,427,916
Other income	49,257	33,286	37,396
Total net earnings	$1,865,192	$1,602,657	$1,465,312
Taxes	445,508	366,450	312,089
Balance	$1,419,684	$1,236,207	$1,153,223
Charges	78,966	94,021	102,408
Balance	$1,340,718	$1,142,186	$1,050,815
Dividends	1,148,810	1,070,770	973,405
Surplus	$ 191,908	$ 71,416	$ 77,410

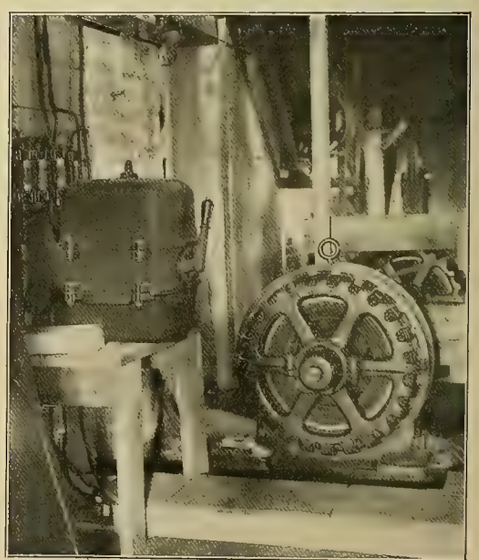
The balance sheet dated June 30, 1906, is as follows:

ASSETS.		LIABILITIES.	
Property account	$18,161,328	Capital stock	$11,488,100
Cash	133,874	Bonds	1,486,000
Stock on hand	403,078	Notes and accounts payable	1,483,029
Notes and accounts receivable	1,780,422	Premium on capital stock	5,307,150
Open accounts	9,208	Coupon notes	53,500
Sinking fund cash	23,914	Accrued interest, taxes and dividends	376,558
		Rep. and reserve	104,077
		Profit and loss surplus	213,410
Total	$20,511,824	Total	$20,511,824

Electric Power in a Casket Factory.

Electricity as the motive power for the operation of industrial plants has come into general use in all branches of manufacturing on account of the simplicity of electric motors, the ease with which they can be applied to almost any class of work and the flexibility attending their use. Another illustration of this fact is found in the plant of the Springfield Metallic Casket Company of Springfield, Ohio, where the rapidly increasing business created power demands that were considerably in excess of the steam-engine equipment, and electric motors were installed in preference to additional steam capacity. The motor equipment is shown in the accompanying picture. This company manufactures high-grade metallic caskets with self-locking covers that cannot be removed when once placed in position.

The electrical equipment consists of two Westinghouse type CCL motors of 50-horsepower capacity each, which are belted to line shafting that in turn drives various machines. This is



MOTOR EQUIPMENT IN A CASKET FACTORY.

only one of the many instances where progressive companies have shown appreciation of the superiority of electric drive.

Chicago Street-railway Situation.

Contrary to expectations the local transportation committee of the Chicago City Council was unable to take up the general settlement negotiations with the traction companies last week. Another week will probably be required to finish the ordinance, which is to include plans for a subway told of in the Western Electrician last week. The city's experts on valuations were also delayed in reporting.

From New York comes the report that the general counsel for the Chicago Union Traction Company, and Thomas E. Mitten, president of the Chicago City Railway Company, submitted to those representing the control in their corporations the plan for the proposed indeterminate franchise ordinance, and it is believed the ordinance will be accepted by the financiers and trustees with little or no change.

A Metallic Support for Cross-arms.

A device of special interest to constructors of power-transmission lines, interurban railways and even electric-light systems is shown in the accompanying illustrations. The device is a steel gain and is clearly illustrated in Fig. 1. In this illustration it will be seen that the cross-arm is attached to the pole by means of a metal fixture, composed of two plates (shown in detail in Fig. 2), engaging each

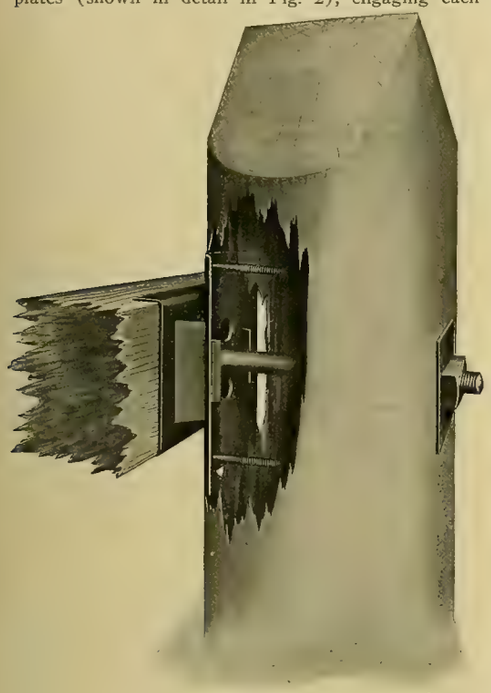


FIG. 1. STEEL GAIN FOR CROSS-ARM.

other and at the same time engaging the cross-arm and the pole. The curved steel plate embraces the pole, while the gain plate, which is provided with projecting braces or tongues, supports the cross-arm. The tongues of the gain plate pass through apertures in the pole plate and fasten into the pole. Shoulders on these braces clamp against the pole plate and afford a rigid support for the gain. The pole plate normally has a greater radius than the largest pole top and when drawn into place not only conforms closely to the circumference of the pole, but by pulling the gain towards it as it is clamped into place, provides sufficient spring tension to compensate any shrinkage in the pole or cross-arm.

By referring to Fig. 1 it will be seen that the device is attached by one through bolt, which passes through the cross-arm, the gain plate, the pole plate and the pole, and is held by the usual square washer and nut. The pole plate is afforded an additional support by the two lag screws, one placed above and the other beneath the gain.

The advantages derived from the use of the steel gain are readily appreciated. The device when properly fastened in place supports a five or six-foot cross-arm so rigidly that cross-arm braces are unnecessary. This fact in itself is a decided advantage, as the cost of cross-arm braces and the cost of cutting a gain are saved. A further saving is effected in mounting the arm with this steel gain, as the relation of the gain to the pole plate is such that the arm is brought into alignment without the usual sighting and without the use of a square. Still another advantage is derived from the fact that this steel gain when in place adds to the strength of the pole instead of reducing the strength at a

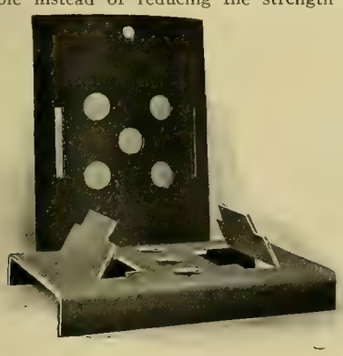


FIG. 2. TWO PLATES OF STEEL CROSS-ARM GAIN.

point where it is most needed. A gain cut in a pole one inch, or even less, greatly reduced the strength of the pole, while this steel gain tends to brace and strengthen the whole structure. It also has the effect of a back brace, as it will resist a lateral strain that ordinary braces, no matter how heavy, cannot withstand.

While the advantages of construction are of importance, undoubtedly the most valuable feature of the device is noticeable after the power-transmission line, or whatever other line the device is used on, has been put into operation. The use of a single metallic cross-arm brace or a pair of metallic braces causes danger of a loss of current by leakage. A wire carrying a high-potential current, even when mounted on the most approved type of insulator, lies not far from that point on the cross-arm to which the brace is connected. Even in dry weather there is likely to be a certain amount of leakage from the conductor on one side of the arm through the cross-arm brace or braces to the other conductor on the opposite side. This leakage is greatly increased during damp, rainy or snowy weather, and it has been the study of a great many electrical engineers to overcome this loss of energy. The steel gain, by eliminating the cross-arm braces, does away with this troublesome feature in power-transmission work and makes it possible to use a shorter arm with safety.

Although the steel gain is new, so far as heavy work is concerned, a smaller and lighter gain has been used in telephone and electric-light work for a little more than two years. In the lighter branches of construction it affords the same advantages, and it has proved itself an economical support for cross-arms. Various sizes are made to accommodate telephone and electric-light arms, as well as the heavier arms for power-transmission lines.

When shipped from the manufacturer (the Steel Gain Manufacturing Company of Chicago) the two plates are assembled, the tongues of the gain plate engaging the pole plate so that the device may be considered as a single unit. Both the pole plate and the gain plate are made of No. 12 Bessemer steel, and the weight of the large gain for five-inch arms is approximately 3½ pounds. The gains are furnished plain or galvanized, as ordered.

Ajax Mast Arms.

With the rapidly increasing cost of poles, and the growing sentiment against wires crossing the streets, the use of center-suspension lamps is decreasing. Similarly, the need of neat, firm and low-priced fixtures for supporting the lamps at some distance from the poles is steadily increasing.

The range of conditions to be met in modern practice is well shown in a series of fixtures made by the Ajax Line Material Company of Chicago. These range from the Ajax front fixture (Fig. 1) with its two-foot reach, to the Ajax medium mast arm (Fig. 2), built in lengths of 8 to 14 feet. The latter is also made with additional bracing for lengths up to 20 feet. The Ajax midget mast arm answers for the

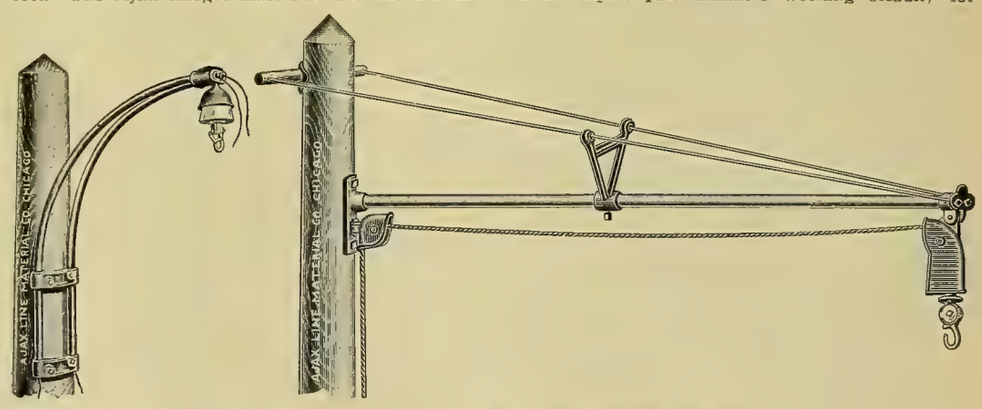


FIG. 1. AJAX FRONT FIXTURE.

FIG. 2. AJAX MEDIUM MAST-ARM.

4 and 6 foot lengths. Both of the last-named types are fitted with safety pulleys, while the front fixture is usually equipped with the high-voltage type of the Ajax arc-lamp insulators.

A Small 50-ampere Dry Cell.

To meet the demand for dry batteries of small bulk and yet of sufficient power reliably and continuously to supply the sparking devices of automobile internal-combustion engines the French Battery Company of Madison, Wis., has brought out a new type called the "Auto Special;" though this cell is but 2½ inches in diameter and six inches high, it is said to show an initial current of 50 amperes and to have an unusually high recuperative power, as shown by tests. Owing to severe requirements this type must satisfy, the demand for it is necessarily limited to a special class of work, in which considerations of high amperage and recuperative power override considerations of economy. But other types of cells, with appropriate modifications for each, are made by this company, in a decreasing series of amperages. For each class of work a certain type is adapted and its expense proportioned to the work in hand. To carry out this general principle each of the four types produced by the French Battery Company is built on lines peculiar to it and differs radically in construction from the other types. For annunciator and bell service a cell showing from 12 to 15 amperes is provided, called the "Bell" type. The "Telephone" type, the name of which designates its use, shows from 22 to 25 amperes, while the "Ignition" type, designed mainly for supplying the sparking devices of stationary gas engines and available for auto engines of not pronouncedly high requirements, shows from 32 to 35 amperes. Owing to the necessity for increased factory space, the French Battery Company has moved to Madison, Wis., and there erected a new plant of much greater capacity than the one it operated in Chicago.

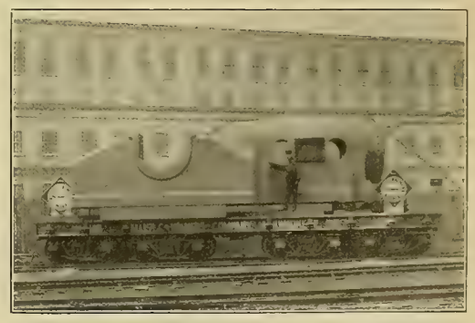
A SMALL 50-AMPERE DRY CELL.

The Making and Shipping of a 105-ton Casting.

An unusually large casting, 105 tons in weight, the largest ever poured by the Allis-Chalmers Company, is represented in the accompanying illustration standing ready for shipment on one of the company's special 16-wheel flat cars, having a normal capacity of 100 tons, the first of its kind ever built. This casting will form the bed-plate and slide of a 4,000-horsepower Allis-Chalmers tandem rolling mill engine, to be installed in the Edgar Thompson Works of the Carnegie Steel Company at Bessemer, Pa.

All through the progress of its manufacture, this engine has been remarkable on account of the size of its parts and for the unusual features attendant upon its construction. For example, the pattern from which the moulds were made for this heavy piece, possesses the following interesting features: It measures 32 feet long, 11 feet wide and 10 feet in height, representing the work of 10 expert patternmakers working steadily for a period of over four months. The amount of lumber used in its construction aggregated the unusual figure of 22,000 feet.

The pit, in which the casting was poured, measured 40 feet by 15 feet by 11 feet deep, into which 108 tons of metal were poured for the



A 105-TON CASTING LOADED FOR SHIPMENT.

rough casting, which process consumed some eight to 10 minutes' time. Nine ladles, four with a capacity of 25 tons each, one of 13 tons and four of 5 tons each, in all 133 tons, were used in the operation.

In building a rolling mill engine with a capacity like the one mentioned, whose required horsepower will vary from the mere friction load of the empty rolls to a maximum of 4,000 horsepower in the severest kind of service, there is a marked

advantage in designing the frame and other parts as heavy as possible so as to secure the greatest possible rigidity to withstand the racking strain of rolling mill service. An extra amount of ingenuity was required in the handling of a piece of this size, however, in the process of building.

In the first place, a piece of this weight being very exceptional, especial precautions were taken against any mishaps in the process. Three cranes, with ample overload capacities and a rated aggregate of 145 tons, were used in conjunction to lift the casting from its pit. A special tackle was devised so that the lifts should be straight upward, applied at the ends of the heaviest of trussed steel lifting bars.

The casting, after being deposited besides its pit, was allowed to cool for 15 days before the operation of cleaning it was begun. The heat still given off, after approximately 20 days' cooling, could be felt several feet away from the huge mass. During the cleaning process, three men were able to work abreast inside the slide aperture, while standing upright, and without perceptible crowding.

The casting, loaded as shown, was shipped from the West Allis Works to its destination at the Edgar Thompson Steel Works on August 13th and was unloaded on August 21st, making unusually good time, when it is considered that only trunk lines with the heaviest track construction could be used, because of the unusual weight of the shipment.

Conditions Surrounding the Inspection of Wires in the Southwest.

By Clarence R. George.

The use of electricity for lighting and power purposes is a new industry. The means of offense always precedes defense, which is always a little behind the times, and the older they grow and develop, the nearer they approach equality. This is true of electricity; its first growth was very rapid, and little, if any, care was taken to surround it with even the ordinary safeguards, but, as time moved on, no one seemed to take to the side of the defense until along in the early '80's the New York Board of Fire Underwriters printed its first set of rules for the installation of electric wires.

It was the practice in those days to staple electric wires the same as bell wires, or to use wooden cleats of the telegraph type; in other words, it was a case of "get it in," even in some cases using bare copper wire; the writer has been guilty of just such installations in years gone by.

It was about this time that the underwriters and those interested in the electric-light business were beginning to understand that some steps must be taken to safeguard this new industry, and to protect property and life. As they considered the matter from two points—one from the underwriters', on account of the fire hazard, and the other from the lighting companies, a business standpoint—this soon brought about a co-operation between those interested, and from this co-operation we have the National Electrical Code rules and requirements for electric wiring.

While the Code is the same everywhere, yet we meet with different rules locally. These differences in some cases are provided by city ordinances, but in the majority of cases it is the result of different interpretation of the Code. I have heard it said—and I am of the same opinion—that good workmanship and poor material are far better than poor workmanship and good material, in so far as the fire hazard is concerned.

These conditions are the kind the average inspector is meeting with every day. The cause we all know, but it is the remedy that we are seeking.

Electricity appeals to the average young person as something mysterious; it is even more than that that brings to the trade the boy who should be in school instead of in the shop of some contractor who makes a practice of employing boys for such work who, within a very few months, will be out "contracting" for themselves—long before they have acquired sufficient knowledge as a wireman to make a practical installation of a doorbell.

Such conditions are met with every day by inspectors who are trying to do all in their power to bring about installations of a standard in accordance with the National Electrical Code. But in nine out of every ten cases he meets with poor workmanship, and no few times, poor material. This is one of the obstacles in the way of the inspector, as he is not only called upon to do his duty as an inspector, but he, in order to get around to all the jobs under construction, and see that the proper installations are made, must, in self-defense, and for the protection of the owner of the building, open up a kindergarten for the benefit of contractors who employ these "juvenile" wiremen. There are many contractors of this class in at least a part of the Southwest.

1. Abstract of a paper read at the New Haven convention of the International Association of Municipal Electricians, on August 15, 1906. Mr. George is city electrician and superintendent of fire alarm at Houston, Tex. The paper was written with special reference to the advisability of one inspector completing each inspection instead of several inspectors, each doing a part of it.

Of course, this does not mean that all of the contractors are of this disposition, for, on the other hand, we have some who would not think of sending out on a piece of work any but the best wiremen obtainable.

The former class of contractor, I have found by experience, cares little or nothing for the safe and neat installation of his work, and is ever ready to claim that the inspector is persecuting him because he turns his work down, and when the inspector will not give in and allow him to have his own way in the matter—which, if not allowed—he will proceed with the filing of a long complaint with the mayor or other city officials, where he thinks he has some political pull, and they will turn the inspector down. This is rarely the case where the officials know that the inspector is doing his duty.

However, just such action on the part of contractors makes the inspection of wires to conform to the rules difficult, that is, if he is turned down by the officials. But, where he is upheld by the officials, he is then placed in a position to do his duty without fear from these unjust and unfounded complaints, and those having the inspection made will be sure of having a safe installation.

Recently I was in conversation with an inspector of another city regarding certain conditions in his city, who informed me that he was in the position of inspector, but not inspector. Of course, I did not understand him at first, but in a minute he told me if he undertook to demand a strict adherence to the rules of certain contractors that he would not "last long" on account of political influences that would be brought to bear on the officials, and as this would be the case with any other inspector in the same city, he thought that he might as well hold the position, draw the salary, and try to do the best he could, under the circumstances.

Another case similar to this: A city electrician had been appointed but a short time, and it was his endeavor to treat all alike, to cause all contractors and wiremen to place nothing except approved listed material and do the work according to the demands of the Code. Now the Code was the city ordinance of this city, and in order to make a good start and accomplish what the ordinance called for he drew up a circular letter and sent it to all contractors, stating his intention, and explaining certain parts of the ordinance. He also drew up another form of letter to be sent out to the owners of such buildings that he found to be defective, notifying the owner of the defects existing, and what the defects were, also the purpose of the ordinance, as well as his duty.

This was a good move on his part, and everything went along smoothly until one day he inspected a very large building that contained numerous defects, and was owned by an alderman. Of course, endeavoring to do his duty, he gave no thought as to who the owner was. Why should he—because he was an alderman? That should make no difference! If it did, it should have been in his favor, as this alderman would be showing to the public that he was in accord with the letter and spirit of the laws that his administration had enacted and was supposed to enforce. But no! This condemnation of the wiring caused this city electrician to be removed because politics were stronger than his duty.

Here is where I desire to call your attention to an inspector, or, rather, the city electrician, who rather than turn from the decision he had passed on regarding the defects of this building, and throw aside duty he had been obligated to perform, and lose his reputation and be looked upon with contempt, accepted his discharge from office with a smile. It was but a short time that some of the city officials found out that this man had only done his duty in condemning the wiring of this building, and that he had been attentive to the very duty that the city had employed him for. The final result was that the same man was replaced as city electrician by the council which removed him from office.

While occupying my present position as city electrician and superintendent of fire alarm, I was told by an alderman who was an electrical contractor that if I did not allow him to do certain work his way he would have me impeached. I simply replied that I would do my duty according to the ordinance, and would expect him to abide by the rules of the ordinance, regardless of his position, and whenever he saw fit to institute his impeachment charge to proceed. My reply seemed to insult his dignity, and in consequence he made three attempts to have me removed between the years 1900 and 1902. But, upon investigation by two different mayors, each of them came to the conclusion that the whole proceedings were brought about through this alderman's disapproval of this office and because he, as an electrical contractor, could not control matters to suit himself.

Now, gentlemen, I simply cite these several cases for the purpose of illustrating such conditions, which I have known to surround the inspection of wires in the Southwest.

Yet, with all this, I have come to the conclusion and would advise that if all inspectors would attend strictly to their duties, and have no fear of the chronic kicker and the man that threatens them with politics, they will win in the end.

Just such conditions as I related to you, on the part of politics, are the cause of many inspectors failing to do their duties, as they are held to believe that if they don't do "this or that" for "so and so" they will "lose out," and as the one I have mentioned said, that he might as well have the salary under the existing conditions as to allow someone else to get it.

These conditions, existing as they do, are deplorable in the extreme, and as long as they do exist, will prove to be a stumbling block to many good and qualified officials of the electrical departments of our cities.

Speaking of politics, with which so many electrical departments of other cities are handicapped and interfered with, I wish to say, while I have the opportunity, that in my city such interference has, to a great extent, been eliminated by the introduction of what we think to be the most approved form of city government in vogue up to date in our American cities.

It is the aim and ambition of all interested in the proper installation of electrical equipments to acquire such knowledge of the rules that will make all inspections when approved—whether by one or several inspectors—be of the same ruling; in other words, that we can all interpret the same set of rules alike. We all know that is of very rare occurrence, even when we find men occupying similar positions in different localities, to be of one and the same opinion. Therefore, this is sufficient to show that we must, as the head of our departments, look forward toward the adoption of some system whereby we can bring about a uniform interpretation of a given set of rules—the Code—which we have all accepted as our standard. This state of affairs, being obtained and retained, would almost, if not entirely, result in a universal concordant interpretation of the Code.

It might not be amiss here to speak of the duties of the inspector and his qualifications. He must be able to judge from his knowledge of electricity and his experience with the different classes of risks and their hazards as to whether the present conditions will continue, or whether those general foes of the electrician—the handyman or amateur—will probably, from the location of the wires and devices, disarrange them and bring about a state of affairs that may prove disastrous.

He must be able to suggest safe methods, which are also practicable, and not too expensive, for accomplishing an end by means not provided for in the Code, and when those provided for in the Code cannot be used.

He must have sufficient knowledge and good judgment not to condemn work that he does not like the looks of, simply because he does not like it.

He must be able to reason with the electrician and show him that he knows whereof he speaks, and give the electrician good reasons for his ruling and for the rules that it is his duty to enforce.

He must believe in the rules, and do what he can to teach others to believe in them.

He should not assume that he—if it were left to him—could frame a set of rules that would be an improvement over those he is working under, because he should know that the Code that he gets his rules from, compiled by the joint efforts and labors of the national associations, all of which are vitally interested in the industrial phases of electricity, and officially endorsed by all these associations, is far superior to any code that he or any one person—no matter how expert he may be—could compile.

At the same time he should be able to rule on such matters locally that may arise, such as outside construction, etc.

It is also very essential that the inspector should be able to know the difference between that class of material that will be safe and that which is unsafe and explain his reasons in a practical way to those who are trying to install such material and devices that will become hazardous.

In order that he may qualify himself to decide such matters, it is necessary that he make a close study of the list of approved fittings, issued quarterly.

Experience is a great teacher, and no doubt, in the rounds of all inspectors, they have found defective points in all classes of material and devices. With this experience he should profit to such extent that will enable him to decide what is good and what is not good in the way of material and fittings.

There is no just reason why one inspector could not inspect the same installation that another inspector has inspected, and both agree. But, nevertheless, there are few who agree with one another, unless they are both of the same office, and have made it a practice to consult with each other.

Now as to each doing a part of it. In this case they do not come in contact with the work of the other. For example: We say that there is a house under construction, and the wires are being concealed, and the inspection is being made by A, and on the completion of this installation to a point ready for the fixtures, etc., B is called on to make the final inspection; then the only reinspection he has to make of the work that A has previously inspected is the outlets at fixtures, which really is the duty of the inspector making

the final inspection. Hence, on such work as this, there could be no difference of opinion.

To accomplish a more uniform system of mutual agreement among inspectors, where there is no chief inspector over a large number of inspectors, who calls them into frequent consultation for the purpose of bringing about a uniform agreement among them, I would suggest that some system be adopted that will bring about a universal interpretation of the Code. For, until this is done, there will always be a difference between inspectors.

Another suggestion I would make is that municipal inspectors make it a practice to combine their efforts with those of the underwriter inspectors.

We have in my territory a gentleman who is the chief electrical inspector for the Texas Fire Prevention Association, and one whom I consider well qualified for the position he occupies. It very frequently happens that not only myself but the other municipal inspectors of other cities in this territory call on him for his opinion and to decide questions and rulings that sometimes arise between inspector and contractor, and we have always found that he is ever ready to assist. This gentleman is Mr. C. B. Roulet, and since we have had frequent interviews with him it has been the means of bringing about an almost uniform decision by all inspectors in this territory.

Therefore, I am a confirmed believer in the frequent interviews among inspectors, with the Code as the subject, and this is one of the best ways to reach the end in view.

Chicago Tunnel Mail Service Improvements.

A 30-day test of the tunnel mail service in Chicago was begun several months ago, and at that time it was found that the most serious defect in the service was inadequate terminal facilities. Improved and enlarged terminal facilities will now be made by the Illinois Tunnel Company as a condition upon which its contract for transporting the mails was awarded by the United States Postoffice Department for a period expiring July 1, 1908. The service now is operated between the postoffice and the La Salle Street, Union, Grand Central and Illinois Central railroad stations. Bores connecting the Dearborn and the Northwestern stations are expected to be in use by November 1st.

Telephone News from the Northwest.

The Northwestern Telephone Exchange Company has about completed another line between Fargo and Minneapolis, this being the third new circuit installed this season.

H. F. Mann has been granted admission to Brainerd, Minn., for his telephone line from Garrison, and also for a local exchange.

The old Harrison Telephone Company, which formerly did business in the Black Hills of South Dakota, has been sold and the materials will be shipped to the Western Electric Company at Omaha.

Will Hedlund of St. Cloud, Minn., has been appointed manager of the Minnesota Central Telephone Company's office at Appleton, Minn. He takes charge November 1st.

The Cortland (Neb.) Telephone Company has filed articles of incorporation. Harry Tweedy heads the list of stockholders.

The Central Telephone Company has completed arrangements for the erection of a two-story brick exchange building at Rockwell, Iowa. R.

Indiana Telephone Items.

The work of closing the gap between Princeton, Ind., and Huntingburg is completed, and the Independent Long-distance Telephone Company of Princeton will have a direct wire to Louisville on the southeast, establishing a new trunk line to eastern cities. When the work is completed the line will be taken over by the Home Independent Telephone Company, in which Indianapolis, Evansville, Vincennes and Princeton capitalists are interested.

Directors of the Lafayette Telephone Company, the Independent system in that city, are considering plans and specifications for an elaborate exchange to cost $120,000, and a contest is on between the manual and automatic switchboard manufacturers. The contract probably will be awarded within a few days. It will call for a 10,000-telephone switchboard and all the appurtenances for an up-to-date exchange. William Folckemer is president and O. P. Frieburg and Dr. E. B. Burt comprise a newly-formed voting trust which will decide the question of switchboards.

The Citizens' Telephone Company of Decatur reports an increase of 162 instruments since February 15th, making a total of nearly 1,000. At Berne, a branch exchange, the percentage of growth has been nearly as great.

A complete investigation of the condition of electric wires in the central portion of Indianapolis has been made by John Berry, the city's chief electrician. In several instances wires were found carrying high and dangerous currents in close proximity to telephone wires. He will recommend some extensive changes in the wiring, so as to afford greater security to those using telephones and the Gamewell system for police and fire departments. S.

Southeastern Telephone Developments.

The Southern Bell Telephone Company is now at work on plans looking to the extension of a telephone service to the rural districts about Macon, Ga. The growth of rural telephones in the South has been phenomenal when it is remembered that this phase of telephoning is comparatively new in the section of the country included under the caption of "The South."

The Columbus Automatic Telephone Company at Columbus, Ga., has placed an order for $15,000 additional equipment for its exchange.

At Albany, Ga., a carload of material has arrived to be used in the work of completing recent improvements inaugurated by the Southern Bell Telephone Company at that point.

R. T. Seay of Amherst, Va., has bought the Amherst Telephone Company and has contracted with the Bell Telephone Company, whereby he will be enabled to furnish subscribers with long-distance connections. The local system was first taken up for an overhauling.

The Farmers' Mutual Telephone Company of Page County, Virginia, is chartered, with $5,000 capital, by D. S. Hite, Isaiah Printz and A. M. Beach, all of Luray, Va.

An important step towards giving rural telephone service through North Carolina was taken when the Union National Telephone Company was chartered with a capital stock of $5,000, authorized to install telephones in the country and cities of western Carolina, thus securing a beginning that may become an important factor in the development of the mountain section.

The Corder and Aulville Telephone Company of Corder, Mo., is chartered, with $1,000 capital, by Nathan Corder and associates.

The National Electrical Supply Company of Washington, D. C., recently secured an $8,000 contract for equipping a new telephone system in Statesville, N. C., through the visit of the "Washington Special Car" of representatives of business houses of the capitol city with their samples. This extraordinary business-pulling scheme has been very successful in its purposes in the South.

The Southern Bell Telephone Company recently passed the 100,000-subscriber mark in the states of Virginia, the Carolinas, Georgia, Alabama, Florida and West Virginia. These are in addition to about 30,000 sub-licensed companies connected with the Bell lines. The company is bettering its service all over the South.

The Rock Hill (S. C.) Telephone Company is making extensive outside improvements, in connection with the new exchange recently erected, and proposes to give a model service to patrons. L.

GENERAL TELEPHONE NEWS.

The Ida County Mutual Telephone Company of Galva, Iowa, has been incorporated with a capital stock of $5,000.

The Marquette (Mich.) Telephone Company has increased its capital stock from $60,000 to $100,000 for the purpose of improving the system.

Burnett & Morse will soon begin the construction of a modern telephone system in Santa Rosa, N. M. They contemplate installing an electric-light plant.

The Holland Independent Telephone Company of Holland, Tex., has been incorporated by W. R. Wallace and others with a capital stock of $7,000. The company will at once begin the erection of a telephone exchange.

Telephone companies recently incorporated include the following-named: Farmers' Mutual Telephone Company, Gueydan, La.; Estancia Rural Telephone Company, Estancia, N. M.; Farmers' Telephone Company, Randall, Kan.

The Southern Michigan Telephone Company will expend $80,000 on its system, to include underground wires in the business section of Coldwater and 20 miles of cable. A brick building has been purchased and Coldwater will be the distributing point for Southern Michigan and Northern Ohio and Indiana.

Albert Held of Spokane, Wash., has completed plans for headquarters of the Home Telephone Company in Spokane to cost $60,000. The structure will be of reinforced concrete, fireproof, and is to be completed in May, 1907. It will have a frontage of 71 feet with a depth of 100 feet, two stories high and basement. A sub-station to cost $5,000 will also be erected in Spokane. The automatic switchboard will be installed on the second floor of the main building. It is given out that work is about to be begun.

The present system of telephones has proved unsatisfactory in the city of Bangkok, Siam, and a change has been decided upon. The plans, specifications and estimates are now completed, having been prepared by Henry W. Wilder of New York, and are in the hands of the post and telegraph department awaiting examination preparatory to the government appropriation necessary for the work. It is estimated that the cost will be in the neighborhood of $50,000 gold. The contract will be let by the Public Works Department.

CORRESPONDENCE.

Continental Europe.

Paris, October 2.—An important hydro-electric plant has been erected in the Alpine region of France, near the Meriterranean coast. Installed by the Sociétié Energie Electrique, it is designed to work in connection with the plants which the same company is already operating in this region so as to secure a supply of current for the towns on the coast, such as Nice, Toulon, etc. The new plant is located upon the Siagne River, near the village of St. Cézaire, and has only been finished within a recent period. It is designed especially for running in parallel with the Entraygues plant which sends current to Toulon, but the line will be run as far as Marseilles, where a large sub-station will be located at Allauch, near the city, so as to give current throughout the region. Using a net head of 1,100 feet, the Siagne plant will produce about 4,500 kilowatts. Pelton water-wheels working at 375 revolutions per minute are coupled on horizontal shaft to three-phase alternators. These units are designed for 1,500 horsepower, and there are four of them erected, besides two exciters, all of the French Thomson-Houston pattern. The machine voltage of 11,000, at 25 cycles, is raised to 30,000 volts for the overhead lines. I expect to give a more detailed account of the plant in the near future.

An electric postal van is now in use at Cologne, and it is said to give satisfaction. As the storage batteries are placed in several distinct boxes and hung underneath the car, it is easy to handle them, and they are arranged so as to load the two axles equally. Against each of the rear wheels and geared to them is mounted a 3½-horsepower motor which drives each wheel separately by single-reduction gearing. The controller allows for eight different speeds, while the maximum speed is 12 miles an hour.

A French army officer gives some interesting points as to the use of telegraphy in the Russo-Japanese war during the operations in Manchuria. On account of the rapid advance of the army front and the extent of the zones which are covered by heavy firing, according to modern practice, it is found very difficult to transmit orders or information by officers or special squads, so that telegraph or telephone methods become more and more indispensable. Recent experiences gave some valuable data as to the part played by the telegraphic corps, which during the attack is obliged to cover the ground as far as the line of sharpshooters, while in the defense it must remain on the spot until the assaulting army drives it from its position. These troops must therefore be prepared to give actual combat like the others. During this time the connections must be well kept up, and the signal corps is often obliged to depend on a worn out cable which is pieced together at each instant. Only the telephone is able to work with a bare wire lying on the ground and often in bad condition. The repairs have to be carried out by skilled men who are detailed for this service.

Among the hydro-electric plants recently erected in Switzerland, I may mention the new Obermatt station in the Lucerne canton, which uses the water of the Erlenbach in order to send current to Lucerne and the outlying district. Here the head of water is 980 feet, and a set of equalizing basins is built so as to give a regular output of 8,000 horsepower. The turbine house is laid out for six main groups of 2,000 horsepower, of which four are already erected. An overhead line goes from the Obermatt plant as far as Lucerne, a distance of 18 miles, and other lines feed a number of smaller towns. Considerable current is used for the Stansstadt-Engelberg electric railroad.

A special form of inspection car is used in the Simplon Tunnel in order to visit all parts of the tunnel rapidly. This is needed, as a frequent inspection must be carried out. There is always danger of water coming from the underground springs through leaks in the vault, and it is also difficult to keep the high-tension wires well insulated, as they work on 3,000 volts or more. Accordingly, the company designed a two-axle car having in the middle part a four-kilowatt group composed of a petrol motor and dynamo. This group is used for lighting the car, and a set of portable poles can be set up in the tunnel, carrying a number of arc lamps so as to light up a considerable extent in case of making repairs. On the front platform is an arc projector, and on the roof of the car are two arc lamps with vertical reflectors so as to light the roof of the tunnel as the car passes along. The car is attached to a locomotive or to a train, or on the down grades it can run by itself with the use of the brakes.

The work which is to take the new Paris subway across the Seine is being carried on rapidly, but owing to the great extent of this construction it will be some time before it is entirely finished. There are two arms of the Seine to be crossed, and at present the work of sinking the metallic caissons which form sections of the tunnel is fairly underway, and some of the sections are already

in place. But as I already mentioned, the metallic construction must be used not only in the island, but also for some distance from the banks of the river in order to make the tunnel watertight. The immense caisson which is now building on the left bank for this purpose has the skeleton frame nearly finished, and the iron plating is now being applied. A smaller caisson of the same design is also in erection on the Island.

A. de C.

Great Britain.

London, October 3.—The good people of Camberwell, which is one of the London boroughs, have been having an uproarious time during the past few weeks over the proposition, seemingly emanating in the main from the town clerk, to undertake an electric-lighting scheme. The conditions are peculiar in that there are no less than three electric-lighting companies in the district already, two of which are in competition; and the local borough council was being seriously pressed to apply to the Board of Trade for a provisional order to also enter the field, regardless of the great duplication of capital expenditure, which the advocates of the scheme have had the simplicity to say would be in the interests both of the consumer and the ratepayer. Fortunately, when the matter came before the full meeting of the council it was opposed by all political sections of the district and for the present, at any rate, will not proceed. The incident, however, exemplifies what has been felt by many people for a long time, though not often expressed, and that is the danger of the control and initiative in municipal affairs passing from the hands of the councils and their committees into those of the permanent officials, an eventuality which would have fairly dangerous results, at any rate in London, where several of the town clerks are notoriously socialistic in their opinions. It is one of those matters that it is necessary to continually protest against in order to counteract the evil influences which are brought to bear upon the inhabitants, who seldom appear to investigate those matters for themselves.

A parallel case to that of Camberwell was Marylebone, where there was only one company, but the Board of Trade insisted that the council should purchase this undertaking before giving a supply itself. The huge price which an arbitrator decreed should be paid to the company has been a millstone around the neck of the municipal undertaking from its birth, and to think that, with a knowledge of this experience, permanent officials of other districts working under even worse conditions—by the same reasoning three companies would have to be purchased—are capable of advising a similar course of procedure, creates a condition of affairs that is worthy of more than passing attention.

The very acute competition over here between gas and electricity is keeping electrical engineers ever on the qui vive for cheaper systems of wiring as one means of keeping down the cost. The expensive methods of wood-casing, which now seem to be giving place to tubing systems, have been most active in keeping persons of poor means away from electric light. The fire offices, too, with their stringent rules, have been most effectual obstacles to the evolution of a cheaper system of wiring. The use of a system of twin lead cable, sufficiently earthed, is not new, but it is again being proposed with certain modifications tending toward greater security and flexibility. The inventor of the system has unfortunately been unable to give exact figures as to the reduction in cost, but he believes, from two jobs he has in hand, that it will be cheaper to the consumer, not so much from the cost of materials, but from the greater all-round facility with which it can be applied. One thing, however, he has accomplished after many trials, and that is to induce six out of seven fire offices to approve of it. The continental system of interior wiring by means of bare cables on button insulators appeals to many here who are working at this problem, and it may be news to some that there are actually two fairly large examples of such work in London.

The London County Council has adopted a wise policy in deciding to reduce the period for which they loan money to the borough councils for electric lighting purposes from 42 years to 30 years. The latter period has been the standard set by the local government board, which deals with the provincial corporations, for several years, and the belated acquiescence of the London County Council may be traceable in part to the persistence with which it is pointed out that few local authorities believe it necessary to set aside any sum annually for depreciation.

The question of the continual breaking up of London streets by electric lighting companies is again receiving attention, and efforts are to be made at further legislation to regulate this by some compulsory co-operation between the companies and the local authorities. Curiously enough, the two bodies which are most energetic in this matter, have given us within the last few weeks a striking object lesson in how not to do these things. The city corporation have relaid a portion of the Thames Embankment with a new patent tar covering, and this had, one might say, hardly become set, before the London County Council came along and cut up a large portion of it for the purpose of the tramways which are now being laid there.

There may or may not be anything in it, but in the present depressed industrial conditions one cannot keep away from comparisons between the financial position of those leading manufacturers that have, so to speak, come from America and set up works here, and their competitors who are purely British. A case occurs this week. The British Thomson-Houston Company paid no dividend for the last year, while Dick, Kerr & Co., a wholly English concern, paid 10 per cent and could have paid a higher dididend but for the directors' desire to place the business in a condition of security. The cutting of prices that is now going on is seen by the fact that Dick Kerr & Co. have had to let business go rather than to follow the low prices which are prevalent, while I know of another large works which, although full with orders, is unable, on its electrical contracts, to do more than pay the expenses of production.

It is to be hoped that there is not to be a shower of electric-power schemes promoted by county councils, to follow in the wake of the recent proposition of the London County Council. Some time ago the Durham County Council had such a project in mind, but was legally informed that a county council power scheme would be ultra vires. The success of its southern compeer, however, has given it heart of grace and the scheme has been revived, notwithstanding that the whole of the industrial north-eastern portion of England is now covered with a number of electric-power companies.

Owing to the loss upon the tramway parcel service in Manchester, the corporation has decided to give only a restricted service.

After much disagreement the Oxford corporation has adopted the Dolter surface-contact system for the local horse tramways. An offer was also made by a company to put down either the Lorain or the Griffiths-Bedell system. The National Electric Construction Company has the order for the Dolter system.

G.

Dominion of Canada.

Winnipeg, Man., October 13.—The construction of the Quebec and Saguenay electric railway, some 58 miles, from St. Joachim to Mobrae, is to be commenced at once.

A contract has been awarded to J. N. Page of Amherst, N. S., for building a new electric power house for the Maritime Coal, Railway and Power Company of Chicnecto, N. S.

The fire, light and water committee of the Winnipeg council has decided to erect, by tender, a larger electric power house and repair shop for the electrical department.

Charles Heath, acting under special instructions from a Winnipeg company, will make an application at the next meeting of the Town Council for a franchise to build and operate an electric street railway in Portage la Prairie. It is the intention to connect with the Winnipeg street railway.

Manager Fleming of the Toronto (Ont.) electric railway has given notice that henceforth street cars will not stop for any parade. Great complaint has always followed a paralyzed service on Labor Day, July 12th, and similar occasions. Orders to roadmasters from this time on are to run cars irrespective of any parade.

The Strathcona Radial Electric Railway Company has been formed and is seeking a franchise to build an electric railway to run between Strathcona and Edmonton.

The first electric locomotives to be used on the Canadian Pacific, or in Canada, are soon to be installed in the Fort William (Ont.) yards of the Canadian Pacific Railway. It is stated that the company will, as soon as the Kakabeka Falls power is completed, use electricity for motive power in the local switching yards.

H.

New York.

New York, October 13.—A deficit of $2,212,997 is shown in the annual report of the New York City Railway Company for the year ended June 30th, not taking into account the special franchise tax which is in litigation. The amount of this tax levied against the New York City Railway Company, after deducting various franchise payments to New York city, was approximately $537,000. Were this included, the deficit for the year would be increased to over $2,700,000. Last year, without taking the franchise tax into consideration, there was a deficit of $2,796,942, and the year before of $1,396,771. The gross earnings of the system for the year amounted to $21,937,944, an increase of $1,047,820 over the previous year. This increase of about five per cent., President H. H. Vreeland says in his report, realizes the expected recovery due to the fact that the short-haul business is rapidly overcoming the loss of long-haul traffic that has gone to the Subway.

The 80-cent gas law has been held unconstitutional in a decision by Supreme Court Justice Bischoff. The decision denied 127 applications for writs of mandamus commanding the Consolidated Gas Company to furnish gas at the rate provided for in the law passed at the last session of the Legislature. The justice said that the company had shown that the enforcement of the law would amount to a confiscation of its property. The whole case is now before the United States Court, and will be determined some time this winter.

The Appellate Division of the Supreme Court, sitting in Brooklyn, decided that the City of New York cannot inspect the books of the Brooklyn Union Gas Company in an effort to determine whether the company overcharged the city for gas between January 7, 1903, and March 16, 1904.

Plans for the large terminal and electric power station to be built in Harrison, N. J., by the Pennsylvania Railroad are completed, and active work will be begun at once. In addition to building the terminal station and power house, the latter for operating the electric trains to and from New York, the plans provide for a large car plant. This will include a modern building to be used as a general machine shop for repair purposes. There will also be a blacksmith shop, coach shop, storage houses, and pattern shops. Altogether it will be one of the largest railroad plants in the East. At a later date the plan of extending the electric system to Matawan will be taken up. The engineers, it is said, favor this extension.

The second river tube of the Pennsylvania Railroad was opened this week. When the opening between the two sections was made beneath the middle of the river it was found that the headings and shield came together perfectly true.

The organizers of the Fort George Street Railway Company, incorporated several months ago, are now taking active steps toward carrying out their project, which will consist of building a trolley line from the Dyckman Street station of the Subway to the top of the Fort George hill.

Sealed proposals will be received until the 30th day of October for the installation of an electric passenger elevator and approaches to replace freight elevator on Broadway side of the Postoffice in this city in accordance with plans and specifications on file with James Knox Taylor, supervising architect, Washington, D. C.

C. I. C.

Southeastern States.

Charlotte, N. C., October 13.—Mayor Knight of Waycross, Ga., will take up with the Council the question of municipal ownership of electric lighting. In the meantime the city has installed a dynamo in the water station to supply the public buildings with light.

The dedication of the new power plant at Great Falls, S. C., was made the occasion of elaborate ceremonies, at which a number of prominent people were present. A fine polished slab of granite with the name of the company, etc., was set in place with due formalities at the new power house of the Southern Power Company. The power house was begun in August, 1905. On the slab are the names of the officers: Dr. W. Gil Wylie, president; B. N. Duke of Durham, first vice-president; W. S. Lee, Jr., of Charlotte, second vice-president; R. B. Arlington, secretary and treasurer.

Arrangements have been practically finished for the installing of machinery for the lighting plant of the Seaboard Air Line shops at Scottsville, Va. Steam-driven machinery will be dispensed with and electricity used entirely for motive power in the big shops.

The Thomasville Manufacturing, Electric Light and Power Company has been chartered in Alabama. W. A. Scott, Jr., John S. Henderson and others are interested.

The North Georgia Electric Company of Gainesville, proposing to transmit power to Atlanta, has filed a $7,500,000 mortgage for record, this being one of the biggest mortgages ever filed in Atlanta. The Knickerbocker Trust Company of New York is trustee, the bonds bearing five per cent. The company will operate entirly by water power from the Chattahoochee and Cheastaee rivers.

The Buckhorn Falls property has been sold at auction at Pittsboro, N. C., by the receiver, and was bid in by a representative of the hondholders for $250,000.

The Jacksonville (Fla.) Electric Company has closed negotiations to transfer its franchise to the city for electric lighting, and will quit the field, giving the city exclusive control of the lighting system. The company heretofore was in competition with the municipal plant and carrying on a business of $60,000 annually. The Jacksonville Electric Company also operates the street-railway system.

The Raleigh (N. C.) Street Railway, recently bought by new interests from Gen. J. S. Carr of Durham, and associates, has put in an order for $50,000 worth of new machinery. Interurban lines, it is believed, will eventually follow the change of property.

The North Georgia Electric Company has completed its transformer stations and steel towers for bringing power into the city of Atlanta from the Chattahoochee, near Gainesville, and will be ready for disposing of power by spring. Over $7,000,000 of bonds have been floated, and the most modern machinery is to be used. Current is to be brought into the city over five-eighth-inch cables that will be supported by porcelain insulators eight inches high and having a six-inch diameter at the summit. These insulators are fastened at the tops of 50-foot steel towers erected at intervals of 200 yards from Gainesville to Atlanta. The current comes to the transformer station at 50,000 volts, to be transformed into 5,500 volts, and then carried over proper wires to the Edgewood sub-station where the voltage is brought down to 110 to 220 volts, alternating. The transformer station on the East Boulevard road is to be fitted up with the latest batteries and rotary transformers, with an electric pump, furnishing power, utilizing a small stream not far distant.

L.

Ohio.

Cleveland, October 13.—Negotiations for the lease of the property of the Cincinnati, Newport and Covington Light and Traction Company by A. S. White of New York and his associates have been pending during the week. The plan is to form a company with a capital stock of $4,000,000. The preferred stock will be offered at par with one share of common with each share of preferred as a bonus, and the stockholders of the present company are to have the right to subscribe for a certain proportion of the stock of the holding company.

It is now said that the incorporation of the Lake and River Transit Company by the bondholders of the old Miami and Erie Canal Transportation Company is for the purpose of taking over whatever rights the old company has and protecting the property that is left, with a possible view of securing some further legislation that will permit them to save some of the money they have put into the proposition. In effect a corporation will now handle the interests of the bondholders instead of a committee.

The Lake Shore Electric Railway Company formally took over the Lorain Street Railway and the Avon Beach and Southern early in the week. The roads will be consolidated under the name of the Lorain Street Railway Company, with a capital stock of $2,000,000 and a bond issue of the same amount. The local lines in Lorain were purchased from Tom L. Johnson, mayor of Cleveland, and the Avon Beach line was built to connect the Lake Shore with South Lorain.

The lease of the Interurban Railway and Terminal Company to the Union Gas and Electric Company of Cincinnati has been recorded. The lease is for 99 years, but it may be terminated any time after five years by the payment of $10,000.

The Commercial Club of Xenia is said to be considering the organization of a company to build an electric line between that city and Jamestown. It will be known as the Xenia, Cedarsville and Jamestown Traction Company. O. M. C.

Indiana.

Indianapolis, October 13.—The Chicago-New York Electric Air Line Railway Company has filed a copy of its articles of association with the secretary of state. The articles state that the company has $10,000 invested in property in Indiana. This company has begun building an electric line across northern Indiana, which has been described in the Western Electrician. D. D. Bates of South Bend is named as the Indiana agent.

A party of prominent traction men from the East made a tour of the Indiana traction lines last week with a view of gathering information relative to the reputed superiority of the Indiana traction lines. Among the number were Stanley C. Richmond, Joseph Walker, Jr., W. E. Burnett, Edward H. York, J. N. Durnet and Samuel Welsh of Philadelphia, V. R. Crosby of Boston, W. K. Schoepf and J. B. Foraker of Cincinnati. The party was taken in a private car over a number of the Indiana lines.

The Indiana Union Traction Company has adopted an express service for its lines. The rate charged for this service is about half the price charged for similar service on steam lines.

Acting under instructions given at the last meeting of his organization, John H. Merrill, secretary of the Central Electric Railway Association, is conferring with the various roads in the association's membership with a view of bringing about a uniform adjustment of charges made for excess baggage on interurban lines. At the present time several different schedules are being followed, and this leads to confusion and inconvenience. The plan is to check 150 pounds of baggage, free of charge, with an excess above that weight of 20 per cent. of the one-way fare for each additional 100 pounds or fraction thereof, with a minimum charge of 25 cents for excess. It is presumed that all the Indiana and Ohio lines will comply with this rule.

T. E. Bell and associates of Hammond are promoting a new electric railway to connect Indiana and Illinois towns. The new road will be called the Harrisburg and Ohio River Electric Railroad, and will be 40 miles long.

The City Council of Milford has decided to erect an electric-light system. The power will be derived from the power house on the dam across the Elkhart River at Benton. S. S.

Michigan.

Grand Rapids, October 13.—The village of Coopersville has voted to bond for $1,500 to install an electric plant in connection with the waterworks plant.

Isaac Applebaum of Detroit, who controls two-thirds of the bonds outstanding, announces that he will complete the Detroit, Flint and Saginaw electric road from Frankenmuth to Flint, a distance of 18 miles. The company has been reorganized with the following officers: President, Isaac Applebaum; vice-president, T. G. Sullivan, Detroit; treasurer, M. Mitchkun, Detroit; secretary, C. T. Anderson, Saginaw.

The Electric Land and Development Company of Traverse City has petitioned the supervisors of Wexford County for the right to build a dam on the Manistee River near the line between Wexford and Missaukee counties. The company has 10 miles of flowage rights, having purchased much of it outright, and having options on the remainder. It expects to develop 15,000 horsepower. A Mr. Cobb is asking the board for the right to build a dam on the same site named by the development company. It is also opposed by the Manistee River Navigation Company, which will insist, if the franchise is granted, that it require the building of a lock for the passage of vessels of 15 tons burden. The dam project, it is said, is part of a project for an electric railway to be known as the Northern Michigan Traction Company. Behind the project is the Cleveland Trust Company. Preliminary surveys are being made by F. O. Olson of Lima, Ohio, and G. Allen Smith of Traverse City.

Three new cars with multiple control have been turned out of the Detroit United Railway shops at Detroit for the limited run of the Port Huron division. In all 10 are to be built. A private car is being built for President Jere Hutchins. L. W. B.

Illinois.

Peoria, October 13.—The Simpson Mutual Telephone Company of Rock Island has been incorporated to furnish telephone service. Incorporators are John R. Harper, Milo Austin and N. A. Martin.

The Taylorville City Council has granted the Springfield and Southeastern Railway Company a 50-year franchise to operate through and in Taylorville.

The meeting the Rock Island Southern Railway officers and the capitalists from New York and St. Louis was held at Monmouth. The Rock Island Southern secured $1,250,000 to extend from Rock Island to Monmouth. Surveying will commence at once. The construction contracts will be let and the line completed within a year.

W. J. Zellae of Pana has been appointed superintendent of the Chillicothe Water, Light and Power Company. A new engine and generator will be added to the equipment and other repairs made.

New cars are now being built in St. Louis for the Peoria Railway Company and will be put in service soon as completed.

The McKinley syndicate (Illinois Traction Company) has recently placed an order for 50 cars with a St. Louis company, which will be completed before the advent of winter.

City Electrician Lyons has completed the installation of the underground cables for the fire-alarm and patrol system. V. N.

Northwestern States.

Minneapolis, October 13.—The Twin City Rapid Transit Company is contemplating the construction of a tunnel and subway in Selby Avenue, St. Paul, to do away with the heavy grade up Selby Hill, which is now 16½ feet per 100. This will be reduced to about seven feet.

A proposition has been made by the Illinois and Iowa Interurban Company to a number of towns along its route from Clinton to Davenport, Iowa, for providing them with street illumination.

The Mississippi River Electric Power Company has begun condemnation proceedings to secure land near Clearwater, Minn., for flowage rights so as to permit the construction of the proposed dam there.

W. L. Hixon and others have applied for a franchise for a street-railway system at Mankato, Minn. About $25,000 worth of stock has been subscribed locally.

The recently voted bonds for $35,000 for an electric-light plant at Aberdeen, S. D., have been tied up by the Supreme Court. The court has decided that a majority of all the legal voters in the city was necessary, not merely a majority of the votes cast. This will necessitate an official determination of the number of voters in the city before the bonds can be issued. Under this ruling the vote will be very close.

The Langstedt & Meyer Construction and Supply Company of Appleton, Wis., has secured the contract for the construction of a municipal power plant at Eagle River, Wis.

The Omaha (Neb.) Commercial Club is attempting to raise money for a trolley line from Omaha to Tabor, Iowa, and Tarkio, Mo.

The Council at Janesville, Wis., has refused the franchise requested by H. H. Clough, and substituted one without freight privileges. It is thus rendered improbable that the proposed interurban line from Madison, Wis., to Chicago will be built. R.

Pacific Slope.

San Francisco, October 11.—Numerous complaints of unsatisfactory gas lighting have recently been made in various portions of the city, but with good healthy competition in view this will probably be corrected.

Since the big fire the inadequate electric-light and power service in the city has caused many persons who are about to erect buildings to plan on installing isolated electric plants in the basements to supply their own and adjoining property with light and power for operating electric elevators. The new five-story stone and re-enforced concrete hotel building to be erected by the Irving M. Scott estate, on Ellis Street, at the corner of Anna Lane, will be equipped with a direct-current isolated lighting plant, intercommunicating telephone system and a pneumatic cleaning plant. Other buildings in which isolated electric plants are to be installed include the Kohl Building, corner Montgomery and California streets; the Whitney Building, Geary Street, near Stockton, and the Santa Marino Company's new eight-story building at the northeast corner of Drumm and California streets.

The United Railroads of San Francisco has announced its intention of resuming operations this week on its Valencia Street branch electric line, extending to Twenty-eighth street. This branch has been changed from a cable road since the fire.

The Home Telephone Company of Alameda County has been granted a franchise for the construction and operation of a telephone system in Berkeley, Cal. An automatic system is to be installed and a large proportion of the wires will be placed under ground. The company has laid a large portion of its underground mains in Oakland and has built an exchange in the eastern part of that city.

The Board of Supervisors of San Francisco has confirmed the granting of a franchise to the Home Telephone Company of San Francisco. The ordinance was originally passed several months ago, during the period of special legal holidays following the fire, and it was contended that the act of the supervisors in granting a franchise on a legal holiday was invalid. The company is now free to proceed with the construction of the extensive underground system projected.

The Merchants' Independent Electric Company has acquired the water rights of the Fort Miller Power Company on the San Joaquin River. T. J. Boyd, the promoter of the new enterprise, talks of a power transmission system extending to Fresno at a cost of $1,000,000.

The Pacific States Telephone Company has declared a dividend of $1.25 per share for the quarter ended September 30th. The stockholders thought it possible this dividend would be passed owing to the heavy losses by the fire of April 18th and the immense amounts that must be expended before the system is entirely rehabilitated. Considerable improvement has been made in the service, which is still far from complete. The new main switchboards, which have been building in the East under rush orders, will be installed in the new main office on Bush Street, near Dupont, as rapidly as possible. Service has been resumed in the new east office on Hyde Street, near Sutter. An additional cable has been laid across the bay, somewhat improving the congested service to Oakland. A.

PERSONAL.

Theodore Nelson has succeeded R. J. Rivers as manager of the electric-light system at Hastings, Minn.

S. L. Nelson is now manager of the Peoria (Ill.) Railway Company, succeeding John Finley, who resigned.

A banquet was given a few days ago by 100 North Shore residents for A. C. Frost, president of the Chicago and Milwaukee Electric Railroad, in recognition of his services to the general community in providing high-class entertainment at Ravinia Park.

Ex-Mayor George A. Carter of Saco, Me., for many years manager of the Western Union Telegraph Company in that city, died on October 6th, aged 75 years. He was agent of the American Express Company for 42 years, a director of the Saco Savings Bank, president of the York County Fire Underwriters and held many positions of trust. He was a native of Wakefield, N. H.

Mr. E. J. Nally left Chicago on October 16th to enter his larger opportunity in New York as vice-president of the Postal Telegraph-cable Company. On the evening before his departure Mr. Nally was given a complimentary dinner at the Union League Club. B. E. Sunny, western manager of the General Electric Company, was toastmaster. Mr. Nally has been general superintendent of the Postal company in Chicago for many years.

Mr. G. E. Fish, who was for several years superintendent of the Chicago Arc Light and Power Company in the pioneer days of the electric-lighting business, is once more in technical "harness," so to speak. Mr. Fish has recently accepted the superintendency of the Centralia, Ill., Gas and Electric Company. For a number of years Mr. Fish was also in the contracting and construction business in St. Louis. In fact, he has been in that city almost the entire time since leaving Chicago.

Graham B. Dennis, who built the first electric railway in the Northwest in Spokane in 1887, and who has since been identified with development projects, commercially and industrially, has just been elected president of the Pacific Northwest Development League, which will exploit the resources of Washington, Oregon, Idaho and Montana. The league will have a fund of $100,000, to be used in a campaign for population and commerce in the four states. As chairman of the publicity committee of the Spokane Chamber of Commerce Mr. Dennis attracted millions

of eastern capital to that part of the country and he has been the means of interesting prominent men in the East and Middle West in electric-railway construction and power plants.

ELECTRIC LIGHTING.

J. K. Martin contemplates installing an electric-light plant at Beaver Crossing, Neb.

Crowley, La., has voted $100,000 in bonds for the extension of the waterworks and electric-light plant.

Woodburn, Okla., will vote on a proposition to issue $150,000 in bonds for an electric-lighting plant.

Marble Rock, Iowa, has granted a franchise to Fred W. Smith to establish an electric-light plant in the town.

The Walsenburg (Colo.) Light, Power and Ice Company has been incorporated with a capital stock of $40,000.

It is proposed to organize a stock company for the purchase of the Ortman electric-light plant or the establishment of a new plant at Cullom, Ill.

Bids will be received until October 27th for the construction of waterworks, lighting and heating systems in Scribner, Neb. Thomas Shaw, Omaha, Neb., is engineer.

The Weatherford Electric Light and Power Company of Weatherford, Tex., has been incorporated with a capital stock of $10,000 by E. E. Balcomb and others.

The St. Louis and San Francisco Railway is preparing to build an electric-light plant to supply the depot and yards at Fort Smith, Ark. J. F. Hinckley, St. Louis, Mo., is chief engineer.

The Cape of Good Hope Government Gazette publishes the texts of two acts promulgated by Cape Colony, South Africa. One of them includes an appropriation of $243,325 for electric lighting.

By a vote of 76 to 1, the citizens of Hyattsville, Md., have approved the ordinance recently passed by the mayor and common council, granting the Potomac Electric Power Company of Washington, D. C., a 10-year franchise to furnish electric power for private and commercial lighting in Hyattsville. The work of installing the plant, which will also furnish current for street lighting, has been started and it is expected the system will be in operation within the next 60 days.

ELECTRIC RAILWAYS

The Bayou Peche Railway and Light Company of New Orleans has been incorporated with a capital of $500,000 by F. A. Longshore and others.

E. H. Harriman has purchased street-railway property in Salt Lake City and proposes to reorganize and overhaul the entire system and to establish a modern and up-to-date service. The line will be extended.

The electrification of the tramways in Adelaide, Australia, is now assured, the company owning them having accepted the government's terms for their purchase at $1,400,000. Governor George Lee Hunt states that the lines will now be electrified as rapidly as possible.

At the last meeting of the Borough Council of Sharon Hill, Pa., an ordinance was passed granting a franchise to the Philadelphia Suburban Electric Railway Company to establish an electric plant within the borough for the purpose of supplying heat, light and power.

The Missouri Interurban Railway Company has been incorporated with a capital stock of $20,000 by J. W. Meller of Sedalia, W. B. Myers of Smithtown, J. D. Starke of Soleville, C. W. Thomas of Jefferson City, and others. A line has already been surveyed, and the right-of-way partially secured from Jefferson City to Sedalia. The line will be 89 miles in length.

POWER TRANSMISSION.

The Big Bend Water Power Company, which controls 28 miles of water rights below Spokane, Wash., has been reorganized with a capitalization of $2,000,000, and will build an electric railway from Spokane to Cœur d'Alene, Idaho, thence into the Cœur d'Alene district, connecting all the mining camps, the entire mileage being 154 miles. B. F. O'Neill of Wallace, Idaho, is president.

The Ventura County Power Company of Ventura, Cal., will install a new power station at Oxnard, the equipment for which has recently been contracted for with the Allis-Chalmers Company of Milwaukee. The outfit will comprise a standard 300-kilowatt Allis-Chalmers engine-type generator, designed to operate at 125 revolutions per minute, 50 cycles, three-phase and 2,300 volts. The generator will be separately excited and will be driven by a Reynolds-Corliss tandem compound-condensing engine of the heavy-duty type, 16 and 32 by 36 inches and operating at a speed of 125 revolutions per minute. The engine is to be fitted with a complete electric synchronizing device and will have valves in the heads of both cylinders.

PUBLICATIONS.

The Gregory Electric Company, Sixteenth and Lincoln streets, Chicago, is sending out an illustrated card calling attention to the merits of Century single-phase motors, made by the Century Electric Company of St. Louis.

The F. Bissell Company of Toledo, Ohio, will have its new street-railway book finished in a week or so. It is also hard at work on a new general catalogue, which will be finished in a month or two and will be one of the finest of its kind.

A series of Nernst lamp advertisements prepared for central stations, for use in local papers, appears in a booklet published by the Nernst Lamp Company. This company will prepare special copy for central stations which do not maintain an advertising department.

Bulletin No. 5 from the University of Illinois Engineering Experiment Station, Urbana, Ill., is the first of a series of bulletins published by the Experiment Station. Its subject is "Resistance of Tubes to Collapse," by Albert P. Carman, professor of physics, and Maurice L. Carr, assistant.

Electric motors for driving ventilating fans and blowers is the subject of a booklet from the Sprague Electric Company, New York city. This company has had long experience in manufacturing motors for driving all kinds of ventilating fans, blowers, etc., and the new booklet will be of interest to those having need of this class of apparatus.

Some of the most attractive and readable lamp advertising yet published comes from the Fostoria Incandescent Lamp Company of Fostoria, Ohio. It includes a "four-phase" article entitled "Lamps and the Man," which will appear during the fall and winter at a "frequency" of about one "phase" per month. Each phase will be "transmitted" to the "consumer" in in pretty-colored envelopes of novel design. The complete article is also bound into a souvenir booklet which will be sent upon application. The writing and designing were done by Mr. H. H. Geary, sales manager of the Fostoria company.

Machado & Roller, general sales agents for the Whitney Electrical Instrument Company, 741 Monadnock Building, Chicago, have just issued a new catalogue of Whitney electrical measuring instruments. In this catalogue is described a new type of direct-current mechanism which will be used in both portable and switchboard types of voltmeters and ammeters. Also a line of dynamometer-type portable voltmeters, switchboard direct-reading indicating wattmeters and other important features of interest. With the additions that have been made the line of Whitney electrical instruments is one of the most complete and up-to-date on the market. Users of electrical instruments are invited to send for a copy of this catalogue.

In announcing the second annual electrical show in Chicago the management of the Electrical Trades Exposition Company is sending out an attractive booklet, in which it invites attention to the history, purpose and results of this successful publicity enterprise for electrical products. Testimonials from some 20 exhibitors at last year's show speak as one of the good results. The cover of the booklet is in colors and within are a number of good illustrations. The coming show will be held at the Coliseum, Chicago, January 14th to 26th. Over 70 per cent. of the space covered by the 1906 show has already been contracted for. Additional space, however, has been secured for the 1907 exhibition. Homer E. Niesz is the managing director, 139 Adams Street, Chicago.

Supply catalogue No. 7602, from the General Electric Company, devotes 70 pages to parts of direct-current automatic circuit-breakers. A very attractive publication from the same company describes and illustrates type H transformers. The following new bulletins are being sent out: 4456, wrought-copper cable terminals; 4457, parts of form B arc headlights; 4459, feeder regulators; 4460, parts of form 3 luminous direct constant-current series enclosed arc lamps with stationary upper electrode; 4461, GE-78 railway motors; 4462, variable-speed direct-current motors with commutating poles; 4463, carrier bus arc panels for brush arc generators; 4464, polyphase induction motors. Price lists Nos. 5154 and 5155 have just been issued, dealing, respectively, with tantalum incandescent lamps and tantalum units and mercury arc rectifiers and rectifier tubes. An interesting publication is that numbered 3488 which gives information on packing and standard package quantities.

SOCIETIES AND SCHOOLS.

The committee on public policy of the National Electric Light Association, consisting of Everett W. Burdett (chairman) and Messrs. Henry L. Doherty, Charles L. Edgar, Samuel Insull, J. W. Lieb, Jr., Jos. B. McCall, Alex Dow and Samuel Scovil, held a meeting at the Waldorf Hotel, New York, on October 11th. Mr. W. H. Gardiner, Jr., has been appointed secretary of this committee which is one of the most important committees of the association.

Mr. Paul Lüpke of Philadelphia, editor of the Question Box, is planning to make this feature of the next convention of the National Electric Light Association more useful than ever before. He is sending to the members and central-station non-members a flat card cut and creased so that it can be shaped into a box. As questions or answers occur they can be jotted down and dropped into the box, which can be hung at a convenient place. At the proper time the boxes and contents will be called for.

SPACE TELEGRAPHY.

To minimize the danger of losing oil barges in storms in the Gulf of Mexico and along the Atlantic Coast the J. M. Guffey Petroleum Company has decided to equip its barges, as well as its towing steamers, with space-telegraph apparatus. The De Forest system will be used.

Three movable stations for the working of wireless telegraphy have been installed in German West Africa by Telefunken, a company which exploits a combination of the Slabo-Arco and Brown-Siemens systems of wireless telegraphy. The wave lengths adopted are of 350 and 1,050 meters, respectively. The antennæ, instead of being fixed on poles, are carried to a height of 200 to 300 meters by balloons and kites. The installation for each station is carried on three vehicles. The first carries a spirit motor coupled to a one-kilowatt alternating current motor provided with an exciter. The spirit tank has a capacity of 30 liters, which is enough for an equal number of hours of working. A battery which is placed at the top of this exciter is used for starting. The balloon is attached to a kite, the string of which can be wound around a cylindrical drum. The transmitter and the receiver are mounted upon the second vehicle. The third vehicle is fitted with two tanks, each holding five cubic meters of gas at a pressure of 120 atmospheres. It also carries reserves of spirit batteries, tools, etc. One horse suffices to draw each vehicle.

MISCELLANEOUS.

The Fire Department of Brandon, Man., proposes to build a new electric fire-alarm system.

A proposition has been made in Great Britain to form a zinc trust, including largely South African and Australian concerns.

The Chapin Mine, in the heart of the city of Iron Mountain, Mich., and known for many years as one of the largest producers in the Lake Superior Region, is to have added to its present equipment a new Allis-Chalmers duplex, single-drum hoisting engine of the first motion type, built by the Allis-Chalmers Company of Milwaukee.

Metallic molybdenum and a number of its alloys have been produced in Germany by Dr. C. Lehmer, who used an electric furnace of the Héroult type. Molybdenum bisulphide was smelted in combination with lime and carbon, yielding a metal of the following composition, given in percentages: Mo, 88.3; Fe, 2.89; Si, 2.95; S, 0.04 and C, 5.6. Nickel, chrome and iron alloys were produced by smelting suitable charges.

The cement industry has greatly revived in Japan, says Henry B. Miller, consul-general at Yokohama, the demand increasing in home, Manchurian and Korean markets, while large orders have been received from San Francisco. The Osaka Cement Company, though working night and day, is unable to keep pace with the demand. The present capacity of the works is 13,000 barrels a month, and it is proposed to increase the plant to obtain an output of at least 250,000 barrels per annum. The necessary machinery has been ordered, the extension to be completed by the end of October.

Joseph Restucci, a mechanical engineer of the Royal Italian Marine, recently invented a new diving machine which has proved a success in experimental tests made with it in deep-sea diving. The interior of the machine contains a small electric lamp capable of illuminating a certain space under the water. The diver communicates with the ship escorting him by means of a telephone. A special arrangement for furnishing air permits him to remain under water for a long time. The Restucci machine has already proven its value, it is said, for by means of it a Russian ship with a large amount of gold on board sunk near Balaklava during the Crimean war has been discovered.

With the immense development of electrical enterprises in Japan the demand for copper wires and cables is increasing daily, and the Furukawa Copper Mining Company has decided to establish a new factory for the manufacture of copper wires at Nikko, the present factory being found to be inadequate to meet the demand. According to the latest report the total output of copper wires from its works amounts to 300,000 to 400,000 kin (kin = 1⅓ pounds) per month, which is chiefly supplied to the various cable manufacturing companies of Tokyo and Yokohama. Most of the covered wire and cable used by the department of communica-

tion is imported from abroad and the native manufacturers are said to be contemplating a cable factory on a very extensive scale.

According to Consul-general Guenther there were employed on April 1, 1906, at the celebrated works of Krupp at Essen, Magdeburg, Kiel, Annen, and at their ore and coal mines, 62,553 persons, against a total of 55,816 employes in the year before. The company's principal plant and accessories at Essen consumed as much water in the year ended April 1st, last, as did the entire city of Dresden, which has a population of over 400,000 inhabitants. The gas made and consumed by the single cast-steel plant at Essen exceeds the gas consumption of the city of Elberfeld. Besides this, the electric plant of the cast-steel works supplies 1,651 arc lamps, 15,304 incandescent lamps and 763 electric motors. The average daily wage paid in 1905 to the workers in the cast-steel plant was $1.22 per person, which is about 5½ cents more than was paid in the preceding year.

TRADE NEWS.

The Reliance Electric and Construction Company of Albuquerque, N. M., has been incorporated with a capital of $20,000.

The Jeffrey Manufacturing Company, Columbus, Ohio, has established a new Canadian branch office in Montreal, Quebec, at Lagauchetiere and Cote streets.

The Kimble Electric Company of Chicago has been incorporated with a capital stock of $10,000 for the purpose of manufacturing machinery. August Kimble, Alfred W. Craven and E. M. Madden are the incorporators.

Bids are called for until November 23d by the Corporation, Melbourne, Australia, for turbo-alternators, engine, generator and switchboard. Information is on file at the Bureau of Manufactures, Washington, D. C., file No. 353.

Alvin & Jackson, 502 Monadnock Building, Chicago, have been appointed western sales agents for the Novelty Incandescent Lamp Company of Emporium, Pa., and will handle the company's full line of Elk new standard lamps and Novelty renewed lamps.

The Electrical Trades Exposition Company announces the opening of its permanent headquarters at Nos. 1006 and 1007 Monadnock Block, Chicago. The second annual electrical show will be held under its management at the Coliseum, Chicago, Ill., January 14th to 26th, inclusive, 1907. A limited number of spaces are still open and will be sold in the order of receipt of applications.

Sealed proposals will be received at the office of the clerk of the Board of Public Service, Dayton, Ohio, until October 25th, for furnishing and erecting on foundations three centrifugal three-stage pumps, direct connected to alternating-current motors, with automatic controlling device and accessories. Plans and specifications are on file in the office of the city civil engineer. Bidders are to use printed forms provided by the city civil engineer, as none other will be received. T. M. Paxton is president and William F. Miller clerk.

For the information of shippers and in order that they may avail themselves of through car service, the Chicago Commercial Association has prepared a schedule of the daily through merchandise car service from Chicago to the principal points in the Southeast and Southwest to which through cars are loaded daily with package freight of all kinds, through to the destination shown, without transfer, also the time of departure from Chicago and arrival at destination. Shipments delivered for loading in these cars will be greatly expedited.

In some of its recent attractive advertising literature, Pass & Seymour of Solvay, N. Y., manufacturers of electrical specialties, say: "We are always anxious to examine and pass on ideas, patterns and models, which, if they appear to us sufficiently meritorious, we will be glad to manufacture on a royalty basis or purchase outright. Encourage your men to condense the discoveries they have made, no matter how simple. You're sure on this point, everything we turn out, whether the product of your minds or ours, will attain that high standard of excellence for which P. & S. products are famous."

The Sprague Electric Company's round-type, Lundell single-field-coil, direct-current motors have been on the market for many years and have won an excellent reputation through their adaptability to a wide variety of fuses and because of their design and the workmanship. But a single field coil is used to energize the poles and the motors are simple, having but a few essential parts. They are manufactured in 12 sizes of frames, ranging from one-twentieth to 7½ horsepower. A thorough description of these motors is given in Bulletin No. 219, which also contains excellent illustrations of the various parts and a number of pictures showing the motors in use.

On October 1, 1906, an important decision was made by Judge Hazel in the United States Circuit Court for the Southern District of New York, relating to the regulating of storage batteries. The suit was brought by the Electric Storage Battery Company against the Gould Storage Battery Company, alleging infringement of the patent to Mailloux No. 430,868, of June 24, 1890. The alleged infringement was the system regularly employed by the Gould Storage Battery Company in which the battery booster has its field automatically regulated by a counter machine whose electromotive force is in turn regulated by the current fluctuations of the main generator or generators. The court held that "the defendant's system cannot be included in the scope of the claims in suit, and its means of regulation do not correspond to those of complainant nor do they produce the same result."

BUSINESS.

The Crocker-Wheeler Company of Ampere, N. J., has shipped within the last few weeks nine carloads of electrical machinery, exclusive of other smaller shipments, as follows: Four carloads for the National Tube Company, including motors of various sizes; two carloads to the Lehigh Portland Cement Company, including one direct-current generator and a number of motors of various sizes; two carloads consisting of alternating-current generators to the Snow Steam Pump Company, and one carload of the form L small motors to the Crocker-Wheeler Company at San Francisco, Cal., which are to fill part of the company's orders taken since the fire. This is the second carload of these small motors which has been rushed to the Pacific Coast, besides numerous other large apparatus which has been sent direct to customers. These trainload shipments show the condition of the market for high-grade electrical machinery.

ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued (United States Patent Office) October 9, 1906.

832,612. Method of Installing Electric Outlets and Fireproof Walls and Partitions Containing the Same. Louis Kalischer, Brooklyn, N. Y. Application filed September 25, 1903.

An arm built into the wall contains the outlets, which are reached through openings in the wall closed by face-plates.

832,632. Multiple Contact for Electrical Condensers. John F. Skirrow, East Orange, N. J. Application filed March 14, 1905.

A condenser consisting of two sets of sheets of conducting material in a casing, which contains a series of contact points connected to one set of sheets and a movable contact bar connected to the other set.

832,642. Magnetic Ore Separator. Henry H. Wait, Chicago, Ill., assignor to International Separator Company, Chicago, Ill. Application filed March 20, 1905.

Material to be separated is fed between a magnet pole and a revolving carrier built up of toothed laminæ.

832,652. Railway Block-signal System. Abram L. Bower, Boyertown, Pa. Application filed October 22, 1902.

Signal-rails are inserted in each line of rails proper; the tract is divided into blocks insulated from each other, and home and distant signals located at stations between successive blocks are operatively connected with circuits and relays on the train.

832,653. Electrically-driven Fluid Motor. Gaston A. Bronder, Brooklyn, N. Y. Application filed February 12, 1903.

A prime mover is driven by air, compressed by an electric motor-driven compressor.

832,705. Circuit Breaker. Samuel B. Stewart, Jr., Schenectady, N. Y., assignor to General Electric Company, Schenectady, N. Y. Application filed March 20, 1905.

Co-operating fixed and movable contacts biased to open when closed are tripped by a pair of independently controlled electromagnets.

832,709. Apparatus for Insuring Safety of Traffic on Single Lines of Railway. Edward Tyer, Dalston, England, and James H. Hamilton, Cape Town, Cape Colony. Application filed January 5, 1904.

An indicator operated by a pair of electromagnets, each of which has a separate magnifying coil, is placed at each station controlling a section of a single-line railway.

832,712. Trolley. Henry West, Galesburg, Ill. Application filed July 20, 1903.

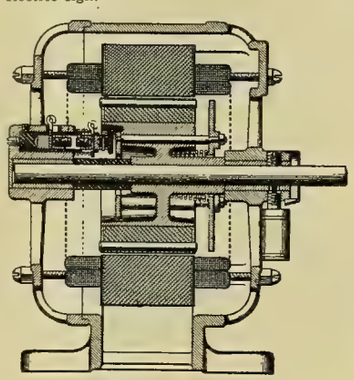
An internal chamber in the trolley wheel contains a collecting ring mounted on the central shaft, and brushes for conducting the current to the collecting ring.

832,713. Alternating-current Motor. John B. Wiard, Lynn, Mass., assignor to the General Electric Company, Schenectady, N. Y. Application filed February 23, 1904.

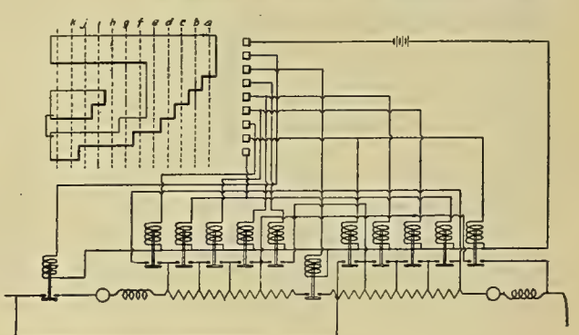
The motor has different starting and full-speed circuit connections and a magnetically operated switch comprising a member adapted to be moved toward the motor-armature under the influence of the strong magnetic field produced in the armature at starting to establish one of the circuit connections and to be moved away from the armature to break these circuit connections. (See cut.)

832,718. Electric Receptacle. Charles A. Chase, Chicago, Ill. Application filed April 29, 1905.

A receptacle for incandescent lamps used to light an electric sign.



NO. 832,713.—A. C. MOTOR.



NO. 832,926.—MULTIPLE-UNIT SWITCH-CONTROL SYSTEM.

832,720. Liquid Rheostat. George W. Cravens, Schenectady, N. Y., assignor to General Electric Company, Schenectady, N. Y. Application filed October 21, 1905.

A water-rheostat in which the resistance depends on the distance between two frusta-conical conductors, one of which is movable.

832,724. Alternating-current Motor. Friedrich Eichberg, Berlin, Germany, assignor to General Electric Company, Schenectady, N. Y. Application filed January 12, 1905.

An alternating-current motor of the commutator type having a transformer connected with its field winding, which is adapted to vary the ratio of transformation.

832,729. Automatic Unlocking Device for Switch Mechanisms. John D. Hilliard, Jr., Glens Falls, N. Y., assignor to General Electric Company, Schenectady, N. Y. Application filed April 20, 1904.

An electromagnet influenced by leads to the machine and to the bus-bars controls the lock of a switch for connecting an alternating-current machine in parallel with the bus-bars of a distribution system.

832,730. Incandescent Electric Lamp. Harry C. Hubbul, Jersey City, N. J. Application filed January 26, 1905.

The platinum-wire terminals are extended through the sides of the bulb and terminate in loops and wire fingers for supporting the bulb in its normal position, and permitting it to drop off the fingers when broken.

832,741. Repulsion-motor Control. Maurice Milch, Schenectady, N. Y., assignor to General Electric Company, Schenectady, N. Y. Application filed April 30, 1904. Renewed February 9, 1906.

This invention covers a method of improving commutation of a repulsion-motor at speeds above synchronism, which consists in reducing the electromotive force impressed on the primary member, and impressing a compensating electromotive force on the secondary member.

832,742. Unipolar Alternating-current Machine. Jakob E. Noeggerath, Schenectady, N. Y., assignor to General Electric Company, Schenectady, N. Y. Application filed March 17, 1905.

This machine has a revolving armature comprising a number of radially arranged conductors of magnetic material and a field structure laminated in planes parallel with the armature shaft and adapted to produce a unipolar flux threading the conductors in an axial direction.

832,745. Motor Control. Jesse S. Pevear, Schenectady, N. Y., assignor to General Electric Company, Schenectady, N. Y. Application filed August 10, 1904.

Motors adapted for both alternating and direct current are controlled by two switches, one for direct, the other for alternating-current operation. The switches have but one handle, which is so connected that only one of the switches is moved by movement of the handle in either direction.

832,746. Telephone Circuit. Milton W. Phillips, Ventura, Cal. Application filed February 20, 1906.

An arrangement by which the supplementary circuit at any sub-station renders inoperative the talking-circuit of such station when any other talking-circuit of an instrument on the line is being operated.

832,747. Electric Clock-winding Mechanism. George H. Rupley, Schenectady, N. Y. Application filed July 14, 1905.

A motor is connected to wind up the clock after a certain amount of the clock-spring has uncoiled.

832,748. Electric Switch. Howard R. Sargent, Schenectady, N. Y., assignor to General Electric Company, Schenectady, N. Y. Application filed April 12, 1902.

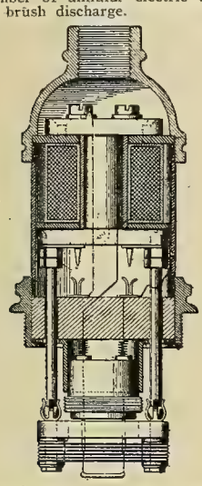
A snap-plunger engages one end of the switch lever which is loosely connected with a spring-pressed actuating plunger.

832,761. Electric Time Switch. Charles H. Van Slyck, Philadelphia, Pa., assignor to the General Electric Company, Schenectady, N. Y. Application filed October 9, 1899.

A clock causes a pivoted contact to close an electromagnet circuit controlling an auxiliary switch actuating the main switch.

832,767. Electrically Treating Air or Other Gases. James H. Bridge, Philadelphia, Pa. Application filed April 3, 1906.

Air or other gas is forced in minute streams through perforations in an electrode, on the surface of which a number of annular electric discharges are formed by silent brush discharge.



NO. 832,934.—HEATING COIL FOR NERNST LAMP.

832,768. Electrifier for Treating Air or Other Gas. James H. Bridge, Philadelphia, Pa. Application filed May 25, 1906.

This device is used for carrying out the method covered by the preceding patent. It consists of tubular electrodes concentrically arranged, and each provided with a conductor.

832,809. Machine for Making Battery Grids. Willard F. Richards, Buffalo, N. Y., assignor to Gould Coupler Company, New York, N. Y. Application filed May 25, 1904.

A carrier holds the grid plate horizontally while it is worked upon by spinning rollers so placed above and below the carrier that they may be moved vertically toward each other.

832,820. Magnetic Separator. Frederick T. Snyder, Oak Park, Ill., assignor to International Separator Company, Chicago, Ill. Application filed December 20, 1902. Renewed June 9, 1906.

Material to be separated is fed to a movable table placed between magnet poles which are energized during the movements of the table in one direction and de-energized during the reverse movement.

832,821. Magnetic Ore Separator. Henry H. Wait, Chicago, and Frederick T. Snyder, Oak Park, Ill., assignors to International Separator Company, Chicago, Ill. Application filed March 9, 1905.

Material to be separated is carried on a conveyer passing obliquely across the air gap between a rotating magnetized cylinder and two magnet poles of opposite name.

832,822. Magnetic Ore Separator. Henry H. Wait, Chicago, and Frederick T. Snyder, Oak Park, Ill. Application filed March 9, 1905.

Ore is fed onto the top surface of a revolving cylindrical armature and guided into the gap between this armature and a magnet-pole.

832,823. Magnetic Ore Separator. Henry H. Wait, Chicago, Ill., assignor to International Separator Company, Chicago, Ill. Application filed March 20, 1905.

A stream of fluid-containing material to be separated is directed along the under side of a revolving magnetic cylinder.

832,824. Magnetic Ore Separator. Henry H. Wait, Chicago, Ill., assignor to International Separator Company, Chicago, Ill. Application filed March 20, 1905.

Material to be separated is fed between an axially-rotatable drum forming a pole piece of a magnet core and a stationary armature the magnetic pull of which is approximately balanced by another armature diametrically opposite to the first.

832,825. Magnetic Ore Separator. Henry H. Wait, Chicago, Ill., assignor to International Separator Company, Chicago, Ill. Application filed March 20, 1905.

Material to be separated is fed onto an annular table adapted to cause the material to pass radially towards its outer edge. An annular armature rotates above this table and between pole pieces arranged above and below the table.

832,827. Magnetic Ore Separator. Henry H. Wait, Chicago, Ill., assignor to International Separator Company, Chicago, Ill. Application filed March 20, 1905.

Material to be separated is fed between a non-magnetic shield of a horizontally rotating armature and a non-magnetic shield of a pole facing the armature and of greater thickness than the armature shield.

832,828. Magnetic Ore Separator. Henry H. Wait, Chicago, Ill., assignor to International Separator Company, Chicago, Ill. Application filed March 20, 1905.

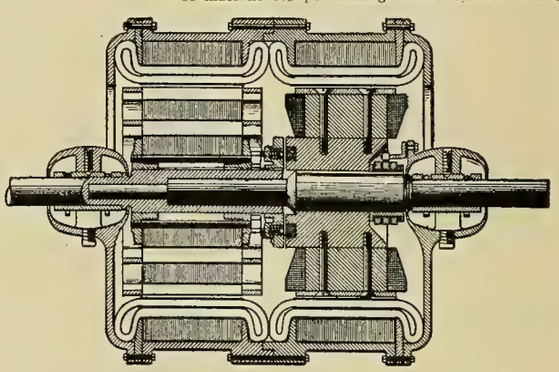
A rotating carrier having permeable projections is opposite a magnet pole piece projecting close to the surface of the carrier below its horizontal axis and cut away above this axis. A shield is provided over the face of the pole piece and the material to be separated is fed between the carrier and the shield.

832,829. Magnetic Ore Separator. Henry H. Wait, Chicago, Ill., assignor to International Separator Company, Chicago, Ill. Application filed April 24, 1905.

A separator cylinder having its surface formed of transversely-disposed magnetizable plates having teeth upon their edges, the teeth of adjacent plates being of progressively different heights to form approximately pyramidal projections upon the surface of the cylinder.

832,849. Electric Perforating Machine. George H. Davis, Brooklyn, N. Y. Application filed April 22, 1901.

A machine for perforating record blanks is covered.



NO. 833,051.—MOTOR AND GENERATOR CONNECTED BY MAGNETIC CLUTCH.

832,852. System of Distributing Electricity by Alternating Currents. William M. Fairfax, Brooklyn, N. Y. Application filed July 18, 1892.

An electrolytic condenser is connected in the secondary circuit of a transformer to decrease the self-inductive effect due to transformer magnetic circuit.

832,862. Means for Installing Electric Outlets. Louis Kalischer, Brooklyn, N. Y. Application filed October 1, 1903.

A base supports an arm provided with means for leveling.

832,876. Connector for Telephone and Other Wires. Charles L. Peirce, Jr., Chicago, Ill., assignor to Peirce Specialty Company, Chicago, Ill. Application filed May 31, 1905.

The wire ends are inserted in a two-compartment clamp having a conducting plate as partition, and held together by a bolt and nut.

832,912. Rheostat. Fred R. Kunkel, Wilkinsburg, Pa., assignor to Westinghouse Electric and Manufacturing Company. Application filed June 12, 1905.

A motor-regulating rheostat is shown, in which the resistance conductor is located on the periphery of an insulating block which carries switch mechanism.

832,913. Fan Motor Adapter. Fred R. Kunkel, Wilkinsburg, Pa., assignor to Westinghouse Electric and Manufacturing Company, Pittsburg, Pa. Application filed August 2, 1905.

A hollow base and bracket for supporting fan motors are described.

832,926. Multiple-unit Switch-control System. Francis H. Shepard, New York, N. Y., assignor to George Westinghouse, Pittsburg, Pa. Application filed February 12, 1904.

A method of controlling a number of electric motors which consists in the following steps: Combining the motors in series-connected pairs independently to the line, connecting a terminal of each motor with resistances and the resistances with supply conductors, and severing connections between the motors. (See cut on preceding page.)

832,934. Electric Glow Lamp. John Van Vleck, New York, N. Y., assignor to Nernst Lamp Company, Pittsburg, Pa. Application filed May 9, 1899.

This invention covers a heating coil for heating a Nernst lamp glower, and means for detaching the heater. (See cut.)

832,946. Automatic Release for Party-line Exchanges. Clarence A. Anderson, Salina, and William Hagstrom, Lindsborg, Kan., assignors of one-third to John Anderson, Salina, Kan. Application filed February 8, 1905.

A step-by-step mechanism is arranged to send a prolonged impulse over the party line with which it is associated, when the latter is disconnected.

832,947. Igniter for Cigar Lighters. George S. Andrews, Butler, Pa. Application filed September 11, 1905.

An electric spark formed between a slotted plate terminal and a sparking finger does the igniting.

832,951. Suspensory Device for Electric Lamps. Samuel R. Bell, Tuscaloosa, Ala. Application filed September 19, 1905.

A flexible duplex conductor wound on a drum suspends an arc light at variable heights.

832,983. Electrode for Use in the Manufacture of Bleaching Liquor. Richard Kother, Cunewalde, Germany, assignor of one-half to Charles Edward Waithman, Gaddum, Montford, Cheshire, England. Application filed November 3, 1905.

This patent covers a series of compartments separated by non-conducting partitions and provided each with an electrode and connections for passing an electrolyte through each compartment.

833,017. Electric Railway. Miles E. Bailey, Washington, D. C. Application filed May 27, 1905.

A normally energized main line is shown, having a siding insulated from it, and cars operated on both, and carrying controllers governed by trips which are operated by track devices.

833,020. Insulated Rail Joint. William F. Bossert, Utica, N. Y. Application filed January 11, 1906.

A suitably insulated chair surrounding the flanges and webs of the rails adjacent to their ends unites the rails.

833,034. Aerophore. Lee de Forest, New York, N. Y. Application filed December 8, 1905.

Mr. De Forest describes a space-telegraph device for sending Hertzian waves in predetermined directions and in a manner which identifies the location of the sender.

833,051. Electromechanical Transmission Device. Arthur W. Harrison, Los Angeles, Cal. Application filed June 12, 1905.

A motor and a generator mounted on independent shafts are connected by a magnetic clutch having its coils carried by the generator shaft and its armature by the motor shaft. (See cut.)

833,125. Electric System for Operating Bulkhead Doors, Hatches, etc. William B. Cowles, Cleveland, Ohio, assignor to The "Long Arm" System Company, Cleveland, Ohio. Application filed July 11, 1904.

Gearing driven by an electric motor closes the doors in bulk heads of ships. A coil spring under compression, connected to this gearing, acts as safety device by cutting off current from the motor when the door is obstructed.

833,129. Electric Controller and Starting Switch. John B. Duckitt, Hyde, England, assignor of one-half to the firm of Joseph Adamson & Company, Hyde, England. Application filed November 4, 1905.

A switch arranged to concentrate a magnetic field across the edges of the contacts where the current is broken, to prevent injury by sparking.

833,135. High-tension Terminal for Spark Coils. Edward B. Jacobson, Pittsfield, Mass., assignor to Pittsfield Spark Coil Company, Pittsfield, Mass. Application filed February 7, 1906.

A device for connecting the end of a cable to a fixed terminal.

REISSUES.

12,538. Electric Controller. Charles H. Keeney, Milwaukee, Wis., assignor to Emil Brand. Application filed March 30, 1904. Original No. 687,829, dated December 3, 1901.

An automatic electric controller system in which a single solenoid controls an electric circuit and actuates devices for successively cutting out resistance after the initial closing of the circuit.

12,541. Telephony. Harry O. Rugh, Chicago, Ill. assignor to Edward C. Hennis, Sandwich, Ill. Application filed October 20, 1905. Original No. 747,491, dated December 22, 1903.

An arrangement for uniting telephone sub-stations for conversation, containing devices for preventing cross-talk.

PATENTS THAT HAVE EXPIRED.

Following is a list of electrical patents (issued by the United States Patent Office) that expired October 15, 1906:

412,758. Electric Circuit-closing Device. W. C. Johnston, Jr., Lynn, Mass.
412,818. Electrical Switch-board. J. J. Wood, Brooklyn, N. Y.
412,854. Dynamo-electric Machine. J. A. Kingdon, London, England.
412,885. Microphone. E. F. Heydler, Dresden, Germany.
412,889. Electric Terminal. C. McIntire, Newark, N. J.
412,924. Electrical Metal Detector. J. F. Kester, Terre Haute, Ind.
412,925. Electrically Operated Ice-cutting Machine. F. E. Kinsman, Plainfield, N. J.
412,928. Governor or Regulator for Electric Motors. R. Macrae, Baltimore, Md.
412,932. System of Distribution by Alternating Electric Currents. O. B. Shallenberger, Rochester, Pa.
412,933. Discharge Device for Dynamos. O. B. Shallenberger, Rochester, Pa.
412,962. Incandescent-lamp Socket. O. P. Loomis, Somerville, Mass.
413,008. Alternating-current Machine. C. Zipernowsky, Buda Pesth, Austria-Hungary.
413,011. Globe Protector for Arc Lamps. G. C. Asmus, Chicago, Ill.
413,038. Electric Meter. W. H. Douglas, Stourbridge, County of Stafford, England.
413,083. Switch-board. J. F. McLaughlin, Philadelphia, Pa.
413,085. Electric Motor. F. J. Patten, New York, N. Y.
413,112. Electrode for Secondary Batteries. H. Tudor, Rosport, Luxemburg, Germany.
413,133. Coupling Box for Electrical Conduits. S. P. Denison, Brooklyn, N. Y.
413,136. Method of Electric Refrigeration. M. W. Dewey, Syracuse, N. Y.
413,146. Insulator. L. McCarthy, Boston, Mass.
413,148. Dynamo-electric Machine. G. Pfannkuche, Cleveland, O.
413,151. Electric Railway Car. F. J. Sprague, New York, N. Y.

WESTERN ELECTRICIAN

EVERY SATURDAY

Vol. XXXIX. CHICAGO, OCTOBER 27, 1906 No. 17

Concrete Power House at Taylors Falls, Wis.

By Charles H. Coar.

A notable exception of concrete-steel construction is found in the large power station of the Taylors Falls Development Company, located on the St. Croix River, about 40 miles, air line, from Minneapolis. This plant has been under construction for approximately two years and was described in a general manner through the columns of the Western Electrician in the issue of October 28, 1905. The plant is designed for an ultimate development of 24,000 horsepower, and at the present time can develop approximately 12,000 horsepower. The power is obtained from the St. Croix River by means of a large dam, which diverts the water to turbines under an effective head of 55 feet. Transformed into electricity, the power from the plant is transmitted to the Twin Cities, where it is used for various commercial purposes. The site chosen for the power house is in Wisconsin, the St. Croix being the boundary between that state and Minnesota at this point. The power house is built on a solid ledge of rock, which was blasted out in sufficient quantities to provide the necessary space for the building.

A general idea as to the surroundings of the building site may be obtained from Fig. 2, showing the nearly completed power station.

In this view it will be noticed that the structure is built in a bank of solid rock, the larger portion of which was removed by the use of steam rock drills and dynamite. The buildings of a foundation under a condition of this kind presented no particular difficulty with reference to construction, it being merely necessary, in most parts, to level up the blasted portions and to construct such column and machine piers as were necessary.

Referring to Fig. 1, which illustrates a general view of the power house and dam under construction at an earlier date, it will be seen that the turbines and penstocks were installed previous to the construction of the exterior walls of the station. The larger turbine units, four of which are installed, as shown in the view, were completely embedded in the construction of the building. Two smaller turbine units, used for exciter generators, are installed in such manner as to expose the turbine and a portion of the penstocks in the generating room, as shown in Fig. 3. The location and general assembling of these turbine units made their installation necessary prior to the actual building construction, as is the usual condition in many instances.

Construction of the walls was accomplished with reinforced concrete, through the aid of wooden molds erected in such shape and position as to meet the requirements as to general dimensions, etc. A portion of one of these wall molds is shown in Fig. 2, at the rear of the building directly over the tail race. The method of building the walls consisted of erecting the temporary molds after proper provisions had been made for the steel reinforcements, when the concrete would be filled in the mold and tamped. The concrete was then allowed to set, when the temporary wooden mold could be taken down and the planking used over again in the formation of a different mold.

From the general building dimensions of this station some conception can be drawn as to the large amount of concrete used in the construction. The fact that a large quantity of concrete was necessary for constructing the dam, which made it essential to provide this material in the cheapest possible manner, greatly furthered the practicability of erecting a concrete building. The rock crusher and concrete mixers handled these materials in large quantities by means of steam tramways, derricks and overhead cables.

The interior arrangement of the power station may be understood by reference to Fig. 3. In this sectional view the interior walls and room arrangements are partially shown. This drawing tends to bring out in a clear manner the nature of the wall construction, position of girders and reinforcements, as well as the dimensions of the various rooms shown. As shown by the grade lines the building stands approximately 70 feet high from the floor of the generating room to the roof of the line tower located on the south end of the station. The various rooms shown in the sectional view will be further described in conjunction with the equipment.

A manhole four by 13 feet and 15 feet deep is built between two of the penstocks to the turbines,

Fig. 1. Power House and Dam During Construction.

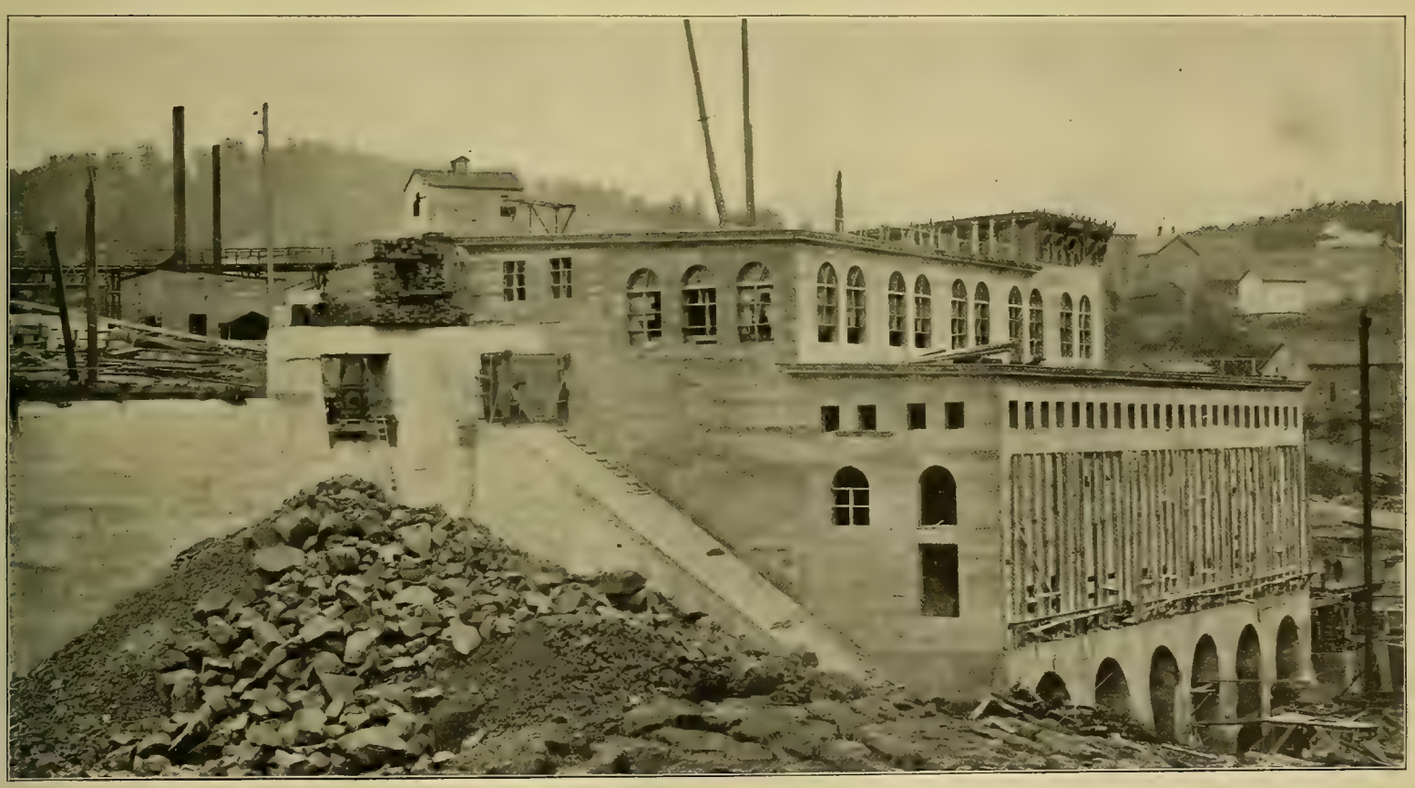


Fig. 2. The Power House Nearly Completed.
CONCRETE POWER HOUSE AT TAYLORS FALLS, WISCONSIN.

entrances being provided to this from either the switchboard gallery or space about the exciter turbines. This manhole is used in conjunction with the ducts and wire compartments shown at (F) to provide the necessary means of conveying the wires from one point in the building to another. The fiber conduit is embedded in concrete and the wire compartments are arranged to provide space for one wire only, this being tied on high-tension insulators mounted every few feet apart in the compartments. A separate compartment is also provided for auxiliary wire as is shown.

Where the high-tension wires pass through floors or walls large glazed sewer pipe is used as bushing, the sewer pipes in some instances being provided with glass covers to fit in the flange, so that the wire is maintained in a central portion of the sewer pipe by passing through a round hole, slightly larger than the wire, located in the center of the glass cover. The arrangement of one of these pipes is shown at (A) in the line tower in Fig. 3, where the line wires pass through to the outside.

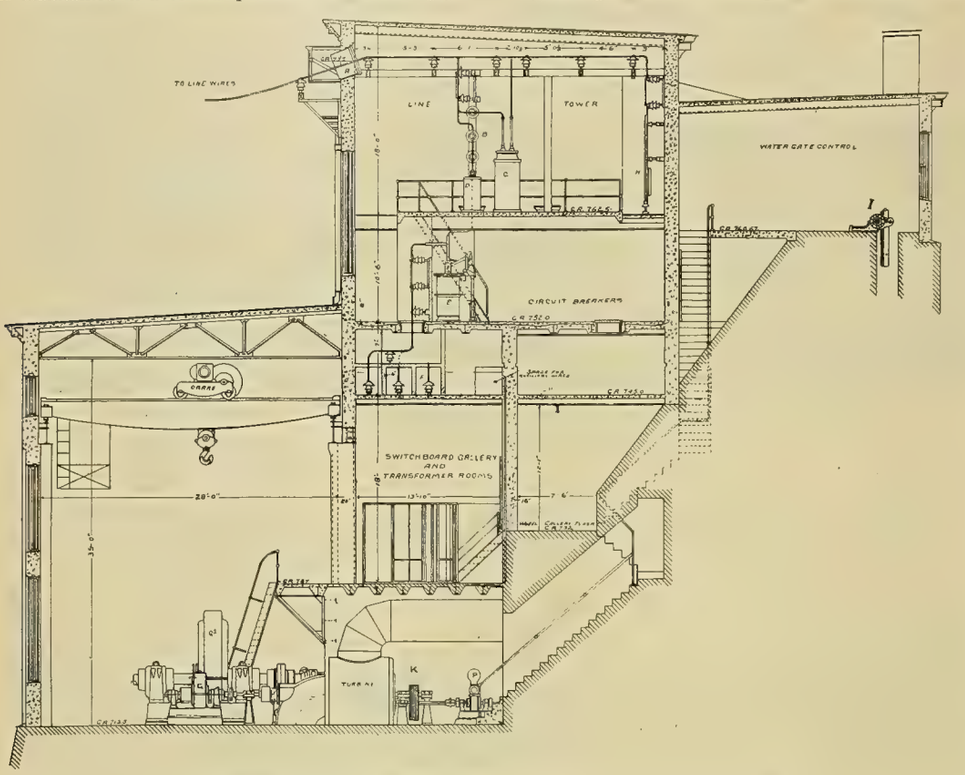


FIG. 3. CROSS-SECTION OF CONCRETE POWER HOUSE AT TAYLORS FALLS, WISCONSIN.

Water supplied to the different penstocks is controlled by water gates arranged to be raised or lowered electrically by means of motors shown at (I) in the water-gate control room. All the turbines are of the Victor horizontal type, the larger units being rated at 4,200 horsepower each, while the exciter turbines develop 225 horsepower each. These turbines are controlled by Lombard governors. The penstocks conveying the water to the turbines are constructed of steel and are mostly covered with concrete jackets. The penstocks to the larger turbines are entirely enclosed, access to them being obtained through manholes provided for this purpose.

Arranged to be connected to one of the smaller turbines through a friction clutch (K) is a fire pump (P), as shown in the drawing.

The larger generators are 2,500-kilowatt Westinghouse alternating-current machines, direct connected to turbines, as are the exciter generators, which are rated at 100 kilowatts each. Current is generated at 2,300 volts and passes from the generator to a sub-cabinet. There is one for each machine, located near the turbine end against the wall. From these sub-cabinets the wires are led to oil switches located in the switchboard gallery directly in front of the transformer rooms. There are four transformer rooms, each being designed to accommodate three step-up transformers. These rooms are arranged along one wall of the switchboard gallery and are provided with individual doors.

From the oil switches the generator feeders pass to transformer cabinets, thence to the transformers. There are three wires passing over such a route from each generator in fiber conduits as before mentioned. The secondary wires from the transformer follow separate compartments (F) the entire length of the building until the south end is reached, where they rise, passing through sewer-pipe insulators to circuit-breakers (E), located in individual stalls composed of concrete. From the circuit-breakers the line feeders pass through current transformers (D), located in the line tower directly above. The wires pass from the current transformers to emergency switches arranged between two insulators, thence through choke coils (C), to the line wires, three-phase at 50,000 volts, for transmission.

A bank of multiplex lightning arresters is connected to each line wire, as shown at (H). Each such bank is located in a separate stall. Five sewer-pipe outlets are provided in the line tower at present, three being used for the outgoing high-tension wires, two being reserved presumably for local distribution.

In closing this brief description it may be well to mention that the exterior walls are being coated with mortar for the sake of appearance, as the board molds leave them in a rather unfinished condition after they have been removed.

Wireless Station Said to Have Affected Lighting Circuits.

The fifty-third quarterly fire report of the Electrical Bureau of the National Board of Fire Underwriters gives an account of a space-telegraph station which caused trouble on the lighting circuits of the neighborhood. According to the report, the sending-station apparatus of the wireless-telegraph system was supplied by a three-kilowatt, 2,080-115-volt pole transformer on a three-phase system. This transformer broke down because of high-voltage reactions caused by the wireless apparatus, and was replaced twice by other three-kilowatt transformers in parallel, all of which failed. A 7½-kilowatt transformer was finally installed and operated satisfactorily.

In transmitting signals the secondary voltage (115) was raised to about 20,000 volts, which was impressed on the aerial conductors on the mast. It was found that this equipment when in use produced several breakdowns in lighting and small motor circuits in the neighborhood supplied by other transformers of the same system.

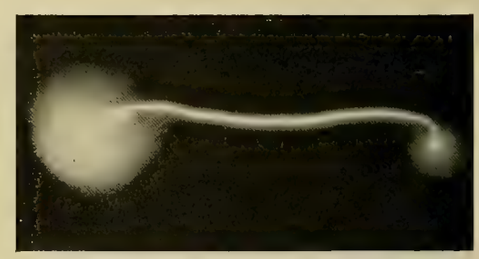
In a doctor's office diagonally across the street from the wireless station were incandescent lamps and small motors supplied from a transformer whose secondary line paralleled the secondary leading to the wireless apparatus. The reactions in the system caused by the sending apparatus of the wireless station caused the Edison plug fuses in the service entrance box to be blown violently, and destroyed the windings of a small motor. It is reported that these breakdowns were accompanied by flashes of flame about the apparatus in the office. Removing the doctor's service line to a position where it no longer paralleled the wireless secondary circuit corrected the trouble in this office. The wireless company also improved the contact of its ground connection, but it does not clearly appear how much this had to do with preventing further troubles. One or two other installations in the neighborhood, a closely built-up city block, were affected to less degree. A number of telephones were rendered useless during sending of wireless messages, the code signals being loudly heard in the receivers. This was remedied by the insertion of suitable capacities in the telephone service circuits.

Laboratory Reproduction of Globular Lightning.

An interesting phenomenon which seems to be a reproduction of globular lightning in miniature has been observed by Dr. Leduç, a French physicist, in the course of his researches. When two very fine and well-polished metal points, each connected with one of the poles of an electrostatic machine, are placed from two to four inches apart, over a sensitized plate or photographic paper, using brilliant-surface bromide paper for the purpose, and having the paper placed upon a glass plate, with the whole placed on a metal plate, it is found that upon charging the points an electric brush diffusion or halo is produced around the positive point, while at the negative point a luminous globule is formed. When this globule reaches a sufficient size, it is seen to separate from the point, and the latter ceases to be luminous. The globule begins to move and continues to travel slowly over the plate. This movement is irregular, and often the globule travels to and fro, returning and then advancing and taking a roundabout path. It continues, however, toward the positive point. When it arrives at the latter, the halo disappears and all luminous phenomena cease. The electrostatic machine is put out of action just as if the two poles had been joined by a conductor. If the positive point is lifted, so as to place it in another position nearby, the same series of phenomena is reproduced.

The speed at which the luminous globule is seen to travel is very slow. It takes from one to four minutes to cover a distance of two to four inches. Sometimes, before reaching the positive point, the globule breaks up into two or more luminous globules which continue their route individually toward the positive point. By developing the plate or the paper, it is found that the path of the globule is traced upon it, including the place of explosion, the paths of the smaller globules, and the discharge halo around the positive point. The photograph thus made seems to reproduce in miniature the path of globe lightning, as may be seen in the illustration, in which the positive point is on the left-hand side surrounded by its luminous brush.

Lightning globes seen in nature resemble these globules thus artificially produced in the slow and vacillating character of their movement. They have been known to change direction in the most unexpected manner and with no assignable cause



PATH OF ARTIFICIAL-LIGHTNING GLOBULE.

a great many times in making a short advance toward their apparent objective.

By stopping the experiment before arriving at the positive end, the photograph shows only the path up to the stopping place. The globule seems to make its path conducting. If, during the passage, powder is sprinkled on the plate—sulphur, for instance—the path followed by the globule is marked by a line of small rays, giving the appearance of a string of luminous beads. Globular sparks have been described by G. Planté and by Righi, but they are quite different in their method of production and their characteristics. Planté used a mica condenser with tinfoil coating. Each coat was joined to one of the poles of the machine. Where the mica was pierced a spark was produced and the tinfoil melted and the mica burned. This combustion was propagated so as to give a moving spark. The phenomena observed by Righi relate to the luminosity of vacuum tubes, and their speed of propagation was so high that he needed to use revolving mirrors in order to observe the movement. It seems, therefore, that the present experiments come the nearest to reproducing globular lightning.

Electric Ironing Equipment of a Modern Laundry in Atlanta.

Electricity has been used as the lighting and power agent in steam laundries for several years (a notable example being that of the up-to-date Chicago laundry described in the Western Electrician of September 29, 1906), but it has been within a comparatively short time that the cleanliness and convenience of this power has been adopted for heating. The Guthman Steam Laundry at Atlanta, Ga., presents an interesting example of this three-fold use of electricity, and is a model establishment in this, as well as in other respects.

The building in which the laundry work is carried on was built especially for the purpose and is entirely self-contained, being a brick structure of three floors and a basement, comprising some 24,000 square feet of floor space. The arrangement of the processes in washing and ironing the clothes are somewhat unusual. The basement contains the generating equipment, repair shop and storerooms, while primary washing machines and

ELECTRIC IRONING EQUIPMENT OF A MODERN LAUNDRY IN ATLANTA.

centrifugals for extracting water from the clothes are located on the top floor, which is, on this account, constructed of cement 14 inches thick. In this way the first and second stories, used for offices, ironing and drying, are kept entirely free from all odors of boiling clothes and soapsuds which will permeate a building in which the washing is done in the basement.

In the basement boiler room are located two 200-horsepower water-tube boilers which supply steam at both low and high pressures, respectively, for laundry purposes and for an automatic engine which drives a 55-kilowatt compound-wound 110-volt General Electric generator for supplying light and power. On the first floor, in addition to the general offices, are four large mangles each driven by a five-horsepower direct-connected motor. Individual motor drives are also used on the shirt-bosom ironers, body ironers, wristband ironers, moisture applying machines, etc. The primary washing machines on the third floor, as well as the centrifugals, are grouped and are driven from two lines of shafting, each belted to a 15-horsepower motor. Aside from the machine drives, there is also installed an electric elevator which carries the work from the delivery wagons in the basement to the sorting room on the top floor.

It is in the hand-ironing department on the second floor, however, where the most interesting use of electricity is evident. Here are installed 30 six-pound and 10 three-pound electric flat irons of the cartridge type made by the General Electric Company. The method of installation is unusually neat and emphasizes the convenience and adaptability of the electric flat iron over the cumbersome gas-heated iron. Over each ironing table, as shown in the accompanying illustration, there is a special goose-necked fixture fitted with a four-candlepower indicating lamp, both controlled by a 10-ampere snap switch. This novel arrangement tells at a glance which irons are doing useful work or which are standing idle with the current turned on. Moreover, this method of attachment allows the operator the greatest freedom in the use of the iron.

The electrical equipment of this laundry was installed by the General Electric Company after plans of Mr. George Wade as consulting engineer for the Guthman company. It has been demonstrated by the Guthman laundry, it is said, that by the use of the electric irons 20 per cent. more work can be accomplished by each operative per working day than that formerly done by the older methods.

The Berlin Wireless Conference.

Writing from Berlin on October 12th, while the international conference on space telegraphy was holding its private sessions, a correspondent of the Western Electrician sets forth the German view as follows:

"The International Conference for Wireless Telegraphy, which commenced its sittings in Berlin a few days ago, is intended to settle some doubtful points as to the international wireless-telegraph service. As matters stand, there is no possibility of avoiding mutual disturbances and of regulating the telegraph service between the navy and merchant ships. It may be said that during maneuvers of the German navy in the North Sea all private telegraph service, even in the case of the most important messages, is interrupted.

"The main object of the conference is, however, without any doubt, to oppose the monopoly of the Marconi company. Ships equipped with the Marconi apparatus are not allowed to communicate with any station or vessel comprising the apparatus of any other company; for example, the Wireless Telegraph Company of Berlin. While the latter has supplied its apparatus to a number of foreign governments, most of the German express steamships plying the Atlantic Ocean are equipped with Marconi telegraphs. The Hamburg-American Line is even stated to have made contracts with that company engaging it to use no other system for a number of years, while the North German Lloyd possesses only one steamship provided with the telegraph outfit of the Berlin company. In view of the present monopoly held by the Marconi company this equipment will be hardly of any use, owing to the impossibility of communicating with any other steamer or any one of the coast stations controlled by Marconi.

"Another drawback to the development of wireless telegraphy in Germany is the government control of all telegrams from sea passing through German coast stations, for which an extra sea fee of 80 pfennig (20 cents) is charged, which fee, in addition to the ordinary land fee, is recovered from the addressee. The sender, being unable to pay for the amount on board, usually gives up any idea of sending a telegram liable to put the addressee to expense. This branch of telegraphy should, therefore, like the working of deep-sea cable lines, be left to private companies to exploit. Anyhow, the commercial success of German coast stations is for the above reason practically nil. The results obtained on board the large ocean-going steamers are on the other hand quite remarkable. According to records extending over six months, made on board a Hamburg transatlantic liner, as many as 1,370 telegrams have been received; 932 have passed through the vessel and 3,710 telegrams have started from the latter, giving an aggregate of 6,012 telegrams, which corresponds to 18,986 marks ($4,557) in wireless fees, while 8,166 marks ($1,960) was paid for the same dispatches in land and cable fees. This shows the results so far obtained to be most worthy of note.

"The sittings of the conference will no doubt last a few weeks. The absence of Mr. Marconi, who had assumed the place of a delegate to Montenegro, has been much commented on in the daily press. However, from the present attitude of the British delegates, it seems likely that some sort of compromise at least will be arrived at. In fact, the delegates representing the Postoffice fully realize the folly of England's resistance, which is quite at variance with her otherwise liberal tendencies, whereas the representatives of the British Admiralty, bound as they are by contracts with the Marconi company, doggedly cling to their opposition. However, England, having been deserted both by France and Italy, is quite isolated in its policy.

"An article of the agreement suggested by Germany which is likely to meet with resistance from many quarters is the one relative to the foundation of an International Bureau, the seat of which would be Berlin, and which would be destined to superintend the wireless telegraphy of other countries. Nor has Article 17, according to which the independent operations of all private companies would be prohibited, any chance of being accepted."

The London Times printed the following from its Berlin correspondent under date of October 9th: "According to semi-official statements, the negotiations of the International Wireless Telegraphy Conference continue to make satisfactory progress. At a general meeting of the delegates yesterday the first reading of the convention was concluded with the exception of certain controversial points, the consideration of which has been postponed. Today was occupied by the deliberations of the special committee which has been appointed to draw up a reglement de service."

The following is from the regular London correspondent of the Western Electrician:

London, October 10.—The wireless-telegraph conference which was opened in Berlin last week has given rise to an interesting correspondence in the daily press concerning the origin of this interesting gathering. No less a personage than Mr. Henniker Heaton, the postal reformer, again makes the complaint that it is a deliberate attempt by the German emperor to deprive the Marconi company of the just reward which it deserves. But he even goes further, in a letter to the Times, in which he states that the conference was only called after Prof. Slaby had been to England and was allowed to inspect the Marconi arrangements. Mr. Heaton takes up the national view that imperial interests are at stake, and that the British government should not deviate from its policy in this matter hitherto.

The British delegates are the secretary to the Postoffice, Mr. H. Babington Smith, C. B.; the engineer-in-chief of the Postoffice, J. Gavey, C. B.; Mr. J. Mackay, also of the Postoffice; the assistant director of naval ordinance, Capt. A. E. Bethell; the assistant director of military operations, Col. F. J. Davies, as well as Lieut. J. G. Loring of the Navy and Col. R. L. Hippisley. Mr. Smith has been elected a vice-president. Many attempts have been made to obtain a statement from the Marconi company, whose monopoly is claimed to be the stake at which the conference is aimed, but without avail. With the proceedings at the conference being held in private all information must be accepted with reserve, but it may do no harm to mention the statement made that the British representatives will resist any curtailment of the Marconi monopoly, while Germany's policy of the "open door" is believed to be supported by the United States. C.

Arthur Williamson has been granted a franchise for an electric-light plant in Chapman, Kan.

New Engineering Building of the University of Pennsylvania.

The new engineering building of the University of Pennsylvania in Philadelphia was dedicated on October 19th. It is one of the finest and best equipped buildings devoted to the teaching of engineering in this country. Including equipment, the cost was nearly $1,000,000. The announcement of the dedication of this building has attracted unusual interest in engineering circles.

Elaborate preparations had been made for the dedication. The building, which was beautifully decorated, was open for private view all day to the guests of the university. At 12:30 p. m. luncheon was served in three of the large rooms on the third floor. The dedicatory exercises were held at two o'clock in the large assembly room on the second floor. Upon their arrival at the university the representatives of foreign countries and the delegates from the various schools and scientific societies assembled in the library room on the second floor and presented their credentials to Dr. Josiah H. Penniman, dean of the college. The seniors in the civil and mechanical engineering courses acted as ushers, and during the day escorted the guests of the university through the building, explaining the uses of the various rooms and apparatus.

At two o'clock the candidates for honorary degrees, the official representatives of foreign countries, of schools and of scientific societies, the provost, vice-provost and trustees, proceeded in a body from the library to the auditorium. After the invocation by the Rt. Rev. Ozi W. Whitaker, the building was formally presented to the university by Emlyn L. Stewardson of the class of 1884, on behalf of the architects, Messrs. Cope and Stewardson. The provost accepted the keys of the building on behalf of the trustees. Mr. Arthur L. Church of the class of 1878, chairman of the dedicatory committee, and a trustee of the university, presented the candidates for honorary degrees to the provost. An oil portrait of the late J. Vaughan Merrick was then presented to the department on behalf of Mr. Merrick's family by Joseph Levering Jones, and accepted by the vice-provost.

Mr. Frederick W. Taylor, president of the American Society of Mechanical Engineers, and Dr. Alexander C. Humphreys, president of the Stevens Institute of Technology, then delivered the principal addresses, being introduced respectively by Prof. Henry W. Spangler of the mechanical-engineering department of the university and Dr. Edgar Marburg of the civil-engineering department.

In the evening the special guests of the university were entertained at a dinner given at the Union League by the general committee and the alumni of the civil and mechanical engineering departments.

The new engineering building is the largest of the 70 buildings now occupied by the University of Pennsylvania, having a frontage of 300 feet and a depth of 210 feet. It is of fireproof construction, and the equipment is of the most modern and approved type. The exterior is of dark brick with limestone trimmings. There are three stories, with a basement covering a third of the entire building, the total floor area being 128,000 square feet. The heating is by direct steam; the ventilation by electrically driven fans, and the lighting by electricity. The steam for the engines is supplied from the central station of the university, and after being used by the engines is sent into the heating system of the building. There are two principal entrances leading to the main hallway, which extend east and west the entire length of the building, to staircases at both extremities.

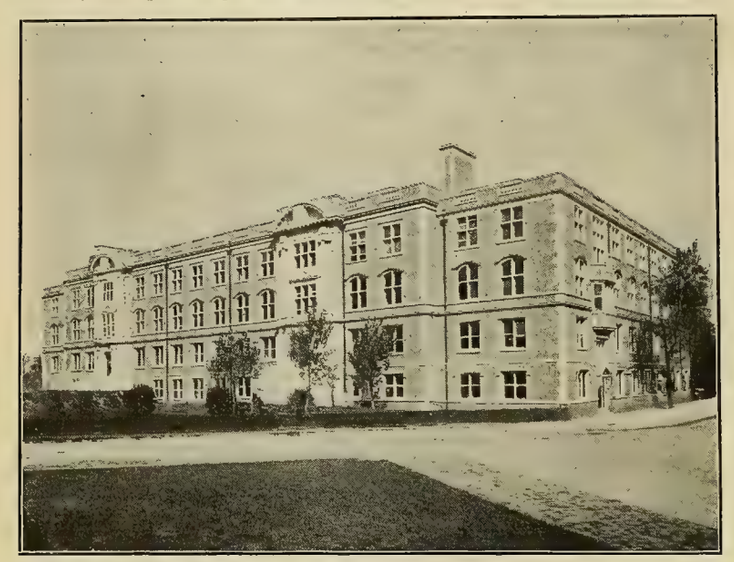
The basement contains locker rooms, lavatories, machinery for heating and ventilating, storage-battery rooms, laboratories of geodetic and hydraulic work, and for the testing of the materials of construction. On the first floor, adjacent to the main entrance, are the offices of the heads of departments, the eastern part of the building being devoted entirely to the civil-engineering department, and the western part to the mechanical-engineering department. Accommodation is also provided for physical and hydraulic testing, instrument testing and for special work in mechanical and electrical engineering.

Rooms are likewise set aside for dynamos and electric motors, steam and gas engines, refrigerating apparatus, hydraulic motors, boiler testing, pattern making, wood and iron working, foundry and machine shops, etc. On the second floor is a reference library and reading room, a students' assembly room, rooms for use of instructors and for lectures and recitations. The rear portion of this floor is devoted almost wholly to drawing rooms. A room for the use of the engineering societies, a general supply store and the library stack occupy the middle portion. In the east and west wings ample space is assigned to the engineering museums, while the rear of this floor is set aside exclusively for additional drawing rooms, which, like those just beneath, will have the full advantage of a north light.

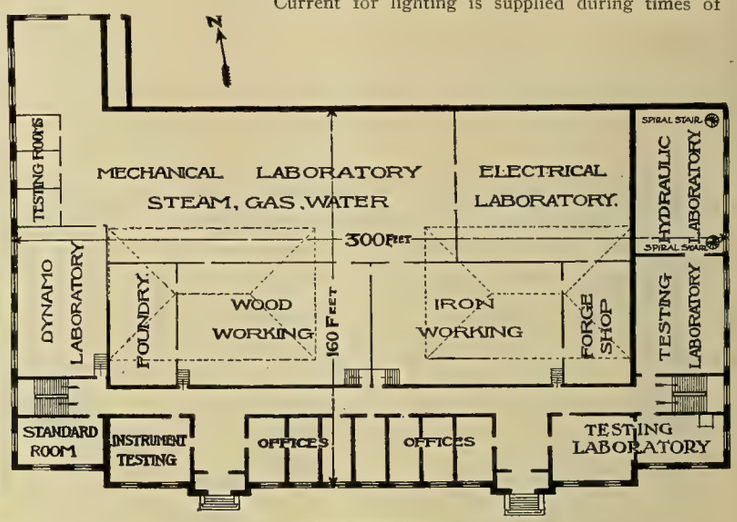
Current for lighting is supplied during times of small demand directly from the light and heat station, and when the demand is large from the local plant in the center of the basement. This plant consists of two 75-horsepower Westinghouse standard engines and one of 25 horsepower directly connected to General Electric generators. Steam for the engines is supplied from the central station and after being used by the engines is sent into the heating system of the building.

The lighting of the halls and library is by 50-candlepower Meridian lamps. The class rooms are lit by clusters near the ceiling. The drawing rooms and laboratories are lit generally by five-ampere enclosed-arc lamps with opaque bottom shade and concentric diffuser, placed about 15 feet apart. The uniformity of the light distribution is very good.

Four electrical laboratories are provided, three on the first floor and one on the second. The beginners'

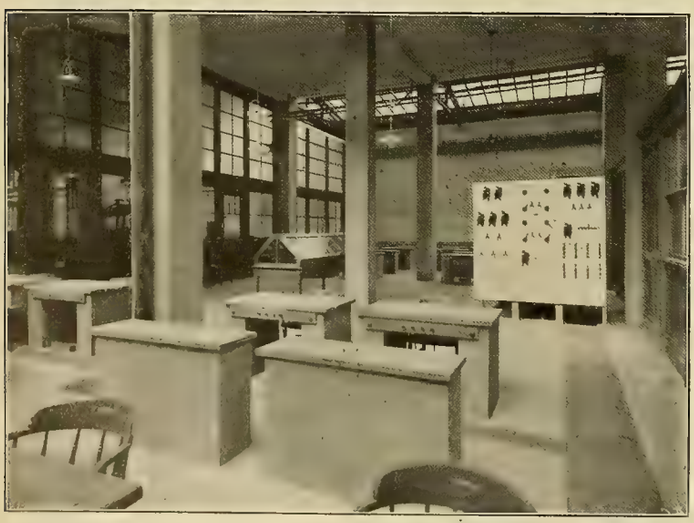


Exterior View.

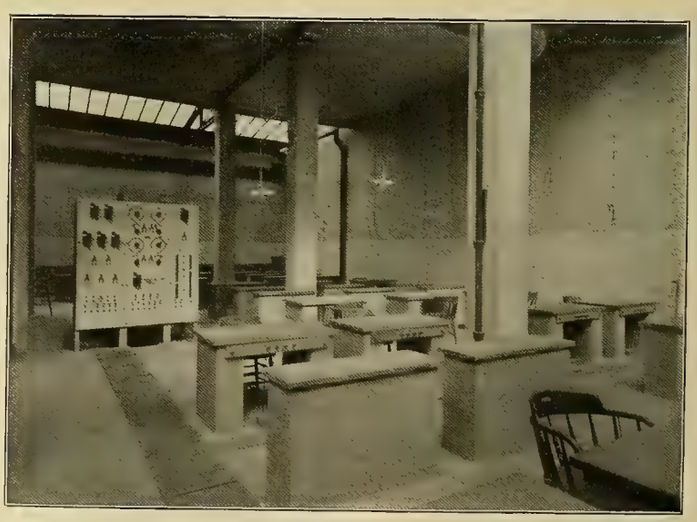


First Floor Plan.

NEW ENGINEERING BUILDING OF THE UNIVERSITY OF PENNSYLVANIA.



Senior Instrumental Testing Laboratory.



Junior Electrical Instrument Laboratory.

NEW ENGINEERING BUILDING OF THE UNIVERSITY OF PENNSYLVANIA.

laboratory, located on the first floor, is intended for measurement of current, resistance, inductance, capacity, etc., the calibration of voltmeters, ammeters, wattmeters, etc. A floor space of 4,500 square feet is divided into four separate testing rooms. A concrete table and a galvanometer pedestal are provided for each student, there being accommodations for 42 men, divided into four sections. Each of the four sections is provided with its own switchboard and its own storage-battery installation, enabling the entire number of men to be working at the same time.

The distributing switchboards have been designed for the work, and it is possible to get any combination of direct or alternating current for testing

purposes. The apparatus supplied for these laboratories is said to be without equal in any technical laboratory in this country.

The testing laboratory for direct current has a floor space of about 2,000 square feet. It is on the ground floor and has all its apparatus mounted on raised foundations, to which any dynamo or motor can be attached. Provision is made for handling 12 tests at one time, and the apparatus for each of these is complete. The distributing switchboard here supplies current of 110 volts, or at six, 20, 110 or 150 volts, or any combination.

The main power supply is taken from the building plant, 500 amperes being available to 110 volts.

All the dynamos used are motor driven, having

NEW ENGINEERING BUILDING OF THE UNIVERSITY OF PENNSYLVANIA.—DIRECT-CURRENT DYNAMO LABORATORY.

field rheostats for regulating purposes. The appliances required for making tests are supplied in such numbers that it is possible to run this entire laboratory at the same time, doing any of the work for which any of the machines may have been installed.

The alternating-current laboratory is located on the second floor. Its total floor space is over 2,100 square feet. The wiring in this room is overhead from a switchboard supplied for handling the work. This board is over 14 feet in length and all the circuits are protected by circuit-breakers. The apparatus installed is such that each testing place is practically a complete isolated plant.

For supplying current four direct-connected generator sets are used, driven by direct-current motors, three sets having polyphase generator and the fourth having four single-phase alternating-current generators.

To give some idea of the small-instrument equipment for each location, there is the necessary equipment of prony brakes, scales, adjusting resistances, switches, thermometers, speed counters, stop watches and tachometers, and, in addition, there are about 90 instruments, 20 of which are for direct current, the remainder being wattmeters, ammeters and voltmeters of suitable range for the rapid and accurate carrying on of the work, together with frequency indicators, power-factor indicators and synchronizers.

Two rooms are built especially for students' work in photometry, these having labyrinth entrances and dull black walls. A separate storage battery is provided for handling this work. Each photometer has a three-meter track and universal rotating stand. One is provided with the Lummer-Brodhum screen and one with the Bunsen screen, and a Flicker photometer is provided for use in measuring lights of dissimilar composition.

A standard room on the first floor with a battery room directly beneath it in the basement has been provided for doing fine electrical standardization work.

The mechanical laboratory is located on the first floor and occupies a total floor space of about 14,000 square feet. It is in the form of the letter L, the main portion of the laboratory being 183 feet long by 64 feet wide and the smaller portion 40 feet long by 38 feet wide. The apparatus is placed in groups, those relating to allied subjects being located together.

The gas-engine plant consists of four gas engines of various sizes and makes, properly equipped for making all classes of tests on them. A 100-horse-power Roberts high-pressure boiler is provided for making boiler tests and for supplying highly superheated steam for testing purposes.

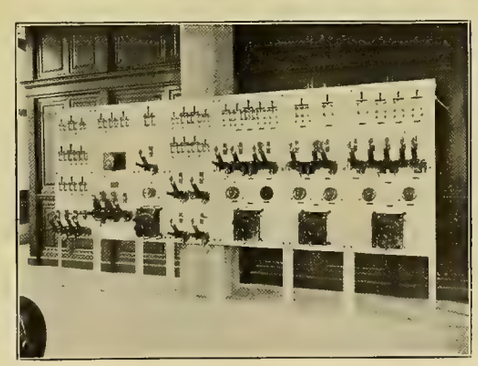
In addition to the laboratory proper a room intended for the testing of instruments and for making tests of coal, gas and the similar work required of a mechanical engineer has been located on the first floor. Three small rooms, in addition, are provided, in one of which a refrigerating machine is installed; in the second, the apparatus for making tests on blowers and heating appliances, and in the third room, apparatus for the testing of radiation through walls of various types.

About 12,000 square feet of space on the ground floor under the skylights is used for shop work, and includes lumber and iron room, offices for instructors and a large central tool room. It is divided into wood and pattern shops, iron and machine shops, foundry and forge shop. Each shop is arranged for handling 15 men at one time, or a total of 90 in a class. These shops are supplied with a modern equipment of tools, the pattern shop having turning lathes, band saw, jig saw, jointer, surface planer, rip and cross-cut saws, sanding machine, etc.

A repair shop is located on the second floor and contains about 900 square feet of floor space. In this room all broken appliances are repaired and much new apparatus is manufactured. The equipment is complete, both for wood and iron work, and tools are all motor driven.

The drawing rooms are located on the north side of the second and third floors and cover 11,800 square feet. Provision is made for independent work of 101 freshmen, 93 sophomores, 75 juniors and 46 seniors. A drawing table and stool is assigned to each student in the upper classes for exclusive use during the college year. These tables are 30 by 54 inches, of red oak with pine tops, and contain a drawer for instruments and a closet for boards and T squares.

There are 13 class rooms in the western end of



NEW ENGINEERING BUILDING OF THE UNIVERSITY OF PENNSYLVANIA.—DISTRIBUTING SWITCHBOARD IN ALTERNATING-CURRENT DYNAMO LABORATORY.

the building, each intended to handle a small section. The entire available wall space is covered with blackboards so that it is possible to insure daily work from every student.

Much of the furniture and apparatus installed in the building has been designed in the department and is especially adapted for the character of work being done.

There are no great innovations in the plant, as it is simply an expansion of the work that has been heretofore done in the department, and the experience gained in the old building has resulted in the installing of apparatus which is especially adapted for the work to be carried on, and the installation, as a whole, is complete.

The engineering department of the university was established in 1874, but the constant increase of numbers in the classes of the departments has necessitated their moving into more spacious quarters three times since their founding. The departments this year have a total enrollment of nearly 600 students, and a teaching force of 40. The new quarters, which will be occupied this fall, are said to be the finest and most complete laboratories of their kind for instruction in engineering.

Western Association of Electrical Inspectors.

The second annual meeting of the Western Association of Electrical Inspectors was held in the Denison Hotel, Indianapolis, Ind., October 17th to 19th, inclusive. F. D. Varnam of St. Paul, president of the association, presided. The first day was taken up with the discussion of various topics, routine business and the inspection of the wiring of the T. B. Laycock plant, in the eastern part of the city, and the enjoyment of the courtesy of the Laycock people at luncheon.

The afternoon session was occupied in the discussion of and action on the report of the committee on the National Electrical Code. The various suggestions in the report of the committee were of a technical nature, dealing with systems of installation and wiring. The suggestions that were acted upon favorably will be submitted to the electrical committee representing some twelve to fifteen associations throughout the country interested directly in electrical matters. This committee is to meet in New York next March and take action on the suggestions that are received from the various affiliated bodies. Those suggestions that are favorably acted on by the committee, will then be embodied in the National Electrical Code, by which the members of the various associations will be governed in their future work.

In his report, as president, Mr. Varnam spoke of the steady growth of the organization and said that although it had been in existence only 16 months, it had a membership of 137. He urged the importance of careful work in electrical inspection to the end that fire hazard might be greatly reduced.

One of the most enjoyable inspection trips was that of the inspection of the electrical equipment of the Indianapolis and Cincinnati Traction Company line and power house at Rushville. The company was taken from indianapolis to Rushville on a special car at high speed. At the power house considerable attention was given to an inspection of the electrical machinery and to the causes that led to the recent accident, destroying life near the plant by reason of a wire fence becoming charged with electricity.

The report of the committee on grounding of conductors for safety aroused considerable discussion. During this discussion a number of waterworks people were present and were interested in the matter of electrolytic injury to water pipes.

The construction and installation of electric signs was discussed, as was also show window and display lighting, and instruction to the public concerning the safe operation and maintenance of electric wiring and apparatus.

Mr. G. H. Sandborn, chairman of the National Electrical Code committee of the National Electrical Contractors' Association, read a paper on the subject of "Electrical Inspection from the Viewpoint of the Contractor." This paper brought out the fact that there is considerable friction between the electrical inspector and the contractor. Much valuable advice was given along lines calculated to lessen this trouble. An interesting and instructive talk on the manufacture and test of rubber-covered wire was made by Mr. Hugh Wreaks, secretary of the Wire Inspection Bureau of New York.

The election of officers resulted as follows: President, Waldemar Michaelson, Omaha; first vice-president, J. H. Montgomery, Detroit; second vice-president, George D. Bayle, Chicago; secretary, W. S. Boyd, Chicago.

Reading as a Trolley Center.

Over $3,000,000 will be expended by the United Traction Company next year in improvements and extensions in Berks and Montgomery counties, Pa., according to a statement credited to Walter A. Rigg, the general manager. Work on the United Traction Company's big power plant along the Schuylkill River, at Reading, will be begun this fall and will cost $1,500,000. Besides furnishing power for all the company's lines in Reading, its current will be sent as far south as Plymouth, Montgomery County. Transformer stations will be established at Oley, Line, Shanesville, Sanatoga, Collegeville and Barren Hill. When all these improvements shall have been completed it will be possible to board a trolley car in Reading for Philadelphia, Harrisburg, Lancaster, Allentown and many other important eastern Pennsylvania cities and towns.

WESTERN ELECTRICIAN

EVERY SATURDAY.

PUBLICATION OFFICES:

507 Marquette Building, - CHICAGO.

TELEPHONE, MAIN 1746.

Eastern Office, 150 Nassau Street, New York.

Telephone, 5220 Beekman.

Trade Supplied by Western News Co.

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CORRESPONDENCE relating to electricity or any of its practical applications is cordially invited, and the co-operation of all electrical thinkers and workers earnestly desired. Clear, concise, well written articles are especially welcome; and communications, views, news items, local newspaper clippings, or any information likely to interest electricians, will be thankfully received and cheerfully acknowledged.

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IN RELATION to municipal ownership President W. Caryl Ely of Buffalo displayed refreshing frankness in his address at the meeting of the American Street and Interurban Railway Association at Columbus last week. He said that the people of any community had an undoubted right to take over at a fair rate of compensation any of the public utilities and operate them. But his advice to the community was like that of Punch to those about to get married—"Don't!" The public-service corporations should be able to demonstrate, he said, that it would be unwise for the municipal corporation to attempt to do a business which could be done better and more cheaply by private enterprise.

This is all quite true, of course. But it is not every private-ownership advocate who displays the candor of Mr. Ely. Truly, the old order passeth away.

AN INTERESTING magnetic method for detecting flaws in an iron casting is described by L. Kann in the Physikalische Zeitschrift and translated in abstract in a recent number of the London Electrician. It is important in many cases to have a more reliable test for the uniformity of a casting than is afforded by sounding. Such a method may be based upon the alteration of the field of force by a flaw of the casting, when the latter is used as an armature in connection with an auxiliary coil and a ballistic galvanometer. In the simplest case, that of an iron plate, the magnetic flux is not affected in any way by shifting the plate in the same plane, and the galvanometer shows no deflection. But if a bubble enters the field, the flux is altered in strength and distribution. A current is induced in the induction coil and indicated by the galvanometer. By a suitable displacement of the plate valuable conclusions may be arrived at concerning the situation and size of the bubble. The adhesion of the casting to the magnet is prevented by a layer of non-magnetic material, or by rollers.

"TO CUT OUT the guesswork"—that is an excellent object for any technical or semi-technical society; and in announcing it as the motto of the reorganized American Street and Interurban Railway Association President Ely set forth felicitously a worthy aim in epigrammatic phrase. The association has now set forth to do things, and although but a beginning has been made it is evident that a great deal of hard, conscientious work has been done in devising and laying the foundations—organizing the plant, in fact—by which future results, such as standardization, will be achieved. Mr. Ely, Secretary Swenson and the others are entitled to cordial praise for their intelligent, far-seeing efforts.

But all has not been easy sailing. Some of the larger street-railway companies, asked to contribute $600 a year under the new plan, still asked to be shown wherein proportionate benefits lie. Indeed, Mr. Ely intimated that it had been proposed to organize a new association of the larger companies to consider exclusively their own particular problems. He said frankly that if such an organization came into being he should welcome it if co-operating with the existing association, but if it proved inimical he should fight it with all his power.

On the other hand, just before the adjournment of the Columbus convention last week, after Mr. Beggs had been elected president, a member complained that sufficient attention was not paid to the small companies. Mr. Beggs said very justly that in selecting officers and making committee appointments, it was not a question of getting a man from a large company or a small company, but rather in getting one who would be interested—who would do the work. The difficulty is to secure such men; there is not an over-supply of them. Mr. Beggs promptly announced an advance appointment by putting his questioner at the head of the committee to solicit competent men to prepare papers for the next meeting. "We will see what these small companies will do," he said. The recipient of this unexpected distinction laughingly said that he hardly knew whether it was an honor or a punishment.

So it will be seen that in trying to meet the needs of the big companies and the little companies and the in-between companies the association has a task of administration before it that is not without its difficulties. A big job of work has been undertaken, but it is important work, very well worth doing, and it has been entered upon after careful thought and preparation, with good men and intelligent methods.

The gathering at Columbus was a tremendous affair, and the exhibits, in five large buildings, were really marvelous in their extent and comprehensiveness. The policy of turning over to the exhibitors their own display is shown to be a good one by the results. A few years ago a conspicuous member of the association referred rather slightingly in a public session to the "bazar." But nowadays it is admitted that these remarkable exhibitions have a great educational value not only for working street-railway men but for the public as well, revealing the extent and diversity of a great industry with which the people that furnish the nickels have a particularly intimate, but not always friendly, relation. Visitors who gain some idea of the money, effort, inventive genius and good gray brain-matter put into the street-railway business may be expected to depart with a more thoughtful, kindly interest than they felt before.

The papers and discussions at the various conventions were not particularly noteworthy for novelty. To the technical man those presented in the Engineering Association were of the most value. Here there was an excellent paper and discussion on gas engines, another on underground cables, a third on what may be styled the dynamic features of car service and a fourth on relative economy of steam turbines and reciprocating engines. Among several good papers presented to the parent association one on "Electric Railways in Sparsely Settled Communities" showed careful thought in working out a comparatively unhackneyed subject. In considering "Leaks Between Passenger and Treasurer" considerable attention was paid to the new "pay-as-you-enter" car, in which the exceptionally large rear platform is so arranged that no one may enter the car without passing the conductor and depositing his fare in a portable fare-box. The Montreal Street Railway Company kindly sent a car of this kind for exhibition, and it proved a real and interesting novelty to most of those who inspected it.

RAILROADING is railroading, whether the train or car is pulled by a steam locomotive, electric motors or even a gasoline engine. Thus, while it is interesting to observe an electric-railway man advocating the use of the steam locomotive for certain service, there is nothing reactionary about it, but rather an evidence of breadth of view which shows that electric railroading is true railroading. The occasion to which reference is here made occurred at the convention of the American Street and Interurban Railway Association at Columbus last week. Edward C. Spring read a paper on "Interurban Freight and Express," characterized by its moderation and conservatism. In it he said:

"A good many electric roads which are handling freight use a steam locomotive with good results. Too many roads figure on high freight rates, while, as a matter of fact, they can get but little more than the steam roads; people are not after quick delivery on freight—that is express. The smaller steam roads are getting nearly four cents per ton-mile, while the larger roads are getting between one and two cents, so that an electric road would have to handle a great deal of business to make money at this rate. The steam locomotive offers the best solution for most of the roads built, about half of which could operate a light locomotive by changing a few grades, curves, etc. But while some roads are built on steam-road standards in the country, track construction in the city prevents operation even if city ordinances do not prohibit it."

Mr. Spring concluded his paper as follows:

"You will pardon me if I have been too severe in my comment upon the freight and express branch of the service, but being in a position, as I have been, to watch the operation of the same in the Middle West, I cannot help but feel that there is a tendency to over-estimate this branch of the service to the detriment of our passenger business."

The author of these remarks is not only the general superintendent of the Dayton, Covington and Piqua Traction Company, but is also president of the Central Electric Railway Association of Ohio and Indiana, which is distinctively an electric interurban railway association. He is therefore entitled to be considered an authority on interurban railroading, and what he says about the employment of steam locomotives is worthy of respectful consideration. Perhaps, however, he is over-conservative in his summing up of the freight and express service and possibilities on electric railways.

AMERICAN STREET-RAILWAY CONVENTIONS IN COLUMBUS.

Tremendous appears to be the word to describe the street-railway conventions held in Columbus, Ohio, last week. The occasion was really the first convention of the reorganized American Street and Interurban Railway Association, although the twenty-fifth of its predecessor, the American Street Railway Association. At the same time, or doing the same week, there were conventions of the American Street and Interurban Railway Accountants' Association, now 10 years old; the American Street and Interurban Railway Engineering Association, three-and-a-half years old, and the American Street and Interurban Railway Claim Agents' Association, which has been in existence two years. These are the "babies" of the older parent association. In addition there is the new American Street and Interurban Railway Manufacturers' Association, which has charge of the exhibits at the convention and also the entertainment features. There was a great deal of enthusiasm at and about the various conventions. The attendance was between 3,000 and 4,000, to say nothing of the thousands of Columbus people who thronged to the State Fair Grounds, where the conventions were held, to view the exhibits. The display of electric-railway machinery and appliances was truly marvelous. It was made up of nearly 200 exhibits, filled five large buildings and was considered the greatest industrial exhibition ever made in connection with a convention in the United States. The convention was a very successful one in every way. John I. Beggs of Milwaukee was elected president of the American Street and Interurban Railway Association.

American Street and Interurban Railway Association.

The 1906 convention of the American Street and Interurban Railway Association—the parent association in the street-railway field—was held on the State Fair Grounds, Columbus, Ohio, on Wednesday, Thursday and Friday, October 17th to 19th. The president, W. Caryl Ely of Buffalo, was in the chair. The opening session was held on Wednesday morning, when Hon. L. C. Laylin, secretary of state, delivered a welcome for the state of Ohio, followed by President Robert Sheldon for the Columbus Railway and Light Company, Mayor D. C. Badger for the city of Columbus and Secretary John Y. Bassell for the Columbus Board of Trade, all speaking in eulogistic strain.

President Ely made this interesting statement: "We have with us in attendance upon this convention Mr. Citoro Sukuma of Japan, who has been sent by the government of Japan to study the express business in this country, and his credentials from the consul-general of Japan at New York say that any courtesies extended to him will be appreciated. He also represents the Tokyo Street Railway Company, and is commissioned by that company to inquire into and report on matters concerning the operation of street cars in this country; and your courtesy is also bespoken for him by the consul of Japan in Chicago."

Reports of Officers.

Secretary B. V. Swenson then proceeded to read the minutes of the various meetings of the executive committee during the year, outlining the arrangements which had been made for the management of the affairs of the association and the plans for the Columbus convention. On motion, the report of the executive committee was accepted and filed.

Secretary Swenson presented the report of the secretary, which showed the membership to be as follows on October 1, 1906: Associate members, 113; active members (old), 145; active members (new), 55; joined since October 1st, 23; old companies paid dues since October 1st, 5; total, 228.

The report of the treasurer showed: Cash on hand and balance from last year and receipts during 1905-1906, $25,444.11; expenses, $18,467.21; balance, $6,976.90.

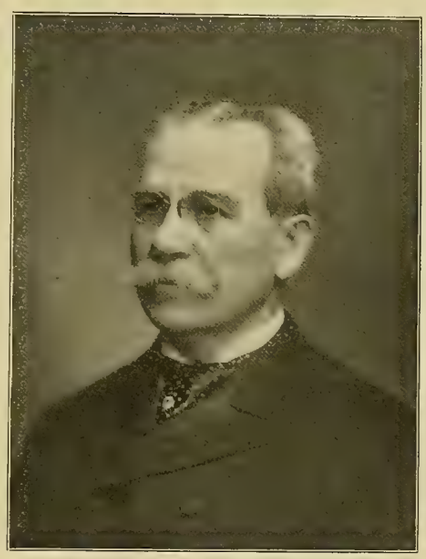
On motion, the reports of the secretary-treasurer were approved and filed.

President Ely's Address.

In his address President Ely gave a history of the reorganization and rehabilitation of the association. Some of his remarks of particular interest follow:

I fancy that there is not a man to-day who is well read and well informed in this business who doubts for a moment the right of the people of any community to take over in a fair way and operate the public utilities, any of them, through their municipalities or other territorial domain. As a matter of right it is undoubted. Then it is up to you to say to the people that as a business proposition it is unwise for the municipalities to attempt to do a business which you are able to establish to the satisfaction of everybody can be done more cheaply for the people by private business interests than by municipal corporations. For years we were afraid to discuss the question. For years we said, "Don't bring it out and talk about it in the convention," and during all those years all the other fellows were talking about it, all the newspapers were spreading what was largely misinformation before the people, and a sentiment was forming against us, that, had the people who entertained it had the just and fair means of information, might have been very different from the manifestations that have become apparent within the last few years all over the country.

When we made up the committees we went about and asked suggestions from the best men in the business, men who were thoughtful and far-



JOHN I. BEGGS, PRESIDENT AMERICAN STREET AND INTERURBAN RAILWAY ASSOCIATION.

seeing, and our attempt was to get able men, strong men, to do actual work upon actual working committees of the organization, and I cite you gentlemen with pleasure and with feelings of great pride to the lists of the committees of this organization and its affiliated organizations, and I say to you that in my best judgment as one who has had experience upon the legal side of this proposition as a practicing lawyer for 20 years, one who has had experience for nearly 15 years as a builder and operator of railways and who has studied these questions in the sociological and every other point of view, that within the next five years it will be cheerfully acceded by the managers of the greatest corporations of this country that the work of the committees on municipal ownership and public relations of this organization, if they are conducted in the way that I believe they will be, will have been worth all this organization has cost to all the street-railway interests. (Applause.) When it is possible for this organization and bring to the chairmanship of the municipal-owership committee such a man as Mr. C. D. Wyman of Boston, a man with legal training, who knows how to collect evidence and the value of evidence and what it means when presented and how to glean the facts from it, about the law and to disseminate it—when you get such a man as that who adds to all his legal learning and ability a personal knowledge of all the conditions that affect us, who represents companies and organizations in almost all the states of the country, thereby putting him in touch with the feeling that obtains throughout the country in these matters—when it is possible to bring the ability and the time of such a man as that to your service, who shall say what it will be possible to do when you work this thing along and push it forward until it reaches a stage where men like that all over the country will be anxious to come to your service? Who shall say what this organization will represent?

Mr. Ely concluded with hearty words of praise for the work of the secretary and of the affiliated associations.

Presentation to President Ely.

John I. Beggs, the first vice-president, then addressed the gathering. He spoke highly of the work of the retiring president, and then continued: "Therefore, on behalf of the officers and executive committees of the five associations which are affiliated in this work, I am charged with the pleasure and with the duty of presenting to you something that is emblematical of the triumph which we believe has been achieved for the time being. [A beautiful bronze statue on a marble pedestal was brought in and placed on the platform by uniformed street-railway employes amid great applause.] I may say that this is a rare work of the sculptor's art, typifying 'Triumph,' and I desire, on behalf of this association, Mr. President, to say that I believe that you will carry with you, and I know we will carry with us, memories as enduring as the bronze from which that figure typifying Triumph has been modeled and molded. I may say that we have had placed upon the base of that figure a tablet setting forth that this is a testimonial from the American Street and Interurban Railway Association and from each one of the affiliated associations, that for all time shall show what was the inspiration which produced this combination of these associations."

Mr. Ely responded in feeling terms.

Addresses from Presidents of Affiliated Organizations.

The presidents of the affiliated organizations were introduced and spoke briefly. W. B. Brockway of Yonkers, N. Y., spoke for the Accountants' Association. He said that his society was celebrating its tenth anniversary and much had been accomplished in the improvement of methods of accounting. He spoke in glowing terms of the amount and character of the work that Mr. Ely had done. Thus: "I say now that we would gladly repeat the efforts of these 10 years simply to be able to call, as we do call, the Hon. W. Caryl Ely our friend. You do not have the slightest idea of the amount of work that this man has put into this cause."

H. H. Adams of Baltimore, from the Engineering Association, extended greetings. Mr. Ely had been the general of the movement, he said. He urged that the member companies should make a point in filling out data sheets or other requests for information coming from the central office. "Only by such co-operation can we accomplish the work before us," he said.

This was supplemented by Mr. Ely in these words: "What other business is there, with $3,000,000,000 invested in it, that has as much guesswork about it at the end of 20 years as there is about the street-railway business? We are aiming to eliminate from street and interurban electric-railway work the element of guesswork. That is the function of this organization, and that is to be our chief effort, not only as it pertains to the practical parts of the business, but also the guesswork that prevails in the minds of the people when they assert that the cities can run the street railways of the country better than the men employed at large salaries to do the business."

For the Claim Agents' Association S. L. Rhoades of Philadelphia gave some rather startling figures: "I want to remind the managers of the various street-railway companies who are members of this association that during the last 12 months they have paid $10,000,000 to people who have been injured. Of this $4,000,000 was paid because you permitted your motormen to run one car into another; $750,000 was paid because your fuses blew out; $2,500,000, approximately, was paid because your motors dropped, or your straps broke, or you had grease on the floor or something of that sort. This is the first opportunity we have had to appear before you, and I call these matters to your attention because I do not know that you as a body recognize the cost of the claim department."

Speaking of the manufacturers' exhibits, President Ely said: "I am told by some of the ablest men who are here representing the manufacturers that this is the largest exhibit and best exhibit of street-railway appliances that has ever been made in this country, and is better and larger than the one that was made at Washington when the International Railway Congress met there in May of last year." James H. McGraw of New York, president of the Manufacturers' Association, was unable to be present, owing to illness, but Charles C. Peirce of Boston spoke in his place. Among other things he said: "I look forward to the time when the steam-railroad interests will come to your meetings as fully as the street-railway interests. I told that to the members of the Master Car Builders' and Master Mechanics Association; I made that statement some years ago, and they are commencing to believe it. Whether they become electric or you become steam, a fraternizing of the two interests is going to be the ultimate end of this thing, and we will have the grandest organization that the industrial world has ever seen."

To this Mr. Ely added: "You see less entertainment of individuals going on on the part of manufacturers than you ever saw before at any convention. At the next convention I believe it will entirely disappear. Such entertainment as is dispensed by the Manufacturers' association will be open and above board, and all of the men and all of the women that come to the convention will participate in it and all together."

Wednesday Afternoon Session.

Considerable routine business was transacted at the opening of the afternoon session of Wednesday. Among other things was presented a certified copy of resolutions adopted by the City Council of Columbus recognizing as the guests of the city each officer, delegate and representative of

the American Street and Interurban Railway Association, as well as each representative of business firms making exhibits. This unusual courtesy was greatly appreciated and heartily applauded. George Westinghouse of Pittsburg sent a letter regretting his inability to be present. The American Society of Mechanical Engineers sent greeting and announced the appointment of representatives of that society to attend this meeting. The National Electric Light Association also sent fraternal greeting. The city of Boston, by its mayor, sent a telegram, asking for the next annual meeting. Many other messages of friendly interest were received, the whole showing the increased prestige of the reorganized association.

Reports of Committees.

With Vice-president Beggs in the chair the reports of committees were received. E. G. Connette of Worcester, Mass., read that on "Subjects," meaning subjects to be selected for investigation and discussion.

Secretary Swenson read the report of the committee on car wiring. This report was very brief and indicated that no great change had been made.

Through H. C. Page of Springfield, Mass., the committee on standardization reported that the committee had accumulated a large amount of data. This information is interesting, and it is felt that during the next 12 months much can be accomplished. The committee has worked through and with the committee on standardization of the engineering association.

W. E. Harrington of New York city presented the report on "Promotion of Traffic." Following is the summary:

"Parks.—Parks are desirable in connection with railway operation, but should not be operated with a license feature. Parks should be leased, conditions permitting, rather than operated by officials of the company. It would be wise for the Accountants' Association to draft a standard system of accounts for park operation. It would be wise to have on file in the office of the association applications and data as to park managers, traffic managers and parties seeking park leases.

"Picnics.—It would be desirable to provide small pavilions with stoves and fuel to encourage picnic parties.

"Traffic Manager.—It would be desirable to develop in each company a department for the 'promotion of traffic,' to be presided over by a traffic manager or passenger agent.

"Freight and Express.—The association should appoint a committee to especially investigate and report at the next convention as to the desirability of street and interurban railway companies engaging in freight and express business.

"Mail.—The rates obtained by railway companies for carrying United States mail are too low and should be materially increased. In the event of special cars being employed, the rate should not be less than an amount sufficient to cover operation, interest on investment, depreciation, and a reasonable profit.

"Irregularities in Fare Collection.—As the question of fares lost is the converse of the work of the committee on 'promotion of traffic' it is found that systematic continuous car inspecting is both desirable and profitable.

"Registration of Fares.—The association should appoint a committee to especially investigate and report at the next convention upon the registration of fares (covering both single and double registers), use of tickets (with and without registration) and systems of checking and inspection in connection therewith.

"General.—Interchangeable mileage is desirable. Special cars, picnic and funeral cars are desirable. Co-operation with theaters in having seats and nights especially assigned for various communities is desirable. The welfare of traffic is of sufficient importance to justify the organization of a separate affiliated association to be known as The American Street and Interurban Railway Traffic Managers' Association."

The report was accepted with the thanks of the association.

For the insurance committee H. J. Davies of Cleveland presented the report. The question of co-operative insurance against fire on the part of traction companies was discussed. One man said that the actual cost of such insurance was estimated to be 0.3 of one per cent. of the amount at risk. Street-railway companies have received about 28 per cent. of the amount paid in premiums to old-line companies as returns for fire losses. Another man, for the old-line companies, said that the companies could give insurance at cost eventually, and that rates were being lowered as conditions improved. The debate between the insurance representatives—co-operative and old-line—was rather lively. The insurance committee itself thought that the traction companies could unite and carry their own insurance in some way. Mr. Beggs said: "It is apparent the old-line companies have awakened to the fact that if they treat us as we have too often been treated in the past, that perhaps we will put ourselves in a position to help ourselves."

Heavy Electric Traction.

The first business Thursday morning was the presentation of the report of the committee on "Heavy Electric Traction," by Calvert Townley of the New York, New Haven and Hartford Railroad. As it is short, it may be given in full here:

As a starting point it seems necessary that the term "heavy electric traction" should be given a specific definition. It is presumed that the definition will include steam railroads or branches thereof which have been electrified. There are, however, many roads which have adopted electric traction from the start, the weight of the rolling stock of which, the capacity of the electric equipment adopted and the operating speeds established are as great as or greater than those obtaining on many ex-steam lines. These electric lines include both the elevated and subway roads in our large cities and many interurban roads as well. Your committee is of the opinion, therefore, in the absence of any other definition, that all such roads would come within the scope of the term "heavy electric traction."

The committee would be glad to have from the association a clear definition of what is intended to be included by the term "heavy electric traction."

In the absence of any advice as to the scope and duties of this committee we have been reluctant to ourselves to define our scope of duties and to undertake any particular line of work based on such definition. It is the opinion of the committee, which is herewith offered as a suggestion to form a basis of discussion, that we can best serve the interests of the association by investigating and recommending for standardization such matters pertaining to heavy electric railroading as may from time to time be referred to us.

The mileage of the railroads previously operated by steam, and now operated by electricity, is as yet comparatively small, but the electrification of several roads entering New York is well under way, and the projected electrification of other roads there and in other sections of the country gives promise that a very large amount of this kind of work may be expected in the near future. It is naturally desirable that the interchange of traffic between such roads should be facilitated, this being perhaps more essential than is the case with the ordinary trolley roads, whose sphere of operations is naturally more localized. On the other hand, the engineering questions involved in the electrification of steam roads present many new features, about which engineers and operating men are by no means agreed. It would, therefore, be quite as dangerous to at this time undertake too rapid a standardization as it would be to neglect the subject, and your committee, therefore, feels that the questions should be approached with caution and treated with prudence.

Reading of Papers.

H. M. Brinckerhoff of New York read his paper on "Elevated Railways and Their Bearing on Heavy Electric Traction." Among other things he said: "I think we may say that consideration of the records and results of elevated electric operation, aside from the much-argued question of economy, shows clearly the three following advantages over steam operation: 1. An increased capacity per car unit due to greater 'availability for service' and higher schedule speed. 2. An increased capacity for the system in general, due to shorter intervals possible at terminals and junction points, abolishing of relays, and general facility for handling at stops and in yards. 3. An increased earning capacity due to (1) and (2), and to more attractive service by reason of greater frequency of trains possible with economy, a cleaner and quieter service, etc., giving returns in larger proportion than the direct ratio of apparent increased facilities."

E. P. Roberts of Cleveland abstracted his rather long paper on "Electric Railways in Sparsely Settled Communities."

"Interurban Freight and Express" was the title of the paper read by Edward C. Spring of West Milton, Ohio. Mr. Spring thought there was a tendency rather to over-estimate the importance of this business. Others took issue with this view, and there was a good discussion, in which George W. Parker of Detroit, Ernest Gonzenbach of Sheboygan, Wis., G. B. Hippee of Des Moines, Mr. Brinckerhoff of New York, P. P. Crafts of Clinton, Iowa, and Mr. Spring took part.

The next paper, on "Tickets and Rates," was read by F. W. Coen of Cleveland, secretary of the Lake Shore Electric Railway. There was no discussion.

Theodore Stebbins of Cohasset, Mass., author of the paper entitled "Some Notes on the Evolution of Electric Transportation," was not present, and his paper was read by title.

At the afternoon session of Thursday (Vice-president James F. Shaw of Boston in the chair) the first paper presented was on "Electric Railway Employes and the Young Men's Christian Association," by E. M. Willis, a railroad secretary of the Y. M. C. A. in New York city.

Clarence E. Learned, superintendent of inspection for the Boston Elevated Railway Company, then read his paper on "Selection of Trainmen." Next came "Discipline of Trainmen," a paper written by F. W. Brooks of Detroit, but read by Secretary Swenson in the absence of the author. Following was a paper on "Uniforms and Badges" by John R. McGivney of the New Orleans Railway and Light Company.

Rules of Operation.

E. G. Connette submitted a brief report from the committee on rules. He said that from answers to inquiries it had been deemed advisable to revise the interurban rules which were submitted to the St. Louis convention of 1904 so as to conform to the practice of moderate-speed interurban service. All companies operating high-speed electric railroads expressed a desire that the committee formulate a code of rules for high-speed interurban service, and, therefore, a set of rules in pamphlet form for the operation of trains on high-speed electric railroads was submitted. These rules conform, as far as practical, to the rules of the American Railway Association for the operation of steam trains, as the operating conditions of high-speed electric railroads is so nearly identical with the operation of steam railroads that the committee does not believe it is wise to depart from the steam-railroad practice any further than changed conditions necessary for the operation of electric railroads may require.

Concluding Session.

An executive session on Friday morning concluded the convention. The report of the committee on municipal ownership was presented by C. D. Wyman of Boston. The report of the committee on public relations was presented by Henry A. Robinson of New York city. Mr. Beggs, as chairman of the committee on compensation for carrying United States mail, made a report. The paper on "Handling Public Complaints," by John A. Beeler, vice-president of the Denver City Tramway Company, was read by the secretary. The paper on "Leaks Between Passenger and Treasurer," by A. H. Stanley, general superintendent of the Public Service Corporation of New Jersey, was read by the author.

Pay-as-you-enter Car.

In the discussion of Mr. Stanley's paper W. G. Ross of Montreal took a leading part. This gentleman's company exhibited a "pay-as-you-enter" car, and was heartily commended for his enterprise. A vote of thanks was given to the Montreal Street Railway Company and its managers. D. McDonald of Montreal explained the operation of the car as follows:

"The pay-as-you-enter car is not a pay-before-you-enter car. The rear platform of the car, as you have seen, is very large and has been made the pay office of the car. When you have 35 or 40 passengers to deal with, your pay office is sufficient to accommodate them, and while these 35 or 40 persons are getting on, there will be at least 10 or 15 that will have already passed through and squared their account and there will probably remain a bunch of 25 or 30 that must be attended to. I might mention that our conductors carry four different kinds of tickets, and must furnish tickets of each of the series to passengers who request them and issue transfers at the same time; but the issuing of transfers and the giving of change and tickets is done while the car is under way, those who have still to be attended to remaining on the platform. The practical operation is to get your passengers into your pay office and then start up and collect the fares, and before you get to the next corner you will find that 35 or 40 persons will have paid their fare, and also the satisfaction of knowing that the company has received its proper dues."

As to the transfer question, Mr. McDonald said that in Montreal the issuing of transfers has practically resulted in simply handing the transfers to the passengers. He continued:

"The object which we have in mind is that which was so ably stated by your worthy president here the other day; we are trying to cut out the guesswork. So far, we must admit, we have been groping around our cars and instructing our conductors to search for their fares. The conductors oftentimes do this in a searching, suspicious manner, which is very disagreeable to our patrons. The pay-as-you-enter car cuts that out. We claim that the car is also conducive to the safety of the passengers. That is our first claim before the municipalities. We claim that by putting the conductor at the post where he can have control of his car, we are avoiding accidents. The conductor also is benefited by the new arrangement. Our men have a right to demand from us a system whereby they can do their work properly and completely, and we have no right to impose a duty upon them which we cannot do ourselves.

"These pay-as-you-enter cars were first introduced by the operation of a single car. The first car had a seven-foot platform, and the car on exhibition here has a nine-foot platform, and this nine-foot platform was especially designed to accommodate smokers. We have a space of two feet for smokers. The car was taken out with a number of our aldermen and representatives of the press. They all expressed themselves as greatly pleased with the car and said it was a decided improvement. After this trip had been made with the representatives of the press they naturally advertised the car with a report of this tour and with the announcement that the second day after the car would be put in actual service. The car

has a large red number on the front dashboard, to make it distinct from the others and to give notice that it is a pay-as-you-enter car. We had no opposition to it for a long time. When we began to increase the number of cars and began to reach the more considerable number of that part of the public which does not care about paying car fare, we began to get letters about the car, and many letters were sent to the newspapers. The matter was discussed in the papers to some extent, and we discussed the matter with the editors of the different papers, and they were thoroughly convinced we were making a reasonable proposition to the public, and I think that you will agree that when any corporation makes a reasonable proposition to the public, the majority of the public will accept that proposition. The opposition to the car died away in a short time, and instead of having any objection to the car now, the passengers like to wait for the car. It is a more comfortable car in every way and the passengers are not subjected to any annoyance of any kind after they have once paid their fare and entered the car."

ELECTION OF OFFICERS.

On the report of a nominating committee, of which C. D. Wyman of Boston was chairman, these officers were elected:

President—John I. Beggs, Milwaukee, Wis.

First vice-president—Calvin G. Goodrich, Minneapolis.

Second vice-president—James F. Shaw, Boston.

Third vice-president—Arthur W. Brady, Anderson, Ind.

Members of the executive committee—The president, vice-presidents and C. L. S. Tingley, president of the Accountants' Association, of Philadelphia; H. H. Adams, president of the Engineering Association, of Baltimore, and S. L. Rhoades, president of the Claim Agents' Association, of Philadelphia.

Mr. Beggs expressed in suitable terms his appreciation of the honor conferred upon him. He spoke of the necessity of increasing the attendance at the open sessions.

Resolutions of thanks to the Manufacturers' Association, to the city authorities and street and interurban railway companies of Columbus, to the retiring officers and committees and to many others were adopted.

Ernest Gonzenbach made a plea for recognition of the smaller companies, and President Beggs told him that if these companies showed interest in the affairs of the association they would receive official recognition. Naturally the men who did the work were entitled to the honors. He announced that he would make Mr. Gonzenbach chairman of the committee to select men to prepare papers for the next meeting.

The association then finally adjourned.

THE NEW PRESIDENT.

John I. Beggs, the new president of the American Street and Interurban Railway Association, is a man conspicuous in the electrical and street-railway affairs of the country, and he has been identified with the association for a number of years. He is president of the Milwaukee Electric Railway and Light Company and of the United Railways of St. Louis, making his home in the former city. In earlier years he was prominently connected with electrical manufacturing interests, being for several years district manager at Chicago for the Edison General Electric Company. He is a man of much force and energy, possessing a keen intelligence and progressive ideas. Few men in electrical and street-railway circles in the United States are more widely known than he. A man of excellent business ability, he possesses a fluency of utterance in speech-making rather unusual among men of affairs. A high-class and trained executive already, he will not fail to strengthen the association by bringing to the office of president the undoubted talents which he possesses.

The Engineering Association.

The fourth annual meeting of the American Street and Interurban Railway Engineering Association was held at the State Fair Grounds, Columbus, Ohio, October 15-17, 1906. President H. H. Adams of Baltimore, Md., called the opening session to order on Monday morning, October 15th, and introduced Mr. E. C. Spring of West Milton, Ohio, president of the Central Electric Railway Association, who gave the address of welcome.

James H. McGraw of New York, president of the American Street and Interurban Railway Manufacturers' Association, addressed the association briefly. He called attention to the exhibits, in six buildings, and said that never before had the manufacturers made such a comprehensive display. He praised the facilities at the Fair Grounds and the people of Columbus.

John I. Beggs of Milwaukee, first vice-president of the American Street and Interurban Railway Association—the parent association—spoke for that body in a short speech.

PRESIDENT H. H. ADAMS' ADDRESS.

The president then read his annual address. He described the reorganization of the association, which was formerly the American Railway Mechanical and Electrical Association. Of the work of the standardization committee he said:

"The committee has met with liberal response from the various roads, and it is hoped, in the future, that the response will be even greater. At the present time it has under consideration the brake-shoe, wheel tread, flange, journal box and rail section. In the work of standardization your committee has endeavored, as far as possible, to confer with the manufacturers interested in the various parts and it has met with very encouraging response in every direction in which it has reached out. It is the hope of the committee that among the results to be accomplished in the future will be the standardization of certain parts of the electrical equipments upon motors of the same horsepower, such parts as the commutators, brush-holders and brushes, gears, pinions and axle bearings. This result can only be accomplished by the full co-operation of the various electrical companies interested, but I feel sure that when the committee is ready to take up this question, the companies will stand ready to assist it in every way possible. Before leaving this subject I want to extend my thanks to the committee and particularly to its chairman, Mr. H. Wallerstedt, for the able and earnest work that has been done up to the present time, and, although the work is in its infancy, I am confident of its success."

In concluding, Mr. Adams said:

"We do not necessarily come in direct contact with the public, rather occupying the position of the 'men behind the guns,' but the engineer's duty to the traveling public is of the greatest importance. Upon him rests the question of reliability of service. If there is trouble in the power house, in the overhead lines and cables, or on the cars, it is 'up to the engineer.' It is his duty to reduce to a minimum the interruptions due to defects. Nothing is more aggravating to the traveling public than interruptions to the service. Explanations are not what they want, but continuity of service. In the period in which we are operating we are facing questions of great moment as affecting the relations of our companies to the traveling public, and it may be the aim of this association to so direct its work that it will be of the greatest assistance in mastering these questions; and may we as engineers so fulfill our duties to our respective companies, and through them to the traveling public, as to give reliable service."

OTHER BUSINESS OF MONDAY MORNING.

W. B. Brockway of Yonkers, N. Y., president of the American Street and Inteurban Railway Accountants' Association, extended fraternal greetings.

Secretary S. W. Mower of London, Ont., read the minutes of the various meetings of the executive committee which had been held during the fiscal year, which constituted the report of the executive committee. These minutes embody the record of the work transacted by the committee in the management of the association and the arrangements made for the annual meeting. Mr. Mower, as treasurer of the association also, reported receints of $2,272.63 and a balance of $162.66. President Adams said that, in the future, he believed that the parent association would provide funds for committee work with reasonable liberality.

G. J. Smith of Kansas City, Charles Hewitt of Philadelphia and E. W. Olds of Milwaukee were appointed as the committee on resolutions.

MR. ELY SAYS ANOTHER ORGANIZATION IS POSSIBLE.

At the Monday afternoon session President W. Caryl Ely of the parent association was present, and in the course of a speech urging earnest work on the part of the Engineering Association to further the purposes of the reorganized associations he made this interesting statement:

"There are companies that have been called upon to pay large amounts this year for membership in the association that have, as the manager of one of them expressed it to me, been 'jumped up' suddenly from $25 a year to $600 a year; and some of those people are from Missouri, and they want to be shown. Now, the Engineering association is one of the most important branches of this reformed organization, and it is one that appeals in the strongest possible way to some of the largest members of the association, especially those in the great cities that are operating elevated roads, subways, etc.; and the number of those companies is rapidly increasing. Now, there has even been talked of the formation of a separate association among the larger cities that have those distinctive properties; and I favor the organization of such an association, unless it should take the form of an instrumentality injurious to this greater organization; and if it takes that form I am unalterably opposed to it, and shall do everything that lies in my power throughout this country to oppose any such organization."

MULTIPLE-UNIT CONTROL.

J. S. Doyle of New York presented the report of the committee on control apparatus, in which he said:

"It is gratifying to note that the use of multiple-unit control apparatus for heavy service has increased during the year so that its use for new equipments has become the rule rather than the exception. Both the General Electric and Westinghouse manufacturing companies have continued to develop this type of apparatus in the respect of reducing the weight and number of parts, and also increasing the pressure between the contact points of the switches. This latter development may be said to be the greatest improvement accomplished. The committee noted at the last convention that the greatest amount of interest was shown in the standard street-car control problem, and Messrs. Olds and Adams made the statement that they had followed suggestions of previous conventions and were then installing equipments with contactors located beneath the car, which was for the purpose of obviating the platform cylindrical control failures that have been so generally complained of in the past. This particular type of control has been in service some time now, and the committee expects an interesting report from these gentlemen. A number of the members of this association were very strongly of the opinion that the multiple-unit type of control for standard street-car service could not be reduced sufficiently in size to permit of installation in the limited space afforded by the ordinary car, but this committee is pleased to state that both manufacturing companies have been working with this end in view, and have succeeded in reducing this control equipment so that it can now be installed on the standard street car. The great efficiency of the larger types of multiple-unit control also obtains in the smaller sizes, so that this apparatus should be a great improvement over the present practice. Progress has been made by each of the manufacturing companies on control apparatus for heavy railway locomotive work. Single switches having a capacity of from 1,000 to 2,000 amperes have been developed, but inasmuch as these locomotives have not as yet been placed in regular service this subject shall have to be deferred until the next meeting, at which time the control committee hopes to have a more extensive subject to work upon.

A discussion of considerable length ensued. Following is an abstract:

G. J. Smith, Kansas City: I can state that the Metropolitan Street Railway of Kansas City has in service and has had for three months past 30 cars, 30 feet seven inches over corner posts, with the type M multiple-unit control operating as a single unit, and from present indications the results will be so far superior to the platform controller that the management is to-day considering doing away with the platform control. This is because of panics created by controllers operated on platforms. If any gentleman here knows the conditions in Kansas City he will readily see from the grades that at times our motors are taking in 800 amperes, at 575 volts, and the average current on our Troost Avenue Division is 153, on 10 seconds' reading. That current is too heavy to handle on the platform without danger of having not only the automatic opening, but the controller short-circuiting and causing a panic on the car. The people jump off, and they have even gone so far as to jump through the glass of the windows, taking the sash with them. From that viewpoint alone the management is seriously considering the question of substituting the type M control for the K controller on the platform.

E. W. Olds, Milwaukee: We started out last year and put into service 50 cars with the contactor in series. The contactor itself, in throwing off the current, opens a little ahead of the controller. The cars first equipped with the controllers caused a little trouble on account of mechanical defects in the construction of the control circuit-breaker. That was remedied, and since that time they have been working satisfactorily. I will say that we have yet to have the first fireworks on the front platform of these 50 cars. Should a short-circuit occur in operation, as you all know will occur occasionally on any platform controller, the motorman can at once throw his handle to a position which stops the fireworks.

President Adams: I might just add a little word in connection with that same type of control. The first part of the year we put in service 40 equipments. They are four-motor equipments on cars that are 30 feet eight inches over corner posts, weighing about 49,000 pounds, with four 65-horsepower motors, and at the same time we put in service 160 equipments of four-motor cars, weighing about 45,000 pounds, with four 40-horsepower motors. These equipments had the K 28-b control, the first having type K 28-f control. We have had excellent results with the K 28-f, or the contactor combination, and we have not had any of the fireworks that Mr. Olds refers to, and, furthermore, we know that there is considerable saving on the cylinder and the contact fingers.

F. E. Case of the General Electric Company said multiple-unit control is well adapted to cars of 200 horsepower or above, at which size the ordinary cylinder control becomes somewhat bulky.

Mr. Olds: Mr. Case spoke about cars with 200 horsepower or more. Our Milwaukee city cars are equipped with 160 horsepower. I do not believe it is safe to operate the cars with the ordinary K type of controller without something in the circuit which shall open in case of trouble. We found it was practically impossible to place the type M under the car. The contactor itself helps out in that matter; it also reduces the repairs to the controller on account of the burning of the controller; and I think it would be safe to say that the life of the contacts is increased at least twofold.

Paul Winsor, Boston: We have thought for some years that the platform controller was not a safe

thing to use, even on a moderate-sized equipment, and a year or more ago we fitted up 40 cars that have two 65-horsepower motors with multiple control. We had a great deal of trouble with those controllers at first, principally through a lack of pressure on the contact and improper function, but that has been pretty well weeded out now, and those 40 cars are giving very good satisfaction. We are now equipping 50 more with larger motors on them. We are experimenting now with two cars coupled together, using an extra set of contacts, extra contact plates in the reverse circuit on the off position. We couple two cars together permanently with a slide drawbar, no coupler, which does away with the scrapers and platform controllers, between the cars; and with that extra set of plates on the off position of the controller we are enabled to control from the front platform two motors on each car with three wires between the cars.

Mr. Case: I would just like to add that I did not mean to infer that we do not recommend the multiple controller for less than 200 horsepower, but the point is that below that the cost is relatively higher than it is when it goes into the larger capacities. From an engineering viewpoint, I should much prefer to furnish the multiple-unit type of control for all cars. As a matter of fact, we have some in operation with two motors of 40-horsepower capacity. There is no doubt at all that it is a very proper thing to do from an engineering point of view and from an operating point of view, although the first cost is probably greater.

William Cooper of the Westinghouse Electric and Manufacturing Company quite agreed with Mr. Case in relation to the general subject, but rather thought that in placing the limit at 200 horsepower he had got it a little bit high. He could see no reason why there should not be as successful operation or control on smaller equipments provided the controller is small enough to meet the conditions. He did not see why there should be any limit to the reduction of size. His company has developed a controller of this type small enough to go on any car.

Mr. Smith of Kansas City described an apparatus to operate the current-reverser of the type M control mechanically. By a system of bell cranks and levers, connected with a lifting pull lever on the platform, the motorman has the car under absolute control, even though the brake fail. Said Mr. Smith: We have had five cases up to the present time where the man did save collisions and other accidents, as by making a generator of the motor it will operate within from three to five feet travel of the car.

Mr. Case: I would just like to supplement Mr. Smith's remark by saying that his equipment is a four-motor, and consequently there are two motors in parallel, so that when the reverser is thrown it will connect them so that they will generate. The same effect would not take place on a two-motor equipment, because they are not connected in multiple. I might add that we had produced that mechanism, and also worked on a supplemental switch which would be thrown when the hand-operated switch was thrown, to connect the motors in multiple on a two-motor equipment, so that you get the same effect.

Overhead and Track Construction.

C. A. Alderman, chief engineer of the Cincinnati Northern Traction Company, read a paper on "Ties, Poles and Posts." An abstract of this paper and of the following discussion will, it is expected, appear in a future issue of the Western Electrician.

Charles H. Clark, maintenance-of-way engineer for the Cleveland Electric Railway Company, presented an illustrated report on "Ballast." F. G. Simmons of Milwaukee, Mr. Alderman of Cincinnati, J. M. Larned of Pittsburg, E. B. Kirk of Oshkosh, Wis., H. B. Fleming of Chicago, M. A. Schreiber of Newark, N. J., Paul Winsor of Boston, W. H. McAloney of Denver and Mr. Clark discussed the paper at length.

Maintenance of Electrical Equipment.

Secretary Mower read the report of the committee on maintenance and inspection of electrical equipment, of which William Pestell of Worcester, Mass., was chairman. The methods employed by the Interborough Rapid Transit Company of New York were described. Mr. Winsor of Boston, Mr. Doyle of New York, Mr. Olds of Milwaukee, President Adams of Baltimore and others discussed the report. The following shows the trend of the discussion:

Mr. Olds, Milwaukee: The matter of inspection, of course, we all understand is one of a great deal of importance, but, as has been stated, it is one in which we must be governed to a great extent by the equipment that we have. Some of us have motors that have been in service for 12 or 15 years, whereas others have motors that are only five or six years old. Take it in the matter of bearings, with modern lubrication, that is, oil lubrication, with the bearings packed with wool waste, the life of the bearing has been increased four or five times what it was with the old grease lubrication, and the inspection does not need to be so often. As Mr. Doyle says, it goes as high as 11,000 miles. I have made some few tests on that, not keeping the exact mileage, because at the time I made it we were unable to get at the mileage in a satisfactory manner, but the car was in practical service and running 16 to 18 hours a day. I have had a car run for three months with the armature and axle bearings lubricated but once. We have armature bearings that have been in use for over three years with the same method of lubrication. So that I think that the matter of inspection at the present time is one in which we cannot lay down any hard and fast rules. It is one that each of us has to work out to a certain extent, but I really believe that as our standardizing committee is able to advance in its work, so that we shall be able to come to some definite conclusion, we will be able to make great savings for our companies.

As to the keeping of the mileage of the cars—inspection on the mileage basis—I am sorry to say that at Milwaukee we are not doing that. We have not been in shape to do it. I am a thorough believer in it and expect to put it in practice within the next year, but, as I have stated, on account of the conditions that we are up against we have been unable to do so.

As to the matter of lubrication, we have been able to increase the life of the bearings about three times over the old grease method, but that does not come up to the length of life of the newer or later type, which is practically wool-waste feed.

Mr. Kirk: I would like to ask Mr. Olds whether he is having any trouble with the oil not feeding up on the wick in zero weather in these oil cups.

Mr. Olds: I have not. The oil cups we use, I might say, are made of cast iron with a tube in the center which is also cast iron. There is a wire in the center of the tube with a loop in the end of it next to the bearing and going to within about ⅛ inch of the bearings. Passing through that loop are two or three strands of wool yarn. We have had no trouble on account of not feeding.

Standardization.

On Tuesday morning the committee on standardization, of which H. Wallerstedt of New York is chairman, presented a progress report through Mr. Larned of Pittsburg. Following is the major portion of the report:

Because of the great amount of ground it will be necessary to cover ultimately, the committee decided at the beginning of its work that the immediate investigation should be limited to those questions which have appeared to the committee as being of the greatest importance and most in need of early adjustment. It was further considered wise to confine the investigations to such parts and dimensions of the particular equipment under consideration as would make it interchangeable, leaving to the individual worker and seeker after improvement as wide a field of operation as circumstances will permit.

The committee has also deemed it advisable to avoid designs involving patents, and, for the present at least, no attention will be given to the chemical analysis of the material contained in the parts to be standardized.

After a careful consideration of the subject, it was decided to confine the work of the year to the standardization of brake shoes, flange and tread of wheels, rails, and journals and journal boxes. It will be observed that these parts are more or less dependent upon (and bear a certain relation to) each other. As preliminary steps toward standardization, it has been considered necessary to prepare data sheets for the purpose of collecting such data and drawings as would enable the committee to base its future recommendations upon the experience and practice of the various street and interurban railways.

The data sheets and circular letters have been sent in duplicate to over 800 street and interurban railway companies to be filled out and returned with accompanying drawings and sketches. The replies indicate that the managers and engineers of the railway companies realize the importance of the work, and that they have given considerable time and thought to the preparation of their answers to the various questions asked.

The information obtained by means of these various data sheets must be carefully collated and summarized, in order to make it practicable for the committee to make proper use of the same. The drawings and sketches must also be studied, and new ones made up which embody the recommendations of the various companies. This means a large amount of detail work on the subjects now under investigation, which must necessarily devolve upon your standardization committee during the coming years. It therefore does not appear to the committee to be advisable for the association to undertake much new work in the line of standardization of equipment at the present time. However, it would be well to begin the investigation of the standardization of some few additional parts of electric-railway equipment in order that the work of the committee may be continuous and uninterrupted. It is expected that the standardization of motor parts will be added to the work of the standardization committee for the coming year.

It is our desire to emphasize the necessity of standardization of equipment. Some street and interurban railways have already made sincere efforts to standardize certain parts of their equipment, parts that would be standard so far as these particular companies are concerned, but no joint effort has heretofore been made in this direction. Owing to extensions and consolidations which are constantly taking place in the various electric-railway systems, an interchange of cars and equipment will ultimately become necessary, and it is the hope of the committee that the companies which have not already returned the data sheets will give them prompt and careful consideration.

The secretary read a communication from the Central Electric Railway Association recommending the following standards:

Brake Shoes—We recommend the adoption as standard of what is known as Master Car Builders' standard type of brake-shoe, brake-head and key.

Journals and Journal Boxes—We recommend the adoption as standard for journals and journal boxes the Master Car Builders' adopted standard so far as applicable to motor trucks for axle journals, known as 3¾ by 4¼ by 8 and 5 by 9. We further recommend the adoption as standard for these different sizes of axle journals the Master Car Builders' standard journal boxes, journal bearings and journal bearing keys.

Tread and Flange of Wheels—We recommend the adoption of a wheel-tread three inches wide with flange ⅞ inch high and one and three-sixteenths inches thick at the throat for both city and interurban work.

Rails for Street and Interurban Railways—We would recommend the adoption as standard of what is known as the "T" form section of rail for both city and interurban work.

These suggestions were referred to the committee. There was considerable discussion, in which Mr. Olds, Fitz William Sargent, E. D. Priest of the General Electric Company, W. H. Evans of Indianapolis, Mr. Smith of Kansas City, Thomas K. Bell of Philadelphia, H. B. Fleming of Chicago and others took part. The question was raised whether some definite recommendation should not be made. Finally this question was referred to a special committee consisting of Paul Winsor of Boston, G. J. Smith of Kansas City, W. H. Evans of Indianapolis, T. K. Bell of Philadelphia and John S. Doyle of New York. On Wednesday afternoon this special committee presented its report, which was adopted, by which the recommendations of the Central Electric Railway Association were merely referred to the standardization committee, with the request that the latter report on them as soon as possible.

Reading of Papers.

Paul Winsor, chief engineer of motive power and rolling stock of the Boston Elevated Railway Company, presented a paper on "Gas Engines," dealing with the experience of his company with sub-stations of the company at Somerville and Medford, Mass. The result so far has been very favorable to the gas engine. There was a long and interesting discussion, to which the Western Electrician hopes to refer in a future issue.

An excellent paper by H. G. Stott, superintendent of motive power of the Interborough Rapid Transit Company of New York, was read by Mr. Alfred Green in the absence of the author. It related to "Underground Cables" and was discussed by Boardman Reed, Mr. Winsor, H. N. Latey of New York, Charles S. Kimball of Washington, D. C., and others.

At the afternoon session of Tuesday the first paper presented was on "Relative Economy of Steam Turbines and Steam Engines at Various Percentages of Rating," by Walter Goodenough of the engineering department of Stone & Webster, Boston. This paper, read by Secretary Mower, will be given in full in a subsequent issue. The discussion on it was brief.

The next paper was entitled "Economy in Car Equipment, Weights and Schedules," and was prepared and read by E. H. Anderson of Shenectady. It was discussed by N. W. Storer of Pittsburg, E. D. Priest of Schenectady, Mr. Olds and W. E. Rolston of Canton, Ohio.

Concluding Business.

On Wednesday morning the association met in joint session with the parent association.

The concluding session was held on Wednesday afternoon. The Question Box was presented, and resolutions of thanks were extended to the American Street and Interurban Railway Association, to its president, W. Caryl Ely, to Henry Wallastedt of New York for his work as chairman of the standardization committee and to President H. H. Adams. These officers were elected:

President—H. H. Adams, superintendent of shops, The United Railways and Electric Company, Baltimore, Md.

First vice-president—Fred G. Simmons, superintendent construction and maintenance-of-way, The Milwaukee Electric Railway and Light Company, Milwaukee, Wis.

Second vice-president—J. S. Doyle, superintendent car equipment, Interborough Rapid Transit Company, New York.

Third vice-president—Paul Winsor, chief engineer motive power and rolling stock, Boston Elevated Railway Company, Boston, Mass.

Secretary and treasurer—S. Walter Mower, gen-

eral manager Southwestern Traction Company, London, Ont.

Members of the Executive Committee—The officers and F. H. Lincoln, assistant general manager, Philadelphia Rapid Transit Company, Philadelphia, Pa.; Fred N. Bushnell, chief engineer the Rhode Island Company, Providence, R. I.; W. T. Dengan, engineer maintenance-of-way, New York; H. B. Fleming, chief engineer, Chicago City Railway Company, Chicago.

Mr. W. H. Evans of Indianapolis, representing the Central Electric Railway Association of Ohio and Indiana, said that that association would be glad to co-operate with the American Street and Interurban Railway Engineering Association. There were other congratulatory speeches, and the association adjourned without date.

Accountants' Association.

The American Street and Interurban Railway Accountants' Association—the oldest of the subsidiary associations—held its convention on Tuesday, Wednesday and Thursday, October 16th to 18th, inclusive. W. B. Brockway of Yonkers, N. Y., the president, was in the chair. After the opening business President Brockway presented his annual address. He said, among other things:

"I have always been of the opinion that our meeting annually at the same time and place with the other associations is not the most satisfactory plan for us to follow. I am fully cognizant of all the arguments on both sides of the question, and I am still of the opinion that, at some early day, this association must hold its annual meeting at its own time and place; and it may follow whatever plan it may desire or find proper without having to, at every point, square up to the other associations, so as not to affect them or let them affect the plans we find in our judgment to be the best for us. Those of you who have attended most of the meetings of this association will remember that at only five out of 11 meetings have we been able to deliberate in the ways we know to be best for accounting subjects, and one of the five satisfactory times was that one when we did meet alone at our organization meeting.

"We are certainly, at this present time, in a much different place than we occupied 10 years ago. There is no doubt that greater demands are made upon us as a class than there were at that time. We are not mere tabulators of figures any more. We have become, in a large measure, business advisers and one of the five senses making up the whole of the business body. Therefore, it is well to give consideration to our needs in filling our duties up to which we must measure. The necessity of a broad mind is so apparent that it must be recognized. The nature of the work we perform tends to train us into hair-splitting and petty detail, and if we permit full swing to that tendency, we must each find ourself in such a narrow way that the larger and more helpful work must be performed by someone else, although it is quite within our present duties and our capabilities. There are much greater things than making figures balance. Don't forget that. We must learn to analyze, to pull apart and compare, not alone the accounting system, but the financial plans of our own and other companies. Banking methods and the trend of money; the corporation and taxation laws of many states; the procedure followed in reorganization, and many other things which will readily occur to you are now required. It makes it necessary that we must read and study much and patiently, that we may come up in the fullest sense to our opportunities."

At the afternoon session of Tuesday, Mr. H. M. Edwards, auditor of the New York Edison Company and chairman of the committee on "Electric-light Accounting" of the National Electric Light Association, stated that he came to the convention representing that association in search of information in view of the reorganization which was now pending in connection with his association.

The Question Box was discussed.

A. Stuart Pratt, general auditor and treasurer of Stone & Webster of Boston, read a paper, "The Use of Curves in Statistics," on Wednesday afternoon. It was discussed with great interest by the members.

W. F. Ham of Washington, chairman of the committee on "Standard Classification of Accounts," read the report of that committee and also of the committee appointed to attend the convention of the National Association of Railroad Commissioners, held in Washington in April.

Officers were elected for the ensuing year as follows: President, C. L. S. Tingley, Philadelphia; first vice-president, J. H. Neal, Boston; second vice-president, C. F. Bryant, Bridgeport, Conn.; third vice-president, Charles L. Wight, Des Moines; secretary and treasurer, Elmer M. White, Birmingham, Ala.; executive committee, W. B. Brockway, Yonkers, N. Y.; H. T. Bunn, Knoxville, Tenn.; A. Stuart Pratt, Boston; H. S. Swift, Toledo.

Claim Agents' Association.

The Claim Agents' convention was held on Monday, Tuesday and Wednesday. S. L. Rhoades of Philadelphia, the president, and B. B. Davis of Columbus, the secretary, were in their places. A number of papers were read. The general idea seemed to be that all just and fair claims against the street-railway companies should be settled promptly for a reasonable amount. A feature of the meeting was the thorough discussion of the Queston Box.

These officers were elected:

President, S. L. Rhoades of Philadelphia; first vice-president, Henry C. Bradley, of the Union Traction Company of Chicago; second vice-president, Andrew J. Farrell, International Railway Company, Buffalo; third vice-president, W. F. Weh, Cleveland Electric Railway Company, Cleveland; executive committee, Charles B. Hardin, United Railways Company; Peter C. Nickel, New York City Railway Company; E. C. Carpenter, Indiana Union Traction Company; S. W. Johnson, Connecticut Railway and Lighting Company of Bridgeport, Conn.

Convention Notes and Exhibits.

David F. Jennings, Monadnock Block, Chicago, was most energetic in pushing Streeter's new pivot journal bearings.

To enumerate all of the graphite specialties presented at the Columbus street-railway convention by the Dixon Crucible Company of Jersey City, N. J., would require a great deal of space. The Dixon products were certainly well represented by Charles H. Spotts, F. R. Brandon and L. H. Snyder. The advertising novelty of this booth was the distortion mirrors.

Dearborn Drug and Chemical Works.
John A. Roebling's Sons Company.

General Electric Company.
Chicago Pneumatic Tool Company.

Novelty Incandescent Lamp Company.
American Steel and Wire Company.

EXHIBITS AT THE COLUMBUS STREET-RAILWAY CONVENTION.

Frank D. Masterson looked after the interests of the Chase-Shawmut Company, Newburyport, Mass.

Assistant Manager Milton Hartman of the Buckeye Electric Company of Cleveland arrived on Thursday and spent the day at the Columbus convention.

Guy V. Williams of New York, technical adviser to the sales department of the Sawyer-Man Company, was decidedly "in evidence" at the Westinghouse booth.

W. H. and A. S. Elliott looked after the interests of the Elliott Bros. Electric Company of Cleveland, Ohio. Field coils, armature coils and commutators were exhibited.

President F. Bissell of the F. Bissell Company of Toledo, Ohio, assisted by T. C. Norton, was on hand at the Frank Ridlon booth looking after the interests of northern Ohio.

No better index of the wonderful progress of the Ohio Brass Company of Mansfield, Ohio, could have been presented than the company's exhibit at the convention. C. K. King of the company as usual was most prominent among the company's host of representatives. Advertising Manager

Charles D. Young, too, deserves much credit for his work in advertising the Ohio Brass Company at the Columbus convention.

The annual banquet was held at the Great Southern Hotel on Thursday evening. Among the speakers were H. J. Booth, H. M. Daugherty, D. J. Ryan and H. G. Hutchins.

Donald Parsons presented in actual operation a very complete apparatus for making blue-prints by the light of an arc lamp. This machine is made by J. H. Wagenhorst & Co., Youngstown, Ohio.

Southern white-cedar poles and other "electrical lumber" received attention at the exhibit of the Southern Exchange Company, which was represented by E. G. Chamberlin and Walter E. Mitchell.

A new lightning arrester appeared under the auspices of the Oleson-Williams Company of Toledo, Ohio. Electrical tests were shown in operation to illustrate the features of this new arrester in connection with a 500-volt circuit.

Western Manager J. R. Wiley of Chicago, Southwestern Manager E. J. Pietzcker of St. Louis and Manager T. E. Hughes of Philadelphia were, as usual, "doing things" for the Standard Underground Cable Company of Pittsburg, Pa.

Secretary B. V. Swenson was perhaps the busiest man at the convention. The secretary, who is also the treasurer, is not elected by the association, but appointed by the executive committee. Mr. Swenson will undoubtedly be re-appointed.

Headed by Robert F. Carr the Dearborn Drug and Chemical Works of Chicago made a handsome exhibit of water-purifying preparations, also lubricating oils and greases. Assisting Mr. Carr were Grant W. Spear, Dan Delaney, Paul T. Payne and W. O. Clark.

Among head men of the large manufacturing institutions that appeared at Columbus was W. S. Heger, assistant to the president, W. W. Whiteside, of the Allis-Chalmers Company. Mr. Heger is one of the old-timers in the electrical business and was warmly welcomed by his host of friends.

Western Manager Hammond of the American Electrical Works, assisted by Bond Wister, were in constant attendance. Mr. Hammond, since succeeding Manager Frank Donohoe, promoted to New York, to the position of western manager of his company, has done most excellent work in the West.

Following are the names of the gentlemen who looked after the very interesting exhibit of the Chicago Pneumatic Tool Company, Chicago: J. W. Duntley, W. O. Duntley, C. E. Walker, C. B. Coates and Edward Aplin. A complete line of electric drills and grinders was exhibited, and there were portable electric drills for rail bonding. There was shown also a complete line of pneumatic drills and hammers.

"Kirk," or, more formally, Mr. Kirkpatrick, of the McRoy Clay Works, was in Columbus during the entire street railway convention. Mr. Kirkpatrick's company made no attempt at an exhibit, but that gentleman was most active, as usual, doing the honors in his inimitable and Chesterfieldian manner.

John A. Roebling's Sons Company, Trenton, N. J., in addition to making a very practical exhibition of its products, was represented by H. L. Shippy, A. M. Whaley, G. R. Mitchell, W. W. Affleck, J. W. Brooks, A. B. Conover, Mr. Swartz, Mr. Henry and W. P. Bowman. The display consisted of the practical exhibition of the application of rail bonds, car cables, electric wires and cables, armature and field coils.

Adjoining the Western Electric Company the D. & W. Fuse Company of Providence, R. I., under the direction of W. F. Sisson and C. E. Harmon, made an exhibit of Deltabeston magnet wire, showing the great heat-resistance properties of its insulation; enclosed D. & W. cartridges, enclosed fuse cut-outs and boxes were also shown. Messrs. Sisson and Harmon were indefatigable in their efforts for the good of the company.

The Speer Carbon Company of St. Marys made a happy hit in selecting a corner in one of the best buildings in the fair grounds. Under the management of G. P. Fryling of the company a most complete line of Speer high-grade generator and motor carbon brushes was presented and other carbon specialties. Mr. Fryling was accompanied by Mrs. Fryling. Many were the requests for J. S. Speer's book on "Carbon Brushes."

Secretary Albert L. Tucker, of the International Register Company, 124 W. Jackson Boulevard, Chicago, was active at the Columbus street railway convention. Mr. Tucker was for many years connected with the executive department of the Western Electric company at Chicago. He recently accepted the secretaryship of the International Register Company. The company's booth was attractive and generally filled with visitors.

The Heany Fire Proof Wire Company of York, Pa., through William H. Easton, made an interesting and convincing demonstration of the splendid fireproof qualities of its asbestos-covered wire and the ability of the insulation to withstand a red heat. In conjunction with this exhibit J. J. Kesler, the well-known chemist and varnish expert, accompanied by W. N. Eckel, made a most interesting exhibit, too, of the heat-resistance qualities of their insulating varnishes.

"Bonds" were the subject of the very handsome exhibit made by the American Steel and Wire Company, Chicago, and this included, too, a very complete line of rail-bonding tools. The following is a list of the gentlemen who represented the company: George Cragin, C. S. Marshall, F. A. Keys, C. S. Knight, B. B. Ayers, R. K. Sheppard, J. D. Sutherland, L. Banchards, George Long, George Chandler, Henry Pratt, C. R. Sturdevant, J. M. Holloway and Thomas Lavin.

The Electric Storage Battery Company of Philadelphia made an interesting and comprehensive exhibit illustrative of their storage cells. There were shown two type R cells, one containing 55 plates, the other 83, a carbon regulator, compensating hydrometer, signaling hydrometer, recording hydrometer, automatic cell filler, several Manchester positive and box negative plates mounted on boards. The company was represented by C. Blizzard, H. B. Gay and G. H. Atkins.

"Everything in carbon" might have been the catch-word over the exhibit of the National Carbon Company of Cleveland. Under the management of N. C. Cotabish it is safe to say that there were no specialties of the slightest interest to street-railway men, practical or theoretical, that were not shown. Carbon brushes, arc-light carbons and carbon specialties of all kinds were tastefully and convincingly presented. Assisting Mr. Cotabish were the following gentlemen: A. G. Summerell, F. D. Kathe and J. F. Kerlin.

The Gould Storge Battery Company of New York made a most interesting exhibit of its various types of plates, including 49 plates, type U, in lead-lined tank; 19 plates, type S, in lead-lined tank; 21 plates, type O, in Appert glass tank; glass jars; also photographs of large installation for railway and lighting plants. The Gould company's interests were looked after by Manager H. N. Powers of the Gould telephone-battery department and Western Manager R. H. Watson of the company's Chicago office. Assisting these gentleman was J. P. Eipper.

W. N. Mathews & Bros. of St. Louis, represented by Claude L. Mathews and James R. Kearney, had a comprehensive exhibit showing the Stombaugh guy anchor, Kearney cable clamp, Holdfast lamp guard, O. K. sleet cutter and Lima jack box. The use and saving to be made by the Kearney cable clamp was very clearly shown. The firm had three miniature corner poles showing a comparison of the methods of turning a corner with the Kearney cable clamp and the old cut and "make-up." From 10 to 15 feet of cable are saved by use of the clamp.

The Crouse-Hinds Company of Syracuse, N. Y., as is usual at all conventions, came to the front, and this time the following-named gentlemen were most energetic in pushing the exhibit: A. F. Hills, N. Shute and C. M. Crofoot. The display consisted mainly of the Crouse-Hinds headlights. There were shown Imperial arc headlights and combination and arc and incandescent headlights. Also Syracuse changeable incandescent headlights. In addition to these much attention was given to pushing the well-known Crouse-Hinds condulets,

W. N. Matthews & Bro. Speer Carbon Company. | Allis-Chalmers Company. Franklin Electric Manufacturing Company. | Buckeye Engine Company. Crouse-Hinds Company.

EXHIBITS AT THE COLUMBUS STREET-RAILWAY CONVENTION.

Harpoon guy anchors and the Norbitt porcelain specialties.

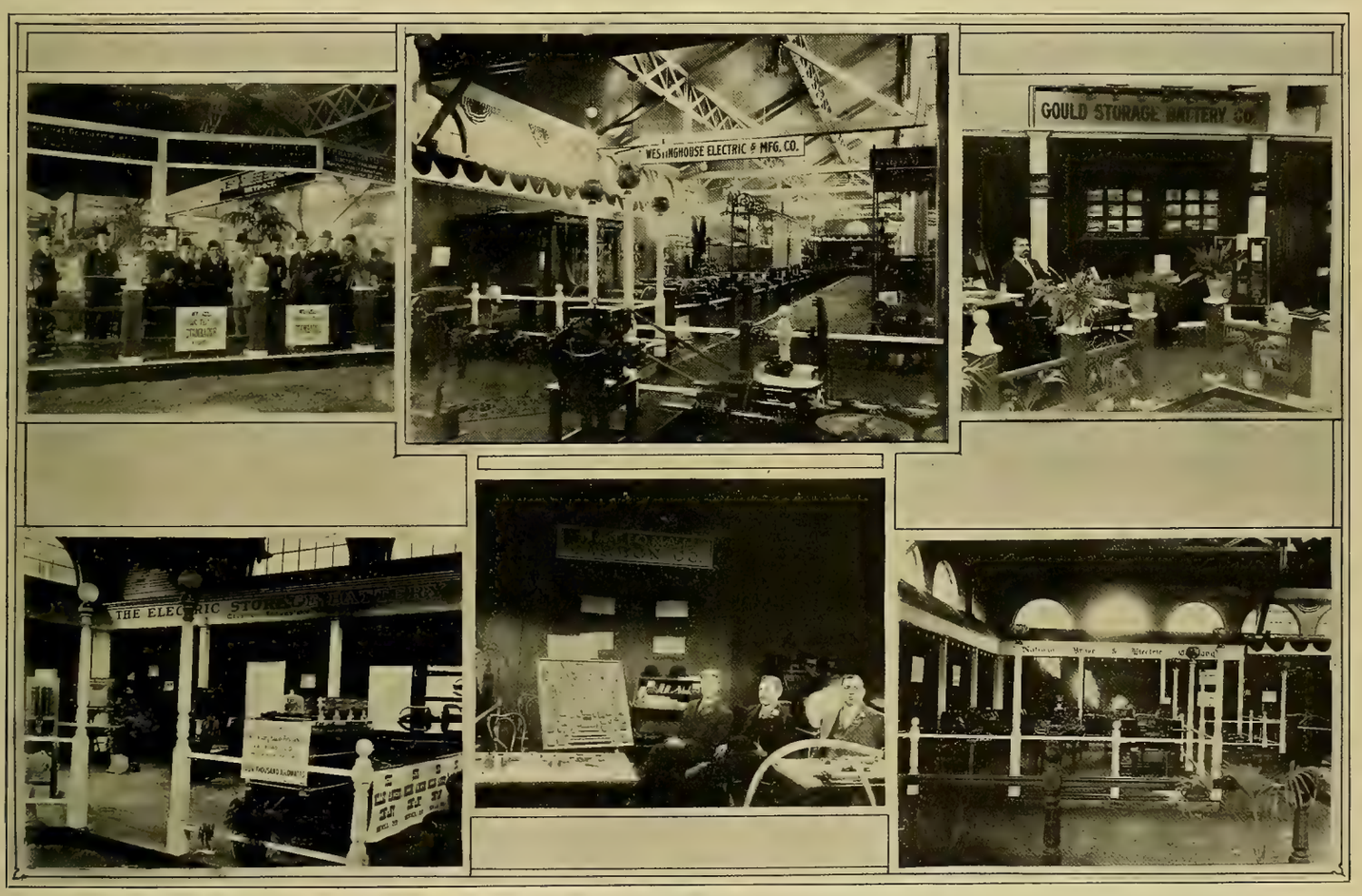
Secretary S. A. Benedict "did" the Columbus Street Railway Convention most energetically in the interests of J. P. Devine Company of Buffalo. This institution has made a specialty for a number of years of the introduction of the Passburg vacuum drying apparatus among the electrical manufacturers of the United States. Mr. Benedict made his headquarters in the booth of the Standard Varnish Works. The advantages of Passburg impregnated coils over coils treated in the ordinary manner are many. To the thinking electrical engineer the Devine Company's process is worthy of careful study especially where great dielectric strength is sought.

The Buckeye Engine Company of Salem, Ohio, made the hit of the convention with its souvenir buttonhole bouquets. Colonel C. H. Weeks' roses have now become a standard souvenir of the street-railway conventions. When one realizes the thousands of flowers that, under the colonel's direction, were attached by two handsome young ladies, one to each of the badge wearers, it is easy to understand the popularity of Buckeye engines, to say nothing of that of Colonel Weeks himself. Colonel Weeks made no attempt at a large exhibit beyond a model Buckeye engine.

Emporium plant is finished it will be run on new lamps exclusively and the St. Marys factory will be devoted entirely to the refilling business. It is reported that the lamp company is preparing to launch a new incandescent lamp. Assisting at this exhibit was A. J. Jackson.

The Franklin Electric Manufacturing Company of Hartford, Conn., showed the Franklin street-railway lamp. A unique feature of this exhibit was a vibrating machine designed to reproduce the conditions under which incandescent lamps operate in street-railway service, on cars, etc. The filament of this lamp is anchored at its lowest point and is supported direct from the stem. This is accomplished by means of a small glass column extending from the stem past the upper portions of the filament coil. The filament is securely fastened to an anchor wire welded in the glass column, and the greatest possible rigidity of filament support is thus obtained. Vibration is sustained equally at all parts of the filament, and not at one point as in the case of ordinary incandescent lamps. All possibility of the filament drooping or touching the bulb is removed. The company was represented by P. S. Klees, C. Leonard and F. E. Wilson.

The Western Electric Company's representatives at the Columbus convention were: W. L. Stockton,



Western Electric Company.
Electric Storage Battery Company.

Westinghouse Electric and Manufacturing Company.
National Carbon Company.

Gould Storage Battery Company.
National Brake and Electric Company.

EXHIBITS AT THE COLUMBUS STREET-RAILWAY CONVENTION.

Assisting in the dispensation of this most artistic hospitality were V. T. Price and G. W. Pope.

S. I. Wailes, J. T. Cunningham, J. E. Perry, W. H. Goble, W. M. Bisel, W. H. Beattys, Jr., W. R. Crawford, Bert Aikman, G. S. Hastings, R. P. Tell and George S. Hastings were most indefatigable in presenting to the street-railway people the most interesting exhibit of the National Brake and Electric Company of Milwaukee. A sight of this outfit is necessary to give a comprehensive understanding of its merits. There were shown a complete straight air-brake equipment, complete straight air-brake equipment with emergency feature, one new-type air compressor, sectional air compressor, sectional slide valve, sectional emergency valve, supply parts for air-brake equipments.

President R. K. Mickey of the Novelty Incandescent Lamp Company, St. Marys, Pa., made a handsome exhibit of incandescent lamps. It will be remembered that Mr. Mickey went into the independent lamp business within the last year with a small plant at St. Marys, operating on refilled lamps. The company, however, was later capitalized at $100,000. At St. Marys Mr. Mickey's factory has been increased to take care of rapidly growing refilling business and a fine new factory is building at Emporium, Pa., which will be completed in about 60 days. When the

general sales staff, street railway apparatus; C. A. S. Howlett, power apparatus sales, Chicago; D. C. Guest, railway department; E. A. Burrows, general sales staff, in charge of railway switchboards; H. Walton Heegstra, advertising manager, Chicago; F. D. Killion, D. & W. fuses, New York; R. H. Harper, general sales staff, railway department; L. T. Milnor, manager at Cincinnati; Ridgway & Co., local representatives at Columbus; F. R. Babcock, power apparatus sales, Chicago. The company made no attempt at a large and comprehensive exhibit of its heavy power machinery. There was, nevertheless, shown a fine line of general railway material, and a specialty was made of the Electros Manufacturing Company's line. There was distributed as a souvenir a pin tray made of Thomas' overhead insulating material, for which the Western Electric Company is agent. The company's new advertising manager, H. Walton Heegstra, made his initial bow at the Columbus convention. Mr. Heegstra was indefatigable in looking to the advertising interests of his company; he distributed among other things an artistic pamphlet entitled "Hawthorne Works." The envelope containing this book, carrying a dainty picture of "Our Gateway —Open and Look Through," was tempting enough in itself to insure perusal of the "Hawthorne Works." Anyone glancing over this piece of advertising literature cannot but be impressed with the splendid facilities possessed by the Western Electric Company's Hawthorne works for competing in the market for heavy electrical apparatus of all kinds.

The exhibit of the Allis-Chalmers Company, which occupied 1,400 square feet of space, was decorated throughout in green and black. Palms and cut flowers were also used to give greater attractiveness to it. The exhibit proper consisted of apparatus used by street-railway systems, prominent among which were two Allis-Chalmers railway motors, one of 50 horsepower and the other of 75 horsepower, together with controller and resistance grids; a complete line of Christensen air-brake apparatus, now manufactured solely by the Allis-Chalmers Company; stationary and movable blading from an Allis-Chalmers steam turbine; Allis-Chalmers power transformers, both assembled and in various stages of construction; Allis-Chalmers induction motors, potential starters, etc. The air-brake apparatus was assembled on a frame similar to the arrangement used on a car, and was put in operation whenever anyone wished to see it working. Visitors had a further demonstration of the efficiency of the Christensen air brake in observing the operation of the street-railway system of Columbus. The induction motors exhibited by the Allis-Chalmers Company, although not strictly in the line of street-railway apparatus, were a constant center of attraction. The steam-turbine model also underwent almost constant inspection. Visitors were particularly interested in the method of securing the blading and of protecting its tips by means of a shroud ring. The exhibit was in charge of C. A. Tupper. Other representatives of the company present were F. C. Randall, W. W. Power, J. H. Denton, W. S. Doran, G. B. Foster, W. T. McCaskey, A. N. Libby, W. S. Heger, C. A. Stranahan, H. A. Strauss, M. W. Thomas, George Voigt, H. S. Buell, F. C. Colwell, C. E. Lord, W. J. Buckley, W. H. Powell, Ervin Dryer, Fred L. Webster, J. W. Murray, J. W. Gardner, A. Brodock, B. A. Behrend, Louis Bogen, E. Mattman, David Hall, W. B. Spellmire, W. J. Richards, W. D. Pomeroy, B. Ellshoff and Lea Nicholson.

The Westinghouse exhibits occupied one whole side of the Agricultural building in the fair grounds. It was lighted by Nernst lamps, Cooper Hewitt lamps and Westinghouse arc lamps, each of these types having its peculiar advantages. A most comprehensive line of apparatus was on exhibit, including almost every type of device used in the electric-railway field. There were, of course, several railway motors. An interesting part of the exhibit was the Westinghouse unit-group system of multiple control in operation. This system, which has been developed by the Electric Company, is an ingenious combination of electro-

magnetic and pneumatic devices which produce a reliable and effective method of controlling from a single point a single car or a train of cars. Included in the electric exhibit was also a complete line of detail apparatus, such as circuit-breakers, lightning arresters, fuses, fuse blocks, etc., and a line of switchboard instruments. The Westinghouse M. P. (multipath) lightning arrester, which is suitable for either alternating-current or direct-current service, embodies a new principle. By a special method of development tests, an arrester has been produced which has an indefinite length of life and offers a freedom of discharge said to be many times greater than any low-voltage arrester now on the market. The arrester takes its name from the fact that the static discharge separates itself over the block along a number of minute discharge paths. The Westinghouse Traction Brake Company had working racks of several air-brake equipments. A number of cars on exhibit in other sections were of special interest because fully equipped with Westinghouse air-brake apparatus of the improved type. Among the Westinghouse men present were the following-named: J. B. Allan, J. A. Brett, L. M. Cargo, William Clegg, Jr., C. S. Cook, H. P. Davis, W. F. Fowler, Guy H. Gibbs, J. J. Gibson, A. L. Humphrey, S. N. Kintner, W. M. McFarland, J. C. McQuiston, C. F. Medbury, L. A. Osborne, C. S. Powell, C. W. Regester, F. F. Rohrer, F. H. Shepard, O. T. Smith, H. C. Stier, N. W. Storer, T. Varney, J. E. Webster, Edwin Yawger.

The General Electric Company exhibited a portable air-compressor outfit, which promises to fill in a satisfactory manner the demand for such apparatus. It consists of a portable truck with 4 by 5-foot platform, with a compressor, governor and gauge mounted on top of the platform, while the tanks are located beneath. It is equipped with a portable connecting cable and hose, the entire outfit making a most convenient addition to the equipment of a car-barn or repair shop of the electric railroad. Mercury arc rectifiers were also shown. The very considerable interest on the part of railway men in the single-phase system led the General Electric Company to exhibit a complete equipment, an adaptation of the Sprague-General Electric multiple-unit control system to single-phase work. The simplicity of this outfit, which is most complete and flexible, is quite in contrast with complicated designs exhibited at earlier conventions. The equipment shown was one of those being manufactured on order from the Central Illinois Construction Company. A novel and interesting feature of the company's exhibit was a CP 21 air compressor from which various parts have been so cut out as to permit examination of all the various details of construction. For the first time at any convention there was exhibited this company's commutating-pole motor for railway use. This motor is known as the GE 100 and has a normal rating of 100 horsepower. Line material and general railway supplies were also displayed. One of the most ingenious devices recently presented to the trade is the large-capacity automatic circuit-breaker shown by the General Electric Company. This device consists of a motor-operated circuit-breaker in combination with a main switch also motor operated. It has a capacity of 12,000 amperes at 650 volts. The General Electric Company's exhibit space was lighted by 250-watt Gem lamps with Holophane reflectors. Besides these, the new Tantalum lamp was also used. Among those representing the company were the following named: J. R. Lovejoy, Schenectady; C. C. Peirce, Boston; G. D. Rosenthal, St. Louis; H. L. Monroe, Chicago; R. E. Moore, Philadelphia; E. H. Ginn, Atlanta; J. J. Mahoney, New York; H. H. Crowell, Buffalo; E. H. Anderson, Schenectady; C. E. Barry, Schenectady; H. N. Ransom, Schenectady; E. D. Priest, Schenectady; W. G. Carey, Schenectady; F. E. Case, Schenectady; W. J. Hanley, Columbus; M. M. Corbin, Cincinnati; H. H. Corson, Memphis; Frank H. Gale, New York.

Production of Natural Gas in 1905.

During the year 1905 the value of the natural gas produced and sold in the United States, according to a forthcoming report of Mr. W. T. Griswold of the United States Geological Survey, exceeded that of any previous year by $3,066,099. It amounted to $41,562,855. This result has been accomplished by a general advance in price rather than by any increase in the quantity of gas produced. Out of 16 states in which natural gas is produced but two show a decrease in value in the year 1905 as compared with 1904. The greatest increase during 1905 was in West Virginia, where the increased value amounted to $1,961,655 more than the previous year. Pennsylvania shows an increase of $1,057,442. Louisiana appeared for the first time as a gas-producing state, and notable increases over previous production were shown by Kansas, Oklahoma and Indian Territory. Kansas showed an increase of 49 per cent. over its previous production, and the combined production of Oklahoma and Indian Territory was 161 per cent. over the production of 1904.

A falling off in value is shown in Indiana, Kentucky and Tennessee. The great gas fields of Indiana have shown a steady decline since 1902, and the value of the output last year was considerably less than one-half of the maximum production.

THE SMALL CENTRAL STATION.

Practical Hints on Its Construction and Operation.

CHAPTER XV.

COST OF PLANTS.

Alternating-current Lighting Plants. — In preparing the following data on the cost of plants, the writer has made use of information collected from all parts of the United States and can, therefore, submit to the central-station man a fairly accurate estimate on the initial and operative costs of an electric-lighting plant. It will be understood, however, that these figures represent averages and are accordingly absolute for no particular set of conditions. They will be of use in estimating the outlay of money needed to build and operate a plant, and along these lines should be of value.

The total operative expense of a plant may be separated into items, as shown in the following table. The percentage accorded to each item of expense in the total account was determined from the annual reports of a large number of stations and may be taken as fairly representing actual results. Small installations will show high labor and low fuel percentages, while the larger installations will give the opposite results, low labor and high fuel percentages.

APPROXIMATE PROPORTION OF ITEMS CONSTITUTING EXPENSE ACCOUNT.

	Per Cent.
Salaries and wages	30
Supplies and materials	17
Fuel	17
Interest on bonds, insurance, rents, taxes, etc.	36
Total	100

From the reports received it was possible to obtain an average value of the cost of producing a kilowatt-hour. This average cost was found to be 2.77 cents, with coal at an average price of $2.09 a ton.

The steam turbine promises to reduce this cost of production materially, a 5,000-kilowatt turbine unit now in operation furnishing current at the switchboard at one-half a cent per kilowatt-hour, with coal at $2.25 a ton. This figure cannot be reached with the smaller turbine units of today, but the immediate future promises small turbines, the steam economy of which will be equal to or even better than that obtained by Corliss engines.

On the total investment recorded in the plants from which data was received it was shown that the total yearly operative and maintenance cost of a plant will run between 11 and 15 per cent. of the initial investment. This affords a ready means for obtaining the approximate yearly outlay necessary to keep in operation a lighting plant, the initial cost of which has been previously determined.

Another source of information states that the total expense per year will average, in well-constructed plants, $55 to $60 per kilowatt capacity.

The following estimates are given on belted apparatus. Proper increase for direct-connected machinery may be obtained from the proper tables. The item "Boiler" includes boiler and necessary appurtenances, pump, heater, injector, etc.

AVERAGE COST OF CONSTRUCTION OF A 450-LIGHT ALTERNATING-CURRENT PLANT.

Station Equipment.

Boiler and stack (iron) ready for operation	$929.00
Engine erected, including foundation	845.00
Piping	75.00
Belt	27.30
Generator, 25-kilowatt set	775.00
Switchboard wired to generator	125.00

Line Construction.

Transformers, 400-light capacity—	
10 12-light at $28.00	280.00
5 20-light at $36.00	180.00
3 30-light at $47.00	141.00
1 40-light at $58.00	58.00
1 50-light at $64.00	64.00
300 lamps and sockets	90.00
Wiring up 300 incandescent lamps (open work)	350.00
Six alternating-current arc lamps at $18.00	108.00
Wiring arc lamps	42.00
3,000 feet No. 6 feeders, 345 pounds at 20 cents, delivered to pole	69.00
15,000 feet No. 8 feeders, 1,200 pounds at 20 cents, delivered to pole	240.00
75 poles (30-ft.), set with arms and insulators, at $3.50	262.50
Balance, labor on line and incidental expense	100.00
Stock-room supplies	100.00
Total	$4,860.80

AVERAGE COST OF CONSTRUCTION OF A 750-LIGHT ALTERNATING-CURRENT PLANT.

Station Equipment.

Boiler (60 in. by 14 ft.) and stack (iron), set ready for operation	$1,196.00
Engine (11 by 12 in.), erected on foundation (inc.)	1,080.00
Piping	150.00
Belt	33.00
Generator, 45-kilowatt set	1,125.00
Switchboard, wiring connections made to generator	300.00

Line Construction.

Transformers, 750-light capacity—	
15 12-light at $28.00	420.00
10 20-light at $36.00	360.00
5 30-light at $47.00	235.00
3 40-light at $58.00	174.00
2 50-light at $64.00	128.00
600 incandescent lamps and sockets	180.00
Wiring 600 incandescent lamps (open work)	720.00
12 alternating arc lamps at $18.00	216.00
Wiring arc lamps	84.00
2,500 feet No. 4, 313 pounds at 20 cents, delivered to pole	62.60
15,000 feet No. 6, 1,725 pounds at 20 cents, delivered to pole	345.00
10,000 feet No. 8, 850 pounds at 20 cents, delivered to pole	170.00
100 poles (30-ft.) set with arms and insulators, at $3.50	350.00
Balance, labor on line and incidental expense	300.00
Stock-room supplies	150.00
Total	$7,828.60

AVERAGE COST OF CONSTRUCTION OF A 1,500-LIGHT ALTERNATING-CURRENT PLANT.

Station Equipment.

Boiler (72 in. by 16 ft.) and stack (iron) set ready for operation	$ 1,796.00
Engine (16 by 14 in.) erected on foundation and including same	1,775.00
Piping	300.00
Belt	75.00
Generator, 75-kilowatt set	1,650.00
Switchboard, wiring connections made to generator.	500.00

Line Construction.

Transformers, 1,400-light capacity—	
25 12-light at $28.00	700.00
20 20-light at $36.00	720.00
10 30-light at $47.00	470.00
5 40-light at $58.00	290.00
4 50-light at $64.00	256.00
1,000-light capacity in meters from 10 to 50 lights each	500.00
1,100 incandescent lamps and sockets	330.00
Wiring above lamps	1,300.00
15 alternating-current arc lamps at $18.00	270.00
Wiring arc lamps	105.00
25,000 feet No. 4, 4,125 pounds at 20 cents	825.00
12,000 feet No. 8, 960 pounds at 20 cents	192.00
130 poles (30 and 35 ft.) at $4.50 each, set with arms and insulators	585.00
Balance, labor on line and incidental expense	400.00
Stock-room supplies	200.00
Total	$13,239.00

AVERAGE COST OF CONSTRUCTION OF A 3,000-LIGHT ALTERNATING-CURRENT PLANT.

Station Equipment.

Engine (20 by 20 in.) erected on foundation (inc.)	$ 3,400.00
Two boilers (72 in. by 16 ft.), set	3,130.00
Stack (iron), 100 by 42 ft., with breeching	485.00
Piping	500.00
Belt	100.00
Generator, 150-kilowatt set	3,150.00
Switchboard, complete, set and connected to generator	750.00

Line Construction.

Transformers, 3,000-light capacity—	
50 12-light at $28.00	1,400.00
30 20-light at $36.00	1,080.00
15 40-light at $58.00	870.00
10 50-light at $64.00	640.00
3 100-light at $99.00	297.00
2 200-light at $157.00	314.00
3,000-light capacity of meters from 10 to 200 lights.	1,800.00
3,000 incandescent lamps and sockets	900.00
Wiring above lamps	3,500.00
20 alternating-current arc lamps at $18.00 each	360.00
Wiring arc lamps	140.00
23,000 feet No. 3, 4,830 pounds at 20 cents, delivered to pole	966.00
4,000 feet No. 4, 660 pounds at 20 cents, delivered to pole	132.00
3,000 feet No. 6, at 20 cents	69.00
200 poles (40, 35, 30 ft.) at $4.75, set with arms and insulators	950.00
Balance, labor on line and incidental expense	500.00
Stock-room supplies	300.00
Total	$25,733.00

[To be continued.]

BOOK TABLE.

THE MANAGEMENT OF ELECTRICAL MACHINERY. By Francis B. Crocker and Schuyler S. Wheeler (revised sixth edition). New York: D. Van Nostrand Company. 1906. Pp. (4¾ by 6¾), vii., 223, with 131 illustrations. Price, $1.

This admirable little work is peculiarly adapted for the use of practical men. It presupposes a certain amount of knowledge of matters electrical on the part of the reader, so that none of the space is taken up by elementary descriptions or general principles. As far as was possible information has been condensed into tables covering the various cases apt to arise in practice.

None of the five parts into which the book is divided will be more acceptable than Part III., "Localization and Remedy of Troubles." Here every reasonably conceivable derangement or defect of generators and motors is taken up in concise, systematic manner, under the headings "Cause," "Symptoms" and "Remedy."

On page 86 of Part I. appears the important statement: "Almost all persons accidentally killed by artificial electricity have been experienced linemen or station men." This is printed in order to emphasize the importance of care in handling apparatus carrying dangerous currents.

So complete is the treatment, including special articles on the management of arc-light dynamos and of railway motors, that one is rather surprised to find no mention of the single-phase traction motors.

The Suppression of Industrial Smoke.[1]

By A. Bement.

The problem of burning bituminous coal without producing smoke can be divided into two distinct features, one referring to legislation and its enforcement, the other to the technical or engineering phase of the matter, and it is more particularly the latter feature that is considered in this paper. It is the author's wish to emphasize certain fundamental principles upon which the complicated and difficult problem of smoke production and suppression rests, rather than attempt the detailed treatment of any individual condition or set of conditions.

It is a recognized fact that bituminous coal can be burned without smoke; also that the consumption of the volatile gases results in increased economy, and while great improvement has been made there is very much still to be accomplished, and the great and foremost requirement is a technical one, demanding not only a recognition of the principles involved in smokeless combustion, but better engineering practice as affecting design of plants and furnace apparatus. In the author's opinion, the people who are to blame for present conditions may be divided into three classes in the order of their responsibility:

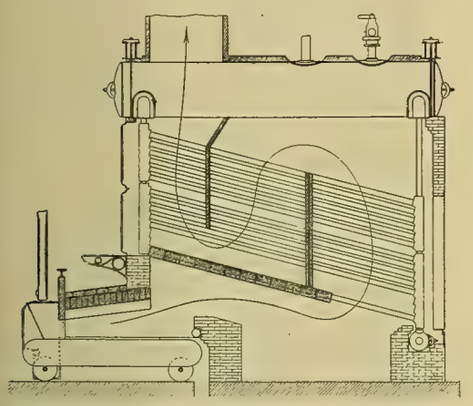
First—Manufacturers of furnace apparatus.

Second—Consulting engineers and architects.

Third—Purchasers who operate the apparatus.

In considering the matter from the standpoint of manufacture, the important fact should be emphasized that with one possible exception there are, strictly speaking, no smokeless apparatus made. This single exception will be mentioned later, but it is first desirable to outline the requirements governing smokeless combustion. They are:

First—Uniform evolution of the volatile gas,



SMOKE-PROOF STEAM GENERATOR.

which requires with a stoker a positively uniform feed of the coal.

Second—The location of a chamber of sufficient length or capacity between the fire grate and exit to the boiler to ensure that the volatile gases shall become thoroughly mixed with the air which enters with them.

Such chamber, which the author has called a furnace, to distinguish it from the grate, must, of course, be made of refractory material to enable it to withstand the heat, and its walls necessarily become red hot; this has caused many people to believe that the high temperature in itself was the cause of the volatile gases being burned, failing to take into consideration the fact that the most important requirement is a thorough mixing of the gases with the air in the chamber. Failure to realize this fact has resulted in disappointment with many brick arches, "Dutch ovens," etc. The chain grate, owing to its feed of coal being on a horizontal line, ensures a positively uniform rate in the feed, and consequently there is a steady evolution of the volatile gas, which will be burned if there is such furnace located between it and the boiler, and this apparatus may properly be called smoke-proof, because it is impossible for the operator either to cause or allow the coal to be fed in other than a steady and uniform manner.

Even when a very large furnace chamber is used with any form of stoker (other than a chain grate) or a hand-fired grate, a smokeless condition is dependent upon careful manipulation. For example, with a hand fire, if too much coal is added at one time the evolution of gas will be greater than the mixing capacity of the chamber; or, with sloping grate stokers, when a large quantity of coal is poked or slides down the grate, the result is the same as when a large charge of coal is added to a hand fire. Thus the fuel-feeding apparatus or method of manipulation must not overtax the mixing capacity of the furnace chamber if a smokeless result is to be secured.

The accompanying illustration shows the latest and best type of smoke-proof steam generator, its furnace chamber being formed by tiles covering the lower row of the tubes of the boiler. It is not a patented apparatus and may be adopted by anyone who wishes to do so. In fact, many boiler plants now installed may at small expense be altered so as to conform to all of its essential requirements. While this particular improved apparatus has already been built when demanded by purchasers, no manufacturer is willing to erect it unless required to do so. The nearest approach to a smoke-proof apparatus in the form of a complete steam generator, offered by any maker, consists of a brick arch as an essential adjunct for the direction of the gases against the tubes of the boiler, and when this manufacturer installs a chain grate under this arch it becomes the above-mentioned exception to the rule. This does not mean, however, that a purchaser may not buy a boiler from one maker, a stoker from another, and with a little engineering produce an apparatus which is strictly smokeless, but that an entire apparatus of satisfactory character, as a unit, cannot be purchased from any other manufacturer.

For a clearer understanding it is essential that furnace apparatus be considered in two classes, one which is smoke-proof, the other depending upon careful manipulation for good results. This latter class may also be separated into two divisions, those which by reasonably careful working will be smokeless, and others which it is very difficult to operate without smoke. Thus there are three grades of apparatus, the perfect, the moderately good and the bad.

The efforts of health departments and smoke-inspection bureaus should be to enforce the adoption of the perfect apparatus, proper manipulation of the moderately good and the abandonment of the bad. Unfortunately, however, the most serious offenders —the manufacturer, consulting engineers and the architects—are not affected by smoke laws, therefore can only be reached indirectly through the purchaser who bears all of the burden. Thus the only alternative is to enforce the laws in such manner as to be most effective.

The position of the smoke inspector from the engineering standpoint is a difficult one. As a general rule he is an administrative official, appointed or elected for the purpose of enforcing laws, and his time and efforts are taken up in such work, and the character of the requirements largely determines the training of the man selected. It necessarily follows that often he is not an engineer, at all events to that extent necessary for the solution of the difficult engineering problems encountered; the conditions under which he must necessarily work prevent to a very great extent his becoming technically proficient, because the tendency would then be for certain apparatus to be recommended in preference to others; this immediately results in trouble, caused by the influence of manufacturers who would not be favored. As it is, if a prospective purchaser applies to a smoke inspector for information as to the most desirable apparatus to be procured, he may be referred to a number of plants which are examples of good practice, in which he may find a variety of apparatus. After selecting one of these he often finds after it is in service that under his conditions it is not satisfactory; upon further investigation he discovers that others labor under as much difficulty as he, and thus often feels that he is an innocent victim of circumstances.

There are many plants where conditions render it difficult to correct the apparatus except at great expense. Such cases present a real problem to the smoke inspector. On the other hand, there are many owners who do not try to improve conditions; in fact, make no effort to discover whether or not they can correct their practice or the apparatus, and they make promises they do not intend to fulfill. One of the most common excuses is that their boilers are "overloaded" and for this reason they can do nothing, and unless the inspector is an engineer and familiar with this phase of the matter, he often encounters a seemingly insurmountable difficulty, when in reality these same owners, for reasons of economy, would not work their boilers at a lesser capacity. As a matter of fact, the practice which ensures a smokeless condition also results, as a general thing, in the production of a large capacity. The remedy with such owners is a drastic enforcement of the law.

In view of the fact that the greatest trouble is one that may be overcome by better engineering practice, and that there is no accepted or recognized independent source of information for the guidance of well-intending purchasers, it is recommended that the Engineering Experiment Station of the University of Illinois and the State Geological Survey present information to the people of this state, which, coming from such sources, may be accepted with confidence and used to advantage.

Among the speakers who discussed the subject of smoke suppression were a number of chief engineers of large plants and office buildings. These men said that while it was necessary to have a modern furnace, much depended upon how the engineer and fireman did their work.

Chief Engineers Goddard of the International Harvester Works and Saxe of the Railway Exchange Building gave their experiences, saying that smoke could be suppressed if the proper furnaces were installed and the engineers and stokers did their duty. Frank Elliot, chief engineer of the Northwestern Elevated power house, and others were of the same opinion.

Smoke Inspector Schubert of Chicago said that considerable improvement had been made in the city in the last three years. He did not think it just to prosecute manufacturers who are making changes in their plants, but in many plants engineers and firemen are to blame.

A number of representatives of engineering and furnace houses spoke, each endeavoring to show the superiority of his own device.

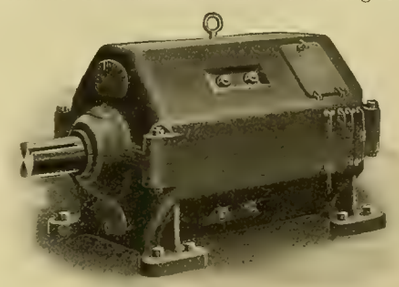


FIG. 1. ROLLING-MILL MOTOR.

Motors for Rolling Mills.

In its form W direct-current motor the Crocker-Wheeler Company presents its latest ideas in a motor to meet the heavy demands of rolling mill service, which requires a completely inclosed motor for intermittent but very heavy and jerky work. Fig. 1 shows the form W motor ready for service. It is built for outputs of 25, 50, 75 and 100 horsepower, and in its construction the suggestions of the best mill engineers were invited and utilized.

The parts of the motor are simple, substantial and strong. Fig. 2 shows the form W motor with the top half lifted off. Bearings are completely inclosed, even the ends being sealed so that no particle of dust can enter.

The armature is so designed and proportioned with reference to the field that these motors will operate in both directions, under ordinary overloads, with no sparking. The motors are insulated with fireproof material and can be operated in the hottest places.

The field frame is of steel, octagonal shaped, with four poles and is divided horizontally, the halves being held by four heavy bolts on the outside. The upper half can therefore be removed almost instantly. In the 25 and 50-horsepower sizes, this removes also all of the brush rigging, which is connected to the top half of the frame. The connections are all made outside the shells of the machine so as to be plainly visible and easily handled. The machines are jig made, and therefore interchangeable, and parts can be obtained from stock. The frame is of the inclosed type with hand-hole covers suitably placed on front and rear ends, for inspecting the interior. The pole shoes are built up of sheet-steel laminations.

Windings for the armature are simple and substantial, each coil consisting of a single turn only, without joint except where soldered to the commutator bar. The armature conductors are made of flat strip copper, separated from each other by

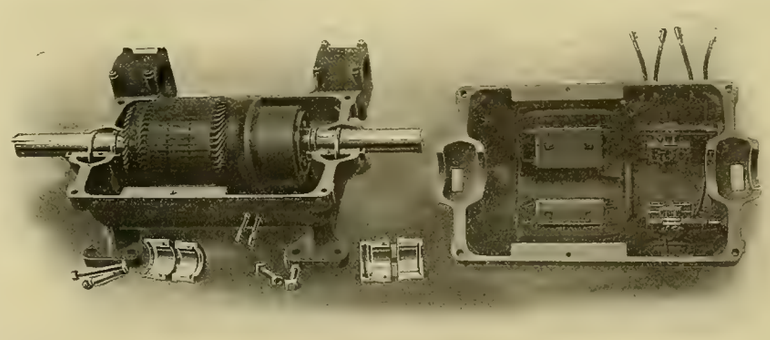


FIG. 2. ROLLING-MILL MOTOR WITH TOP HALF OF CASING REMOVED.

1. Paper read before the Western Society of Engineers, Chicago, on October 17, 1906. Mr. Bement, who is a member of the society, is a mining and mechanical engineer of Chicago.

asbestos. The conductors lying in one slot are bound together with insulation and the slot is also lined with insulation before the completely insulated coil is inserted.

The motors are wound either series or compound. In the compound winding the shunt coils are strong enough to prevent the motor running at more than double speed if the load be thrown off. The use of asbestos insulation in the field winding renders it fireproof and permits running the motors under greater overloads, and of placing them in hotter locations than ordinary motors.

Railway Signal Association.

The Railway Signal Association held its eleventh annual meeting in Washington, D. C., on October 16th, 17th and 18th. The sessions were held in the New Willard Hotel and were well attended, about 530 delegates being present. Aside from the technical value of the meeting, through the good papers and committee reports, the convention was a success from a social point of view. Luncheons, receptions, banquets, sight-seeing trips, theatre parties, etc., were plentiful. The Signal Appliance Association was active in entertaining the visitors.

Some of the more important subjects discussed at the meetings came in the shape of committee reports. On the first day reports and interesting discussions were had on the following subjects: "Standard Specifications for All-electric Interlocking, and Material for Construction Work;" "Standard Specifications for Mechanical Interlocking, and Material for Construction Work;" "Storage Battery—Installation, Maintenance, etc.;" "How to Remedy the Effects of Foreign Currents on Automatic Block Signals."

The following reports and papers were taken up on the second day: "Rubber-covered Wire;" "Signal Lamps;" "Interlocking and Block Signals;" "Circuits for Automatic Block Signal Systems—Steam, Elevated Electric and Surface Electric Roads;" "What Shall Constitute Costs in Estimates for Installation and Record of Maintenance?" "Circuits for Interlocking Signals." Papers—"Devices to Keep Railroad Switches from Becoming Clogged with Snow and Ice;" "The Optics of the Signal Lens."

At the morning session of the last day specifications were adopted on relays for automatic signals on railroads, and routine business was completed. Milwaukee was selected as the place for the annual meeting next year.

After lunch the following officers were elected:

President—J. A. Peabody, Chicago and Northwestern Railroad, Chicago.

Senior Vice-president—A. H. Rudd, Pennsylvania Railroad, Broad Street Station, Philadelphia.

Junior Vice-president—L. R. Clausen, Chicago, Milwaukee and St. Paul Railway, West Milwaukee, Wis.

Secretary-treasurer—C. C. Rosenberg, Lehigh Valley Railroad, South Bethlehem, Pa.

Executive Committee—H. C. Hope, St. Paul; J. C. Mock, Detroit; C. H. Morrison, New York city; A. R. Raymer, Pittsburg; H. S. Balliet, New York city.

Western Union's Annual Report.

The annual report of Robert C. Clowry, president and general manager, at the annual meeting of the Western Union Telegraph Company, shows a large increase in revenue for the year ended June 30th. The gross revenue for the year was $30,675,655, compared with $29,033,635 for the preceding year. Expenses amounted to $23,605,072 and included: Operating and general expenses, including taxes, $17,191,039; rental of leased lines, $1,553,288; maintenance and reconstruction of lines, $4,422,960; equipment of offices and wires, $437,785.

The large increase in revenue warranted a continuance of the policy of making large appropriations from earnings for improvements and extensions.

From the $7,070,582.88 net revenue of the year, $4,868,088.75 was paid for dividends, and $1,327,975 for interest on bonds. The remainder, $874,519.13, was added to the surplus. The net growth of the plant was: In poles and cables, 2,735 miles; in wire, 71,590 miles; in offices, 509. Of the total of 1,256,147 miles of wire at the close of the year, 352,164 miles were of copper and 903,983 of iron; an increase in copper of 45,428 mues and of iron 26,162 miles during the year. Cost of new construction was $3,292,981.36, which was $2,115,481.12 more than last year.

The increase of 4,009,762 in the number of messages resulted in a corresponding increase in the operating and general expenses. Contracts covering 8,311 miles of railroad were closed during the year with a large number of railroad companies. At a special meeting of stockholders an issue of $25,000,000 of bonds was authorized for extensions of existing lines and the purchase of new property.

Minneapolis and the N. E. L. A. Convention.

A Minneapolis correspondent writes: "A. W. Leonard, general manager of the Minneapolis General Electric Company, has received assurances that the annual convention of the National Electric Light Association will be held in Minneapolis next year." There has been, however, no official confirmation of this report.

Allis-Chalmers Oil Insulated Transformers.

The Allis-Chalmers Company of Milwaukee says that its power transformers are installed throughout the country, but that there has never been a breakdown in one of the transformers, nor has the company failed to meet its guarantees in any particular. Both the water-cooled and self-

FIG. 1. 500-KILOWATT OIL-FILLED SELF-COOLED TRANSFORMER.

cooled types are oil-filled, but in the latter type the heat is carried off by radiation from the case, while in the former water circulation is used to insure cool running.

Allis-Chalmers self-cooled transformers are built in sizes up to 300 kilowatts. Above this size the external surface of the case is not sufficient to radiate the heat developed in the transformer core and coils, unless the enclosing tank is made abnormally large. Fig. 1 shows a standard transformer of this type.

The water-cooled transformers, Fig. 2, are made in sizes from 100 kilowatts up. Water is circulated in a coil of seamless copper or brass tubing immersed in the oil, and the heat is effectively carried off.

Whenever the water is available and not expensive this method is preferable to air-cooling, even with comparatively small transformers, as it permits operation at lower temperatures and allows more margin for overloads.

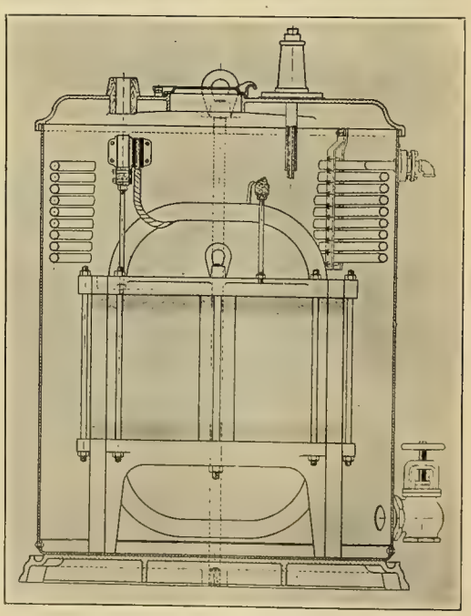


FIG. 2. SECTION OF OIL-FILLED WATER-COOLED TRANSFORMER.

Where water is not available, there is a choice of two kinds of air-cooled transformers—the oil-filled, self-cooled type, and the air-blast type which is cooled by a forced circulation of air through the core and coils. Air-blast transformers, however, are unreliable for pressures much above 25,000 volts.

Much has been written about the relative fire risks of air-blast and oil-filled transformers, but this is a matter that depends as much on surrounding conditions and the location of the transformers as on the construction. The air-blast transformer contains a small amount of inflammable material as compared with the oil transformer, but this material is much more easily ignited. A breakdown in an air-blast transformer is usually followed by an electric arc that sets fire to the insulating materials, and the flame spreads under the action of the forced circulation of air. Although the fire is of comparatively short duration, it is quite capable of igniting the building unless everything near the transformers is of fireproof construction.

The chances of an oil-filled transformer catching fire on account of any short circuit in the windings are extremely small, because oil will burn only in the presence of oxygen, and, as the transformer is completely submerged in oil, no air can get at it. Moreover, the oil used in transformers is not easily ignited; it will not burn in open air unless its temperature is first raised to about 400 degrees F., and with the oil at ordinary temperatures, a mass of burning material can be extinguished as readily by immersing it in oil as in water. In fact, the chief danger of fire is not that the oil may be ignited by any defect or arc within the transformer, but that a fire in the building in which the transformers are installed may so heat the oil as to cause it to take fire.

Allis-Chalmers oil-filled, water-cooled transformers are placed in boiler-plate tanks, cylindrical in form, and provided with a substantial cast-iron base and cover, as shown in Figs. 1 and 2. The tanks, which are riveted and calked, are supplied with eyebolts extending from the cover to the base, so that the transformers as a whole can be

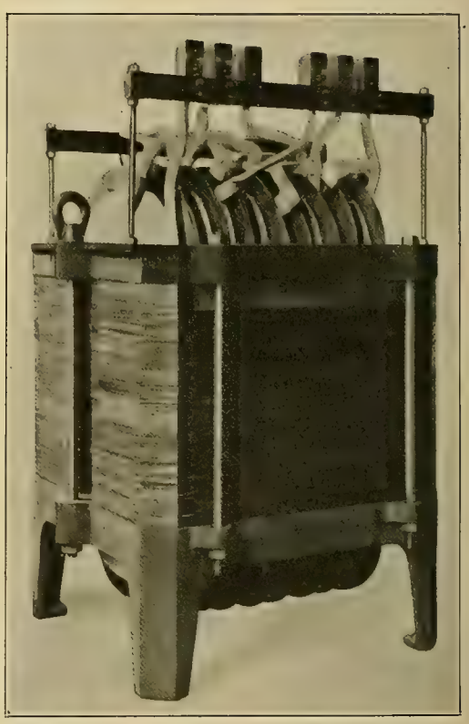


FIG. 3. CORE AND COILS OF 500-KILOWATT, 20,000-375-VOLT TRANSFORMER.

lifted without straining the tank. The cooling coils are made of 1¼-inch tubing, without joints throughout the portion immersed in the oil; all coils are tested with a water pressure of 200 pounds per square inch.

With coils constructed in the usual manner it is very difficult to drain all the water from them, and trouble has been caused in some cases by water freezing and bursting the pipe. This has usually occurred either during shipment or some time before the transformers have been placed in operation. In order to avoid this, and also the danger of condensation on exposed parts not covered by oil, the ends of the cooling coils in these transformers are brought out through stuffing boxes, arranged below the surface. The lower end is thus below the level of the lowest coil, so that all water can be easily drained off. The coils are permanently fastened to the case and are of such diameter that the transformer can be lifted out without disturbing the coils or water connections. Water-cooled transformers are supplied with an oil gauge, drain valve, and thermometer with contacts for an electric-alarm attachment that gives a signal in case the temperature exceeds the allowable limit.

When the conductor is large, several strips are used in parallel and insulated from one another to prevent eddy currents. The coils are neatly and tightly bound with extra long linen tape, and no varnish or insulating compounds are used on the windings. Such materials deteriorate with continued use in hot oil, and in many cases are the

cause of a deposit on the water-cooling coils or on the bottom of the transformer.

The transformer core is built up of selected sheet steel, 0.014 inch thick. The steel is the best obtainable and is thoroughly annealed, thus insuring uniform material and excellent magnetic qualities. Fig. 3 shows the core and coils of a 500-kilowatt transformer. The laminations are thoroughly insulated from one another by a coating of varnish, which reduces the eddy current loss to a minimum. The steel is of such good quality that it is practically non-ageing, i. e., the core loss does not appreciably increase under long-continued operation. There is no steel which will not age slightly when subjected to temperatures above 75 degrees C., but with normal load and temperature the core loss in these transformers is guaranteed not to increase, within one year, to such an extent as to decrease the full-load efficiency more than one-tenth of one per cent.

Automatic Control for Motors.

The accompanying illustrations show a new adaptation of the unit system for the automatic or remote

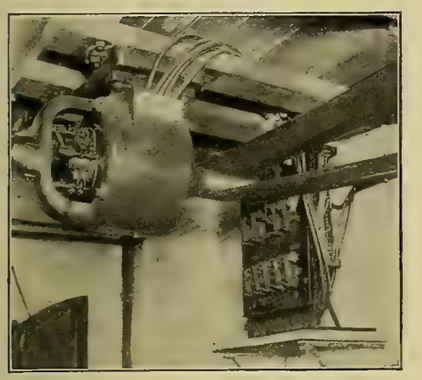


FIG. 1. ELEVATOR CONTROLLER ON SIDEWALL.

control of electric motors. Fig. 1 is an elevator controller fastened to the side wall, securing a great economy in space. The peculiar feature of this type of apparatus is the absence of solenoids, dash pots, cylinders, etc. As explained by the manufacturer, the New York Electric Controller Company of New York city, all mechanism that has given trouble has been eliminated. The controlling unit is of a most ingenious but simple design, consisting of a shunt magnet requiring approximately 0.1 ampere to operate, with a metal rocker arm. The actuating current is taken across the armature of the motor, so that the motor actually regulates the closing of the device, the time being in proportion to the increase of the counter electromotive force. The reversing switch is of equally simple form,

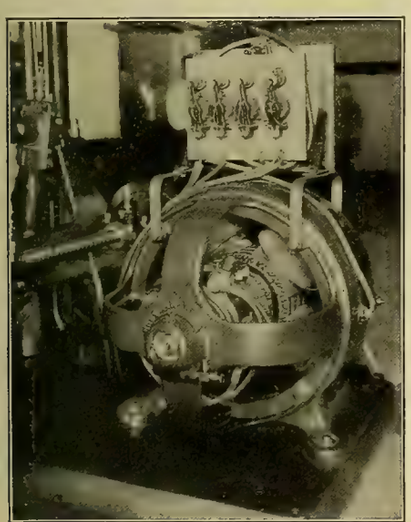


FIG. 2. MOTOR STARTER ATTACHED TO MOTOR FRAME.

and the main switch has a positive dynamic brake. In fact, a single panel contains all the essential mechanism for complete control of the motor.

Fig. 2 is a motor starter of the same unit type fastened direct to the motor frame. The operation is equally positive and the possibility of this apparatus getting out of order seems practically nil.

Lewis Institute of Chicago has just completed 10 years of educational work. Vol. V., No. 1 of the Institute bulletin has just been published and contains some interesting information about the school, which is a polytechnic institute for both sexes, giving instruction in general and technical studies covering the usual college and high school periods. The courses are grouped into three main divisions—engineering and the mechanic arts; general science, including domestic economy, and the liberal arts.

Ohio Telephone Notes.

Ohio telephone men are greatly interested in the merger effected by the American Union Telephone Company a short time since, because it embraces traffic arrangements with the United States Telephone Company, and at the same time some of its branches reach Youngstown and other points in the state. Because of the wide extent of the merger, long-distance facilities in this state will be greatly facilitated. The new company will pay special attention to this branch of the business and it will give Ohio better connections with cities in the states of New York, Pennsylvania, Virginia, West Virginia and Maryland, including Baltimore. The merger includes a score or more companies located in towns in all these states, with traffic agreements with companies in all the large cities, so that the possibilities for development in the East are now practically unlimited. It will enter into competition for long-distance business. H. Prentiss Taylor of H. P. Taylor & Co., Pittsburg, was the leading figure in the consummation of the merger.

The annual meeting of District No. 1 of the Ohio Independent Telephone Association was held in the Electric Building, Cleveland, Tuesday, there being 50 members present. Frank L. Beam and J. S. Brailey, Jr., made addresses. Mr. Beam confined his remarks to the conditions existing in Ohio, showing that they were very satisfactory in every way, while Mr. Brailey spoke of the method of financing companies. Others who made short talks were Dwight E. Sapp of Mt. Vernon; E. B. Fisher, president of the Michigan association; C. E. Tarte, general manager of the Citizens Telephone Company, Grand Rapids; C. Y. McVey, head of the operating department of the United States and Cuyahoga Telephone companies, and E. U. Hyde of Warren, Ohio. The reports of committees showed that much work had been done along the line of standardization in the different departments. They also showed that great improvements had been made in the long-distance service during the last year, an increase of 50 per cent. in efficiency being shown. Even greater improvements have been promised for the future. The other district meetings will take place during the month and the early part of November.

The Cincinnati and Suburban Bell Telephone Company is contemplating the erection of a new building for the accommodation of its West Exchange. The old building has been in use 20 years and is out of date.

A franchise has been granted the Central Union Telephone Company at Coal Grove, a suburb of Ironton. The company will at once build an exchange there.

The Morgan County Telephone Company of Stockport has been incorporated with a capital stock of $5,000 by Charles D. Mosher and others.

A toll circuit will be built from Norwalk to Olena, arrangements to that end having just been completed between the Local Telephone Company of Norwalk and the Olena Telephone Company.

For the purpose of reducing its floating debt the Cuyahoga Telephone Company has, through the Ohio telephone syndicate, disposed of $100,000 preferred stock. About the same amount remains and this can be sold at any time that additional funds are needed.

At the last meeting of the board of directors of the Citizens' Telephone Company of Columbus several matters of importance were taken up, but no action was taken on the proposed increase in rates.

C.

Indiana Telephone Items.

Ground has been broken for the construction of a new telephone-exchange building in Richmond for the Home Telephone Company. The City Council of Richmond has passed an ordinance requiring that all telephone, telegraph and light companies put their wires under ground in a prescribed section of the city. This ordinance will likely provoke some extensive litigation, since the Bell company is going ahead with the reconstruction of its overhead system, claiming that its charter provides for an overhead system.

The Citizens' Telephone Company of Terre Haute has cut over its lines to the new exchange recently installed with a full central-energy multiple board. The new plant is regarded as the most modern and up-to-date plant in the state, its capacity being for 5,000 telephones.

C. L. Fisher of Chicago, who is interested in the manufacture and installation of automatic telephone systems, was in the state during the last week and attended the Marion convention. Mr. Fisher is of the opinion that ultimately all the telephone plants of the country will adopt the automatic system.

Preparation is being made by the Indianapolis Telephone Company for another effort to increase the rate for telephone service. The company points out the fact that every telephone added to the system increases the value of the service to each user, and therefore it is inequitable to compel the company to furnish a service at a less price to a large number of patrons while the Bell company is permitted to charge a greater rate for a service to a much less number of people.

An important damage suit is to be tried against the Central Energy Telephone Company of Frankfort next week. The plaintiff is suing for $10,000 for the death of his wife, occasioned by a current of electricity while attempting to use the telephone. The case will be watched with considerable interest by the telephone people throughout the state. S.

Telephone News from the Northwest.

There is some talk of the city engineer of St. Paul being directed to remove telephone poles from the streets where the companies have failed to comply with orders of the Council to this effect. The corporation attorney says that the law is explicit and the courts have upheld it.

The Pomona Valley Telephone Company succeeds to the Edgeley Electric Telephone Company at Edgeley, N. D., and will enlarge and improve the system.

The Cannon Valley Telephone Company of Waterville, Minn., will increase its capital stock from $50,000 to $100,000 and will make extensions of its lines.

Dr. E. E. Ankes and others have incorporated as the Cortland (Neb.) Telephone Company, with a capital of $2,240.

The Central Telephone Company will erect a fireproof exchange building at Rockwell City, Iowa. It will be two stories, 40x40.

The Iowa Telephone Company has decided to rebuild the exchange at Decorah, Iowa, at once.

The Martin Telephone Company of Webster City, Iowa, has filed articles of incorporation with a capitalization of $2,000,000. R.

Indiana District Telephone Meeting.

The first Fall meeting of the Fifth District of the Indiana Telephone Association was held in Marion on October 17th. N. J. Brown, vice-president, presided. A. C. Lindermuth of Richmond, president of the state association, made a very encouraging talk on the telephone outlook. "County Organization" was discussed by J. A. Brown of Winchester, followed by discussion that brought out numerous suggestions calculated to better local conditions and interest the managers of all the companies in the entire district.

Theodore Thorward, first vice-president of the state association, gave a very interesting talk concerning the "South Bend experiment." Mr. Thorward was asked a number of questions relative to the successful operation of the automatic system in South Bend, and the prospect of further operating arrangement between the companies of that locality. This subject was followed by an interesting address by Chas. S. Norton of Indianapolis, on state organization. Mr. Norton said that the Independent telephone companies had made great progress during the past year and claimed that the prospects for the coming year were flattering in the extreme. Mr. O. L. Barger, replying to Mr. Norton's talk, said that the Citizens' Automatic Company was making rapid progress toward the construction and installation of a new automatic plant in Marion, and he thought that within a short time there would be no need of any Independent company to depend upon the Bell for toll-line connection.

The meeting was of considerable significance because of the efforts being put forth to reclaim this territory. A resolution was passed to the effect that all Independent companies should remain aloof from any connection with the Bell. Twenty-six companies were represented in the convention and the representatives propounded a number of important questions for consideration. Among them was, "What action is possible for the release of telephone companies whose service is greatly impaired by high-voltage trolley lines in the same location?" It was decided to resort to the courts to find out what priority rights telephone companies had, and if necessary carry the matter to the next legislature.

Virginia Independent Telephone Association.

At a meeting of Independent telephone companies of Virginia, held in Richmond a few days ago, the organization of the Virginia State Independent Telephone Association was perfected. Independent companies from all parts of the state were represented. The association will be affiliated with the International Independent Telephone Association. The following-named officers were elected for the ensuing year: President, Albert Parlett, Bristol; first vice-president, F. F. Marbury, Alexandria; second vice-president, W. N. McAnge, Suffolk.

A constitution and by-laws were adopted, and the report of the committee on credentials showed that companies operating over 10,000 telephones were represented as follows:

Capital City Telephone Company, F. F. Marbury, Alexandria; Farmers' Mutual Telephone Company of Albemarle, T. E. Powers; Southern States Telephone Company, G. L. Hadyn, Norfolk; Bristol Telephone Company, Albert Parlett, Bristol; West Halifax Telephone Company, Mr. Ingram; Franklin County Telephone Company, B. L. Fisher, Rocky Mount; Chuckatuck Telephone Company, George W. Watts, Suffolk; Harrisonburg Mutual Telephone Company, W. C. Switzer, Harrisonburg; Nansemond Telephone Company, W. N. McAnge, Suffolk; Rockingham Mutual Telephone Company, W. C. Switzer, Harrisonburg; Floyd County Telephone County, B. L. Fisher, Floyd Courthouse.

CORRESPONDENCE.

Continental Europe.

Paris, October 10.—Among the recent developments of electric traction in France I may mention that at the last meeting of the Municipal Council of Bordeaux it was decided to extend a number of the lines in that city, and to lay new sections of track, in order to keep pace with the increase of traffic. Another interurban tramway system has been decided upon by the Municipal Council of Beauvais. One of the lines is to run from the city to Froissy and Breteuil, and a second line will run to Bresles and Lafraye.

The Societe Lyonnaise des Forces Motrices du Rhone, which has been in operation for some years past and controls a large hydraulic plant on that river, with an extensive set of lines for supplying the region of Lyons, had its annual meeting not long since, and according to the report, is in a flourishing condition. The main hydraulic plant at Cusset is operating well, and while supplying a large amount of current, is not yet worked up to its full capacity. At present there are some 270 miles of lines in operation on the whole system, and the subscribers are using light to the amount of 201,887 10-candlepower lamps, and for motors 16,532 horsepower.

The new electric-railway line which runs from Bonn to Cologne has now been opened for traffic over most of the way. One novel feature of the line is that it uses direct current at 990 volts on the motors. The road follows the left bank of the Rhine in general. Four motor cars make up the standard train, and it carries 250 passengers. Each motor car is equipped with two 130-horsepower motors of the four-pole type. The total length of the road is about 10 miles, and a generating plant located at a central position in Wessling furnishes the current. A double trolley line with rail return is used here. It is expected to handle a large freight traffic on the new line, and to this end a freight depot has been built at each of the stations on the road. I expect to give a more complete description of this system in the near future.

At Brussels has been established a museum-laboratory which is designed mainly for electrical work. It is entirely new, and is due to a donation made by Robert Goldschmidt. A novelty lies in the fact that the apparatus can be used by the public for making investigations and experiments. Four great halls contain all kinds of dynamos and electrical apparatus, and there is a lecture hall and extensive technical library. Two permanent professors are attached to the establishment. This institution is intended to popularize electrical work.

A. de C.

Great Britain.

London, October 10.—The new municipal electric-supply works at Birmingham will be opened to-day, and so disappears altogether another of the original electric-supply companies of the United Kingdom, viz., the Birmingham Electric Supply Company. As a matter of fact, the company's undertaking was acquired some time ago, but the old station has been running since, the new works now opened having been erected in the meantime. The old company started some 15 years ago, and the works now contain specimens of most types of reciprocating engines, as well as Parsons turbines. In those days Birmingham streets were famous for containing a regular museum of traction systems—horse, steam, cable and electric. The latter, however, was a short length of accumulator tramway. Thus the electric-supply works had nothing to do with it, and the undertaking existed solely for lighting and motor purposes. The new municipal works, however, have been designed as a combined lighting and traction station, and already there are some overhead trolley lines in operation for which hitherto the energy has been purchased from a neighboring local authority. It is also the intention of the corporation to acquire, as they fall in under the terms of the tramway acts, the undertakings of the several tramway companies which have been installed in Birmingham from the early eighties, so that in a few years' time Birmingham will rank on a par with the other large municipal towns in owning the whole of the public services relating to electric supply and tramways.

Some time ago I mentioned that the Poplar (London) Borough Council Public Health Department was experimenting with a system of manufacturing a disinfectant by means of the electrolysis of sea water. It is now stated by the department that this has been successfully established on a permanent basis. The view of the medical officer for health is that the system adopted will result in a great saving to the ratepayers compared with the cost of present disinfectants. The plant installed for the experimental work gave a strength of one gramme per litre, but it was considered more economical to have an installation which would give two grammes of chlorine per litre (which is the strength of hermitine) and which could be diluted. The system is the Hermite process, and the solution recommended by the makers is: Water, 1,000 litres; ordinary salt, 40 kilos; chloride of magnesium, 10 kilos. The strength calculated for deodorizing sewage is one-half gramme of chlorine per litre, but the two-gramme plant was recommended for reasons of capital economy.

With the experience of Glasgow and Brighton in mind, no doubt, a feeling of unrest seems to be pervading the minds of the members of the Hull Corporation telephone committee, and an instruction was moved at a recent meeting that negotiations for the sale of the undertaking be entered with the postmaster-general. The matter has yet to be discussed by the corporation.

A tramway journey occupying five hours constitutes a record of its kind for Great Britain. Such a ride is now possible upon the lines of the South Lancashire Tramway Company, Manchester and Liverpool having been put in direct tramway communication.

Once again are the various electric-supply authorities in London marshaling their forces with a view to united action against the anticipated electric power schemes in the next session of Parliament, notices for which will soon be deposited. A reflection of some interest is that the initiative, as in previous sessions, has been taken by the municipalities, and except on one occasion, they have never been sufficiently united to make one combined opposition.

There is considerable activity in labor circles at present in attempts to secure better terms of pay, and the electrical industry has its own "affaire." This particular case, which is at the works of the Brush company at Loughborough, throws an interesting side light upon the social problem which so many electrical firms are attempting to solve by removing their works from crowded cities into the country. A part of this proposition, of course, is that the workmen should be content to accept a somewhat lower wage in return for the better health conditions and cheaper living which obtains away from the large towns. In the case of the Brush company's employes, or rather their tramcar railway coach builders, having obtained these conditions, the effort is now made to force up the rate of wages to the level of those in the cities. Obviously, they cannot have it both ways, and the company is to be commended upon its decision not to give way. When large corporations, however, stoop to allowing such disputes to stand between the manufacturers and the orders which they give out, as is possible here, manufacturers will have to think out drastic measures for self-protection. As a matter of fact, the Brush company pays a higher wage for the work done than is usual in neighboring counties.

G.

Dominion of Canada.

Ottawa, October 21.—Hon. Adam Beck, chairman of the Ontario Hydro-electric Power Commission, states that the applications for electric power totaled considerably more than the amount which the commission gave as an estimate. So far applications have been received for about 68,000 horsepower, while the estimate was for 60,000 horsepower. A larger number of municipalities than was expected are wanting power.

A report has just been made to the civic authorities of Montreal showing the total annual earnings of the street-railway company of that city, and the exact amount that the city is entitled to, in the way of percentage, from the company. It is shown in the report that the total earnings of the company for the year ended August last, were $2,645,000. Out of this there must go into the city treasury the sum of $177,000. For the first time the earnings of the railway company are such that it must pay as high as 12 per cent. on its earnings to the corporation.

The cities of Windsor, Kingsville, Leamington and Chatham, in the province of Ontario, will soon be linked by one of the most complete interurban roads on the continent. The Windsor, Essex and Lake Shore Railway Company has decided that the cost and operating expenses would be less, and cars could be run at higher speed, by the Westinghouse single-phase alternating-current system than by either steam or direct current. This new line will be equipped with the same type of apparatus as that designed by the Westinghouse company for the Grand Trunk Railway.

W.

New England.

Boston, October 20.—The Twin State Gas and Electric Company now controls electric-light plants in Dover, Rochester, Somersworth, Salmon Falls and Hinsdale, N. H., Berwick, North Berwick, South Berwick and Lebanon, Me., and Brattleboro, Vt., and the street railroads of the latter place, Dover, Rochester and Somersworth. It is understood that the company is planning to acquire control of 100 miles of electric railway in Maine. The National Light, Heat and Power Company of New York controls the Twin State Company, which was incorporated at Hartford, Conn., and has as president Harold G. Villard of New York. It is estimated that the companies now controlled by the Twin State Company have annual gross earnings of $210,000 and annual operating expenses of $119,000. The National Light, Heat and Power Company has a capital of $5,000,000.

The General Electric Company has reduced the working time of its Lynn, Mass., employes from 56 to 55 hours per week.

A round-trip daily electric-railway excursion from Providence to Boston and return was established on October 8th. The trip is made in one car, and only enough tickets to fill the seating capacity are sold. No one-way tickets are sold. The car seats 52 persons, and the running time is three hours and 35 minutes from Providence to Boston, and three hours and 40 minutes from Boston to Providence. The car runs over the tracks of the Rhode Island Traction Company, the Old Colony Street Railway Company and the Boston Elevated Railway Company.

The Boston aldermen having refused to grant the Boston Elevated Railway Company's petition for its proposed route for an elevated structure between the North Station and the Charles River—one Boston end of its Cambridge elevated railway—the company has appealed to the Massachusetts Railway Commissioners. The aldermen also refused the company's petition for an elevated station in Causeway Street, opposite the North Station.

In the Massachusetts Supreme Court States Attorney-general Malone has asked for an injunction preventing the direct or indirect subscriptions for stocks and bonds of domestic electric-railway companies by the New York, New Haven and Hartford Railroad Company. The attorney-general also asks for the dissolution of the Worcester and Webster and the Webster and Dudley Street Railway companies on the ground that they violated their charters by allowing their capital stocks to be acquired by the Consolidated Railway Company of Connecticut contrary to the corporation laws of the state. The injunction suit is based upon the charge that the New York, New Haven and Hartford Company has taken and held stock, dividends and bonds and has guaranteed the payment of the bonds and dividends of the Worcester and Southbridge, the Worcester and Blackstone Valley, the Worcester and Webster, the Webster and Dudley, the Berkshire and the Springfield Street Railway companies, without authority under its charter or the laws of the state. It will be remembered that the railroad company recently announced that it had disposed of all its interests in Massachusetts electric railways. It is not known what effect that will have upon the attorney-general's suits.

The corporation of the Institute of Technology held its October meeting last week, when the committee on new sites announced that it expected to be ready to report on October 23d. Frederick P. Fish was re-elected a member of the board to serve five years. The corporation approved the appointments of Prof. D. C. Jackson and Prof. G. C. Sinaad.

The Illuminating Engineering Society held its first fall meeting at the American House in Boston on October 15th. Dr. Bell and Dr. Charles Williams discussed the art of illumination. Dr. Williams said that the modern tendency is to have too much light and too much intensity; that too much light and light not properly shaded and diffused hurt the eyes, and that a shaded or screened light is very desirable both artistically and physically.

The municipal gas and electric-light departments of Holyoke, Mass., will reduce the price of gas to $1 per 1,000 cubic feet on December 1st, making a net decrease of 35 cents since the department was established. Advocates of municipal ownership will use this as an argument in their favor.

The New England Telephone and Telegraph Company has obtained control of the People's Telephone Company of Haverhill, Mass.

The Southbridge (Mass.) Gas and Electric Company's stock has been transferred to Drury & Bonney of Worcester, Mass., who represent people interested in the Webster (Mass.) Electric Company.

The Newton and Watertown Gas Light Company has contracted to furnish the city of Newton, Mass., with arc street lights at $90 each per year, and incandescent electric street lights at $14.50 each per year for a period of five years. This is a reduction of $10 each on the arc lights and of $2 each on the incandescent lights.

B.

New York.

New York, October 20.—The Edison storage battery is attracting renewed newspaper attention. Mr. Edison is said to have worked out a cheap battery, and it is declared that he will be able in six months to put on the market a new cell which "will enable any man to travel in his own private carriage at about the cost of carfare." According to the papers two factories are to be erected for the manufacture of the new batteries into the design of which cobalt will enter largely. The new battery is expected to solve the problem of congested traffic in that it is light and cheap; an outfit which will cost $200 will, it is said, last 15 years.

In a decision by Eugene G. Hay, the Board of United States General Appraisers overruled on Thursday a protest filed by the Safety Insulated Wire and Cable Company of this city, it being held that cottonseed pitch used in connection with insulating cables for electrical purposes must pay duty at the rate of 20 per cent. The importing firm made several claims for exemption from duty and two claims for assessment at the rate of 10 per cent. The Board holds that Collector Stranahan's assessment under the provision in the tariff for non-enumerated manufactured articles will stand.

The Board of Estimate yesterday postponed ac-

tion on all telephone franchise applications until November 2d.

The State Board of Railroad Commissioners has called the attention of all steam railroads to the necessity of operating trains under some form of block signal system to prevent collisions. This can be done, it says, by the manual controlled system, the automatic electrical block system, or the telegraph block system. If, owing to the volume of traffic, the telegraph stations as they are now located are too far apart to properly handle the business by the telegraph block system, intermediate blocks can be established. In the automatic electrical block system the blocks can be established of any desired length. The same is true of the manual controlled system.

The Appellate Division of the Supreme Court entered orders yesterday confirming the favorable reports of the commissioners appointed to report upon six different rapid-transit routes. The routes are known as the Fourteenth Street, Thirty-fourth Street, Third Avenue, Lexington Avenue, Seventh and Eighth avenues, and Gerard Avenue routes.

The Business Men's League of Brooklyn has decided that if the rapid transit commission will not make the contractor who is building the Brooklyn subway live up to the terms of his contract, Governor Higgins will be asked to cause the commissioners to remove the present engineers and to appoint others who will be more interested in the people's service. If Governor Higgins will do nothing, Mr. Hughes and Mr. Hearst will be asked to pledge themselves to remedy conditions along the route of the subway, particularly in Fulton Street, where they are said to be intolerable to the merchants doing business there. C. I. C.

Southeastern States.

Charlotte, N. C., October 20.—The town of Lynchburg, Va., will soon have ready for distribution complete plans of the proposed municipal electric-light plant. The City Council proposes, if the plant is installed, to use a part of the present pumping station, and, with the gravity system in operation, it will require only the machinery to have everything ready for supplying the electric current.

Final arrangements have been made and contract will soon be signed for the use of power from the Southern Power Company by various manufactories of Statesville, N. C. The minimum amount the town is asked to take is 1,000 horsepower, the city itself being responsible for the subletting of 500 horsepower, part of which will likely be used by the city.

An interesting innovation is being made at Pinners Point and Lamberts Point, Va., by which electric lights are used by fishermen in catching large quantities of trout and other fish by night.

The Maryland Electric Railways Company and the United Railways and Electric Company of Baltimore have signed an agreement and lease by which the United becomes possessor of the Maryland company. The deed of trust from the two electrical companies to the Mercantile Trust and Deposit Company was also placed on record at Baltimore.

In Richmond, Va., the question of city lighting is still one of vital interest, and another fight has been precipitated in lighting committee without definite results.

The Mussel Shoals Hydro-power Company has has been chartered at Montgomery, Ala., with a capital stock of $1,000,000, and will develop an immense power at the shoals named, on Tennessee River, in Colbert County, Ala. New York, Montgomery and Nashville capital is interested.

E. F. Peckham and associates have filed papers for incorporating the Current Motor Company of Georgia, with $1,000,000 capital. The company will equip and operate water and light plants and deal in electrical appliances.

The Consolidated Railways Company of Wilmington, N. C., reports that nearly 300,000 passengers were handled during the summer just passed, and that this is 30,000 in excess of the figures of the year before for the same period. L.

Ohio.

Cleveland, October 20.—The deal by which the Northern Ohio Traction and Light Company secured the Canton-Akron properties was formally consummated Tuesday, when deeds were filed simultaneously in all the counties through which the lines pass. The properties of the Canton-Akron Railroad Company, the Canton-New Philadelphia Railroad Company and the Tuscarawas Traction Company were transferred to the Canton-Akron Consolidated Railway Company, and in turn they were transferred from it to the Northern Ohio Traction and Light Company. Mortgages were made to the Citizens' Savings and Trust Company of Cleveland, and S. Reed Anthony, trustee. J. R. Nutt of this bank is treasurer of the Northern Ohio Traction and Light Company. The offices of the Canton-Akron lines will be moved to Akron, and J. R. Harrigan, who has been manager of the roads, will be retained as superintendent of that division.

Mayor Johnson's deposition in the injunction proceedings of the Cleveland Electric Railway Company against the Forest City Railway Company and the city was of rather a sensational nature. Going on the charge that the mayor is financially interested in the new company, the attorneys pressed him for the amount he had made himself liable for the new company. He answered that he did not know just what his liability is, but that he considered himself morally bound to make good every dollar's loss to creditors, stockholders and property owners of the company and that he stood ready to execute legal documents binding himself to guarantee every obligation of the Forest City Railway Company. He said that the guarantee now amounts to something like $400,000.

A few days ago the Cleveland Electric Railway Company informed its employes that if the majority of them wanted a union that it might be formed and that the company would recognize the organization. The president has been notified that the question was put to a vote of the employes and that a majority favor the union. The committee that made the report states that the company has made some stipulations upon which it wants the men to vote. These include a scale of wages and relief from recognizing the national officers, as well as arbitration of differences. The organizers and agitators who have been in Cleveland for some time say they will fight if the union is not recognized just as they want it to be.

Owing to the desire of northern Ohio companies to secure an outlet to Columbus, the Columbus, Delaware and Marion line is becoming recognized as a key to the situation and its importance is thereby considerably enhanced. In fact, it not only occupies a position that will eventually make it a portion of a through line between Cleveland and Columbus, but Toledo and Columbus, as well, besides connecting up all the smaller towns reached by northern Ohio roads. J. G. Webb, president of the Columbus, Delaware and Marion, not long ago said that it would be but a short time until a passenger could travel from Buffalo to Louisville by trolley.

The Toledo Railways and Light Company has secured the contract for lighting the Toledo streets for 10 years at $45 per lamp. It is said the city will save $50,000 a year over former contracts.

Four Cleveland men, Alfred Shaw, M. J. O'Donnell, F. J. Welch and J. W. Moore, have applied to the City Council of Marion for a franchise to build a lighting and power plant costing $150,000 and to operate a conduit system.

The Columbus City Council has passed an ordinance providing for the issue of $140,000 bonds for the light plant. Of this, $90,000 will be spent for plant and $50,000 for the purpose of taking up defective bonds which the sinking-fund commission was unable to sell. The plan to employ an expert to suggest the needs of the plant and plan for future improvements was defeated.

In an election a few days ago the people of Lakewood defeated the proposition to issue $25,000 bonds for repairing and improving the municipal light plant.

Perry Chubb of Cleveland has been awarded the contract for building a concrete power house at West Point for the Youngstown and Ohio River Railway Company. It is said that this will be the only exclusively concrete power house in the state. O. M. C.

Michigan.

Grand Rapids, October 20.—P. C. Miller of the National Electric Company has gone to Fosterville, Wis., where he will install a lighting plant. The company has just installed a 350-light plant at Middleville for the Thornapple Knitting Company and is putting in the electrical equipment for the Oliver Machinery Company of this city.

The Electric Land and Development Company of Traverse City has been granted a franchise to build a dam in Wexford County, 10 miles from Sherman, on the Manistee River. The company controls three dam sites on the Manistee River and announces that it can furnish 15,000 horsepower for Cadillac, Traverse City and intervening towns. The Wexford County dam is to generate 5,000 horsepower and the other dams will be in Missauke and Kalkaska County.

A company has been organized in Chicago which proposes to build the Trans-Michigan street railway from Allegan to South Haven. The promoters are John Hensel, F. B. Kamarks, John Klein and Tony Samp.

E. E. Trowbridge of Chicago and Detroit is promoting an electric road from Muskegon to Ludington to pass through Hart and Pentwater. The estimated cost is $2,500,000. He plans to acquire the rights of the company in which Ex-senator Flood of Hart is interested.

J. A. Thick of Detroit is working to secure the last four miles of right-of-way for the road he proposes to build between Lansing and Saginaw. He expects a company will soon be organized to build the road.

The Detroit, Monroe and Toledo Short Line has acquired property for a private right-of-way through the city of Monroe. A passenger and freight depot and lunch room will be built.

The Tamarack mine at Houghton has arranged to install a 150-horsepower electric plant to experiment in the use of electricity for power transmission and other mine work.

The city of South Haven is considering the expenditure of $17,000 in repairing and extending its lighting plant. L. W. B.

Indiana.

Indianapolis, October 20.—The City Council of Fortville has granted a franchise to the Capital Circuit Traction Company for a right-of-way through the city.

A large number of the steam roads in Indiana have reduced the fare to two cents a mile, and there is considerable speculation as to what effect it will have on the electric lines. It is thought the electric roads will meet the cut immediately by eliminating the excess charge for limited service.

The St. Joe Valley Line is being pushed east from LaGrange, and the grading and track laying is being advanced rapidly with the hope of reaching Orland within a short time. The company hopes to connect with the Toledo and Western, now operating a line from Toledo to Montpelier, the plan being for each company to build to Angola and there to connect.

Engineers have been over the route and set stakes for the construction of the Toledo and Chicago Electric Railway from Bryan, Ohio, to Kendallville, Ind. The link between Bryan and Kendallville will make a good feeder for the main line of the Lake Shore, both east and west. The company will next build on to Goshen, connecting with all interurban lines centering in that place, thereby making a complete system of trolley lines to all points east, west, north and south.

The government officials have received a large number of applications from persons who wish to take the examination for electrical engineers to be held in Indianapolis November 20th, 21st and 22d.

The city of Crawfordsville is wrestling with the labor question and is threatening to restore to the electric-light plant, owned by the city, the right to engage in the wiring and fixture business. This work has heretofore been done by private electricians, who are insisting that the city shall continue to permit this work being done by private interests.

Tangible evidence of marked progress in the construction of the electric incandescent lamp which will do for electric lighting practically what the Welsbach gas burner has done for gas lighting, will be given Indianapolis residents in a short time. The tantalum electric incandescent lamp, which will give a 25-candlepower light from the same current now required to get a 16-candlepower light, and which will soon be available for general use in Indianapolis, will be the first step in the direction of more efficient electric lighting. The Indianapolis Light and Heat Company has ordered a supply of tantalum lamps to be installed in a few days.

Articles of incorporation have been filed with the secretary of state by the Washington Motor Car Company of Washington, Ind. The capital stock is $150,000. The board of directors is headed by Frank W. Fowler. The company proposes to establish and equip a plant to do a general motor car and supply manufacturing business.

The Monarch Iron Works of Plymouth has incorporated with a capital of $50,000 to construct and equip a plant to do a general foundry, electrical machinery and mechanical engineering business. James B. Beattie is president and Chas. A. Johnson secretary.

The Rose Gear and Tool Company of Lafayette, capitalized at $50,000, has incorporated to establish a plant for the manufacture of gearing and other parts of motor cars, and the manufacture of all kinds of tools. William Rose is president and D. E. Rose secretary.

The New Castle Electric Sign Company of New Castle, capitalized at $20,000, will establish a plant to manufacture electric signs and electric advertising devices. William H. Alford, James M. Dumis and H. W. Bolsen are directors. S. S.

Illinois.

Peoria, October 20.—The Grange Telephone Company and the Western Telephone Company at Macomb, Ill., have consolidated to fight the Mutual Telephone Company, and the lines will now be operated from the one board.

W. B. McDonald, general manager of the Evansville Gas and Electric Company was a visitor in Peoria this week. He came to confer with John A. Radford, who is consulting engineer of the Illinois Traction Company's new power house.

The Alton Construction Company of Alton has been incorporated with a capital of $1,000 to furnish public utilities. Incorporators are Robert Curdie, H. H. Ferguson and Henry S. Baker.

The Springfield Gas Light Company will build a new gas plant at Springfield, together with a million-foot gas holder. The improvements will cost $75,000.

The Peoria Gas and Electric Company will ask for a new franchise from the city council. In return it agrees to place wires underground in the central portion of the city and make the price of gas 90 cents a thousand.

The Illinois Traction Company will put on a limited service between Decatur and Bloomington next

month. The cars will make the run from Decatur to Bloomington in one hour and 45 minutes. The present time is scheduled at three hours, but they make it in two hours and 45 minutes.

The Peoria School Board has decided to place a telephone in each school house and establish an exchange at the office of the superintendent.

The company will have its cars into East St. Louis by November 1st, and all their cars will make the loop. For the present the cars go as far as the Alton cars and passengers will be transferred across the Baltimore and Ohio and Vandalia track to East St. Louis cars. Permission to use Thirteenth Street was given by an ordinance passed at the council meeting October 8th, which is so worded that the East St. Louis and Suburban Railway Company has permission to handle cars of other lines. The Illinois Traction Company has a contract which gives it the right to run on any rails owned by the East St. Louis Company.

If the Terminal Company ever allows the Suburbans cars to come over the Eads bridge, the Traction Company will also be entitled to this right under the terms of its contract. Those who are interested hope to see the Corn Belt Limited land passengers from Springfield, Decatur, Peoria and other up-state cities at Third and Washington avenues, St. Louis. Cars of the Traction company will use the Alton lines from Granite City into East St. Louis. The present terminal facilities at Venice will be used for freight and express principally.

The property owners in St. Louis are protesting against the use of the streets by the Illinois Traction Company. They want the service afforded by the traction company, but do not want to allow the company to use the streets. At a recent conference between the railroad committee of the St. Louis council and representatives of the company and prominent shippers of St. Louis the shippers made a plea for the line on account of the direct connections to all the large cities up state. The committee took the arguments under advisement.

J. N. C. Shumway, who is president of the Illinois State Electric Association, was re-elected president of the Building Association League of Illinois which closed its annual meeting here this week. V. N.

Mexico.

Mexico City, Mexico, October 14.—The utilization of the abundant water falls in Mexico for the generation of electrical energy which is, in most instances, transmitted considerable distances and used in the operation of mines and industrial plants, continues to show wonderful development.

Julio Pinal of Mexico City has made application to the federal government for a concession to install a hydro-electric plant on the Actopam River, in the state of Vera Cruz. He will build transmission lines to towns and industrial centers in that region.

Engineers recently completed the preliminary survey for a roposed hydro-electric plant which is to be installed at the Tamasopa falls, in the state of San Luis Potosi. It is stated that a strong American company has been formed to put in this plant. The electric power will be transmitted to the city of San Luis Potosi and other important cities and towns of that part of Mexico. The name of the men interested in the enterprise have not been made public.

An electric transmission plant is to be installed on the Realito de Tubares River, in the district of Andres Del Rio, state of Chihuahua, by Lazaro B. Caballero. The waterfall of El Chorro is to be used for generating the electrical energy.

A hydro-electric plant is to be installed at a waterfall at Atotonilco, state of Jalisco, by M. P. Sheridan of Guadalajara and associates. The same persons also contemplate the installation of an electric-lighting plant at the town of Arandas. There is available waterpower at the latter place also.

The contract for installing the electric-light plant in the new passenger station which the Mexican International Railway Company is erecting at Monterey, Mexico, has been let to Van Voorish Bros. of Monterey. W. D. H.

PERSONAL.

John E. Sewell has resigned the presidency of the Waterbury and Woodbury Street Railway Company of Connecticut. He is general manager for the Connecticut Railway and Lighting Company.

T. J. Whitney has been made district manager for the Northwestern Telephone Exchange Company for the Fargo (N. D.) district. He succeeds C. E. Edwards, who becomes local manager of the St. Paul office.

B. C. Shippin, formerly district engineer for the Westinghouse Electric and Manufacturing Company in Baltimore, has been assigned to important work at the Helena Power and Transmission Company's plant, embodying the installation of apparatus at Butte, Canon Ferry, Hauser Lake and Anaconda. He will be succeeded at Baltimore by Mr. K. E. Sommer, who has been connected with the Westinghouse company for about 12 years.

Thomas W. Carroll of Chicago has been promoted from the position of assistant electrical engineer to that of superintendent of the first district, western division, of the Postal Telegraph-cable Company, with headquarters in Chicago, succeeding W. I. Capen, who takes Mr. Nally's place as general superintendent. Mr. Carroll was born at Cleveland, Ohio, January 22, 1871, and entered the employment of the Postal in Cleveland in 1888 and served in various capacities at Pittsburg, Albuquerque, N. M., and Denver. During this time he studied electricity, which led to his transfer to the electrical department in New York. In 1901 he was appointed assistant electrical engineer in Chicago and served to the time of his recent promotion.

Frank McMaster has resigned his position in the sales department of the Fort Wayne Electric Works, with headquarters at Fort Wayne, to accept with the Nernst Lamp Company the position of sales engineer for the lighting department. Mr. McMaster will be located in the company's general offices in Chicago. Mr. McMaster has a host of friends throughout the West; and it will be remembered, too, that it was he who years ago introduced the George Cutter specialties throughout the West and Northwest. He afterwards represented the Electric Appliance Company in the same territory. But during the last eight years he has done his best work in the central and western states in the interests of the Fort Wayne Electric Works.

William W. Kittleman, a young electrical engineer well known in Chicago and Detroit, died in the Adirondacks on October 23d from tuberculosis, resulting from an attack of typhoid. Mr. Kittleman was a graduate of the electrical-engineering department of the University of Michigan and about 30 years of age. In Chicago he was employed by the Western Electric Company, Commonwealth Electric Company and the General Electric Company. For a short time he was a member of the editorial staff of the Western Electrician. His most recent employment was in the Detroit office of the General Electric Company. Mr. Kittleman possessed a keen, active mind and an alert, pleasing personality. His untimely death is greatly regretted by his friends and acquaintances, by whom he was highly esteemed. It is of melancholy interest to record that he wrote a large portion of the series of articles on "The Small Central Station," running in the Western Electrician, and now nearly concluded.

Mr. Edward Schildhauer has resigned from the technical staff of the Chicago Edison Company to accept a position as assistant engineer with the Isthmian Canal Commission at Washington, D. C. In conjunction with one hydraulic engineer he will be immediately in charge of the design and construction of locks for the Panama Canal. He will pay particular attention to the mechanical and electrical equipment for operating the locks. Mr. Schildhauer graduated from the University of Wisconsin in electrical engineering in 1897. He was engaged for a time on street-railway work with J. G. White & Co., and entered the employment of the Chicago Edison Company in 1898. He has been an assistant to the electrical engineer, Mr. Peter Junkersfeld, during his entire service of eight years, beginning as a draftsman, advancing continually, and dring the last two years serving as engineer of electrical construction. He is by education, training and experience well fitted for his new duties, which he will assume on November 15th.

EDWARD SCHILDHAUER.

The executive committee of the Massachusetts Institute of Technology has formally invited Dr. Andrew Fleming West, dean of the Princeton University Graduate School, to become president of the Institute of Technology, vice Dr. Pritchett. The appointment is subject to confirmation by the entire corporation of the Institute. Dr. West was born in Allegheny, Pa., on May 17, 1853. He graduated from Princeton University in 1874 and has received the degrees of Doctor of Literature from Oxford University in England, Doctor of Laws from Lafayette College, and Doctor of Philosophy from Princeton. Since 1883 he has been professor of Latin at Princeton and he has been dean of the Graduate School since 1901. He is the author of a number of books on classical education and he has been in close touch with the Scientific School of Princeton, while not directly connected with the teaching of applied science. Dr. West has made a great reputation as a collector of funds in Princeton, the "Faculty Song" of the undergraduates mentioning him as "Andy Million West."

ELECTRIC LIGHTING.

The Holton (Kan.) electric-light plant has been destroyed by fire. The loss is $15,000, insurance $10,000.

The Guttenberg (Iowa) Electric Light and Power plant has changed hands, W. S. Horry of Niagara Falls, N. Y., having purchased same of Z. G. Houck. The plant will be enlarged and modern machinery installed.

The Squire Electric Company of Kansas City, Mo., has been incorporated with a capital stock of $10,000.

The Gowrie Lighting and Heating Company has been organized in Gowrie, Iowa, and will ask for a franchise.

The Citizens' Light and Power Company of Texarkana, Tex., has been incorporated with a capital stock of $50,000.

An electric-light and water-works plant will be erected at Brandon, Miss., at a cost of $25,000. Kirkpatrick & Johnson of Jackson are preparing plans.

The City Council of Falmouth, Ky., has granted a franchise for the erection of an electric-light and power plant, the franchise to be sold at public sale.

The Weatherford (Okla.) Light and Power Company has been incorporated with a capital stock of $10,000, for the purpose of erecting an electric-light and power plant. E. E. Balcomb, R. L. Cate, C. A. Galloway and others are the incorporators.

People of Columbus, Ohio, and visitors to the city were much surprised to see the beautiful change in the High Street electric arches, which was made in honor of the street and interurban railway men who were visiting Columbus last week. The lights were colored red, white and blue by E. W. Dolliver of Wheatland, Pa. Mr. Dolliver has a patented dye that he puts on the lights without removing them from the socket. The cost of coloring the lights was met by the Board of Trade.

The Boston Edison Company had its monthly dinner and meeting on Friday evening, October 12th, at which the guest and speaker of the evening was Mr. Van Rensselaer Lansingh, engineer and general manager of the Holophane Glass Company. Mr. Lansingh gave an informal talk on the general principles of illumination, with particular examples of different classes of lighting for houses, etc. Lantern slides were shown illustrating both good and bad features of the lighting of bedrooms, parlors, libraries, kitchens, etc. This was followed by a discussion of the merits and disadvantages of the latest forms of lamps, with the proper and correct reflectors especially designed for them. The lecture wound up with a discussion and criticism of the existing lighting of the desks, and with the offer of Mr. Hale, the general agent of the company, to authorize the funds to modernize the present installation.

ELECTRIC RAILWAYS.

The Philadelphia and Garrettford Street Railway Company will build another electric railway to connect Philadelphia and Media, Pa. A. Merritt Taylor is president of the concern.

The William H. Evers Engineering Company has been granted a franchise to build an electric railway from Tampa to Bartow, Fla. This line will also connect with Plant City, Mulberry and Lakeland.

The Louisville and Eastern Railway Company, Percival Moore, vice-president, will extend its electric line 46 miles from Beechwood Station, three and one-half miles east of the city limits, to Frankfort, by way of Shelbyville.

Members of the Common Council of Janesville, Wis., have passed the interurban franchise as asked for by H. H. Clough, D. McAllister and others of Chicago for the construction of the Janesville and Madison electric railway. This, it is said, assures through interurban service from Chicago to the Wisconsin capital.

PUBLICATIONS.

M. W. Dunton & Co., Providence, R. I., are mailing to all interested a neat little folder with samples of red rope paper, showing the sizes which they carry in stock for insulating purposes. This firm carries a large stock constantly on hand, in different widths and thicknesses.

Vol. IX. of the Transactions of the American Electrochemical Society is out, forming the usual excellent book. The 400 pages are devoted to the transactions at the ninth general meeting held in Ithaca, N. Y., May 1, 2 and 3, 1906. The society headquarters are at 39 South Tenth Street, Philadelphia.

The Joseph Dixon Crucible Company, Jersey City, N. J., publishes an interesting pamphlet on the subject of steam traps, being an illustrated description of the several varieties, with valuable suggestions by W. H. Wakeman, expert steam engineer and author of well-known books on steam engineering. Some steam users seem to think that a steam trap is only a luxury to be enjoyed by those who have expensive plants in operation and wish to show many extra appliances which might be dispensed with and not be missed. This is a great mistake, as a

trap is valuable according to the cost of fuel that must be burned to make the steam. This pamphlet is worth careful reading, for it is instructive as well as interesting.

A miniature magazine of "light" literature entitled Lux has made its appearance from the Nernst Lamp Company, Pittsburg. Vol. I., No. 1, is dated October. It contains some practical hints valuable to central-station men, storekeepers and all others having to do with lighting. By addressing the company, Garrison Place and Fayette Street, Pittsburg, readers can get their name on the mailing list.

Latest specialties of the H. T. Paiste Company, Philadelphia, are given attention in the October bulletin, No. 36, just issued by that company. Fielding receptacles and window lighting are given special attention, there being a number of good halftones to show the various applications of the different styles of receptacles. A few "Aleck" talks and a new price list on cartridge cut-outs complete the bulletin.

An attractive catalogue on engineering work has just been issued by the Wellman-Seaver-Morgan Company, Cleveland, Ohio. This company acts as consulting engineer in mechanical, civil, electrical, mining and hydraulic work and is thoroughly equipped to handle important work. The new catalogue has a large number of excellent illustrations showing some of the more important installations engineered by this company.

The Pacific Electric and Manufacturing Company of 1161 Howard Street, San Francisco, Cal., has issued a catalogue entitled "High-tension Switches," relating to its standard types of oil and air-brake switches, for use on lines of from 10 to 100 kilovolts. It is interesting to note that this company has acquired the right to manufacture under the designs and patents of Mr. F. G. Baum, the well-known power-transmission engineer. The insulation is furnished by bushings of special design fastened to the metal parts with a cement insoluble in oil, and all bearing surfaces for porcelain are so designed as to gain rigidity and security for the parts. While standard designs are listed, many conditions arise calling for special application, and suggestions or sketches will be furnished to meet such requirements.

TRADE NEWS.

Sealed proposals will be received at the office of the Supervising Architect, Treasury Department, Washington, D. C., until November 19th, for an electric passenger elevator in the post office and custom house at Burlington, Vt., in accordance with drawing and specification, copies of which may be obtained at the above office.

The National Metal Molding Company of Pittsburg, having purchased the entire assets, good-will, etc., of the Osburn Flexible Conduit Company, will hereafter control the manufacture and sale of Flexduct. In order better to serve customers all business pertaining to flexible and rigid conduit will be conducted from the headquarters of the company, Fulton Building, Pittsburg, where all communications should be addressed beginning November 1st.

The General Storage Battery Company, with offices at 42 Broadway, New York city, has increased its business to such an extent that it has been obliged to enlarge its present works at Boonton, N. J. Additional generating units are being installed, and the additional switchboard equipment consists of 21 generator and feeder panels. The new building which is being added will be a structure of five stories and basement, for which a separate power station will be erected.

Sealed proposals will be received at the office of the Board of Trustees, commissioners of waterworks, of the city of Cincinnati, Ohio, until November 2d, for furnishing and installing electric lighting, wiring, conduits and cables for buildings and grounds at the Eastern, or River, and the main pumping station, in accordance with specifications and detail drawings on file in the office of the chief engineer of the Board of Trustees. August Herrmann is president and Elmer G. Prior clerk.

BUSINESS.

On account of the rapidly increasing popularity of Franklin compressors, manufactured by the Chicago Pneumatic Tool Company, notwithstanding the fact that extensive improvements and additions were made to the Franklin plant the current year, the business has grown beyond its capacity and the company is now adding another 150 feet to its machine shop, which will increase the present capacity from 55 to 70 compressors per month.

Among the orders recently received by the Crocker-Wheeler Company are the names of customers who have been using Crocker-Wheeler electrical apparatus for the last 12 years. Here are some of them: Lake Shore and Michigan Southern Railway Company, Ashtabula, Ohio, generators; Columbia Chemical Company, Barberton, Ohio, generator; Republic Stamping and Enameling Company, Canton, Ohio, generator; Acme Wagon Company, York County, Pennsylvania, generator and motor; Pittsburg Steel and Construction Company, Economy, Pa., generator; United Drug Company, Boston, Mass., motors; Hirsh-Stein Company, Hammond, Ind., generator.

The Western Electric Company's Hawthorne Works have been most aggressive in securing contracts for heavy electrical machinery. The order recently taken from the Columbus and Hocking Valley Coal Company covers three 350-kilowatt, three-phase alternators operating at 150 revolutions per minute. These machines are to be direct-connected to gas engines and are guaranteed to run in parallel. This feature, of using gas engines and running the machines in parallel direct-connected, speaks well for the purchaser's confidence in the merits of the Western Electric Company's electrical and power apparatus. This same contract also covers two 50-kilowatt exciters operating at 225 revolutions per minute. These also are to be direct-connected to gas engines. The contract further comprehends a large switchboard, 800 kilowatts in transformer capacity, and 30 arc lamps. The Western Electric Company secured this contract only after a "hot" contest.

ILLUSTRATED ELECTRICAL PATENT RECORD.

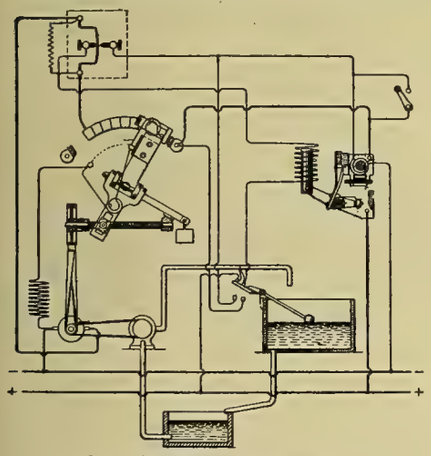
Issued (United States Patent Office) October 16, 1906.

833,152. Circuit Closer. Walter B. Bielak, Gresham, and Barney W. Belock, Cleveland, Ohio. Application filed July 14, 1906.

A metal pin projects through a slot in the top of a track rail. The pin, upon being actuated by a car wheel, closes the circuit of a signal system.

833,159. Relay Attachment and Alarm for Telephone Systems. Charles A. England, Van Meter, Iowa. Application filed November 13, 1905.

A pair of arms, each having a vertical portion, are arranged one in advance of the other and normally out of engagement with one another. A member engages the outermost of the arms.



NO. 833,178.—MEANS FOR OPENING AND CLOSING ELECTRIC CIRCUITS.

833,169. Magnetic Ore Separator. Camden E. Knowles, Joplin, Mo., assignor of three-fourths to G. B. Young, George T. Cooley and Guy H. Elmore, Joplin, Mo., and W. E. Brinkerhoff, E. O'Keefe and Joseph Herrin, Carthage, Mo. Application filed December 5, 1901.

In a magnetic separator magnetic surfaces converge from the feed to the discharge end, thereby constituting a magnetic field; a feeder passes through the field and is adapted to deliver the ore in proximity to one of the surfaces; means are provided for agitating the feeder, thereby stratifying the ores in the order of their magnetic susceptibilities; a carrier is provided with one or more secondary magnets, traveling between the surface and the feeder, adapted to collect the magnetic particles as they pass through the field and to discharge them as they pass beyond the field.

833,178. Means for Opening and Closing Electrical Circuits. Gustaf Rennerfelt, Scranton, Pa. Application filed June 11, 1904.

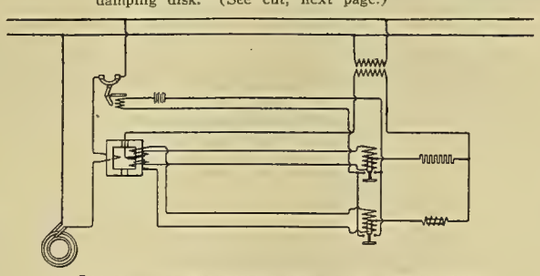
In an electric circuit, including a motor, are a contact block, a switch arm, a magnet for moving the arm into contact with the block, means for energizing the magnet and automatic means for gradually decreasing to zero the current in the magnet. (See cut.)

833,194. Protective Device for Alternating-current Circuits. Leonard Andrews, Manchester, England, assignor to Stanley-G. I. Electric Manufacturing Company, Pittsfield, Mass. Application filed September 18, 1905.

In combinaion with a main alternating-current circuit is a transformer having its primary in series with the circuit and having a core adapted to be saturated by an overload current in the circuit. An electroresponsive device is connected in a local closed circuit with the secondary of the transformer, and there are connections from equipotential points in the circuit to a source of voltage dependent in phase upon the voltage of the main circuit. (See cut.)

833,205. Electric Meter. Thomas Duncan, Chicago, Ill., assignor to Duncan Electric Manufacturing Company, Lafayette, Ind. Application filed July 11, 1901. Renewed January 7, 1905.

The combination, with a meter provided with a damping disk, consists in part of a permanent magnet within whose field the damping disk is arranged, a body of magnetizable material adjustably secured in position between the poles of the permanent magnet and to be drawn in and out to vary the amount of the same interposed between the poles to govern the magnetic reluctance between the poles of the permanent magnet, and a body of magnetic material upon the other side of the damping disk. (See cut, next page.)



NO. 833,194.—PROTECTIVE DEVICE FOR ALTERNATING-CURRENT CIRCUITS.

833,207. Transformer. John J. Frank, Schenectady, N. Y., assignor to General Electric Company, Schenectady, N. Y. Application filed October 14, 1905.

Combined are a case containing a bath of insulating liquid, a winding immersed in the bath, means for creating a difference of potential between the terminals of the winding, a pair of co-operating sparking points or electrodes connected to the terminals of the winding and arranged below the normal surface of the fluid and separated from each other by a distance such that when covered by the liquid the normal potential existing between the terminals of the winding will be insufficient to cause a discharge between the points, but so that when not covered by the liquid a discharge will take place between them.

833,208. Double-throw Electric Switch with Indicator. Edward M. Hewlett, Schenectady, N. Y., assignor to General Electric Company, Schenectady, N. Y. Application filed July 11, 1903.

The combination with an electric switch consists of an operating handle therefor, an indicator having a movement concentric with that of the switch, and lost-motion-transmitting devices between the indicator and switch.

833,210. Interlocking Device for Circuit-breakers. Charles H. Hill, Schenectady, N. Y., assignor to General Electric Company, Schenectady, N. Y. Application filed February 3, 1905.

Two automatic circuit-breakers combine a movable member operated by the opening of one circuit-breaker and a loose yet positive connection between the member and the tripping mechanism of the second circuit-breaker, whereby a movement of the member operates the tripping mechanism, but a movement of the mechanism is permitted without movement of the member.

833,211. Safety System for High-tension Transmission Lines. John D. Hilliard, Jr., Glens Falls, N. Y., assignor to General Electric Company, Schenectady, N. Y. Application filed April 20, 1904.

The combination with an electric circuit includes an impedance in the circuit, a fuse in shunt to the impedance, a circuit-breaker, a trip coil therefor, and means for energizing the trip coil to open the breaker when an overload causes the fuse to blow and the excessive current is opposed by the impedance.

833,224. Receiving Device for Electric Transmission. Isidor Kitsee, Philadelphia, Pa., assignor of one-half to William J. Latta, Philadelphia, Pa. Application filed March 25, 1905. Renewed April 4, 1906.

In combination with a receiving device for telegraphic impulses connected to the line of transmission are a local circuit-embracing air gap, a high-tension current traversing the local circuit and air gap, a translating device in the local circuit, and means operatively connected to the movable part of the receiving device to vary the flow of the high-tension current through the air gap in accordance with the impulses received.

833,225. Telegraphy. Isidor Kitsee, Philadelphia, Pa., assignor of one-half to William J. Latta, Philadelphia, Pa. Application filed April 14, 1905. Renewed January 18, 1906.

A submarine or other cable provided with two or more stations, transmitting means at each station adapted to transmit over the cable simultaneously in one direction two messages, one message characterized by impulses of comparatively slow succession and of comparatively high electromotive force, the second message characterized by impulses of comparatively quick succession and of comparatively low electromotive force, and also provided with two receiving means, one adapted to translate the message characterized by the impulses of comparatively slow succession, and the second adapted to translate the message characterized by the impulses of comparatively quick succession.

833,226. Telegraphy. Isidor Kitsee, Philadelphia, Pa., assignor of one-half to William J. Latta, Philadelphia, Pa. Application filed June 6, 1906.

An all-metallic line has its central battery of two sets connected in opposition as to each other and grounded at their juncture. A series of receiving devices is inserted in one leg of the line and a series of transmitting devices connected to the second leg of the line, part of the transmitting devices being grounded.

833,228. Motor Controller. William A. Lacke, Chicago, Ill. Application filed November 29, 1905.

In combination with a motor-armature circuit and resistance therefor are a source of supply, a reversing switch designed to connect the source of supply to the armature circuit, a series of slow-closing switches each provided with an automatic circuit-closing device, the device of one slow-closing switch being arranged in series with the solenoid controlling the operation of the succeeding switch, whereby means are provided for automatically closing the circuits of the various solenoids in succession, each of the solenoids being in shunt to

the resistance, and the automatic circuit-closing device for the first solenoid in the series being controlled by the reversing switch.

833,248. Street Indicator. Arthur Schimmel, Evansville, Ind. Application filed March 2, 1906.

The mechanism of a street indicator on a vehicle is operated by an electric motor.

833,252. Coupling for Electric Cables. Charles F. Schwennker, Schenectady, N. Y., assignor to General Electric Company, Schenectady, N. Y. Application filed February 14, 1903.

Cylindrical metallic-conductor sections are provided with overlapping ends and with grooves in the cylindrica sides which form a helical path when the sections are assembled. A helical spring is screwed into the helical path, binding the sections together, and there are means to rotate the spring.

833,279. Telephone Receiver. Henry F. Albright, New York, N. Y., assignor to Western Electric Company, Chicago, Ill. Application filed February 5, 1904.

This patent covers an improved receiver, having a tubular magnet with a magnetizing helix surrounding the core thereof.

833,290. Electrical Conductor. Anson G. Betts, Troy, N. Y. Application filed November 30, 1904.

A composite conductor for electrical transmission lines or circuits is described, consisting of a body of free or metallic sodium and a reinforcing sheathing within which it is inclosed, the conductivity of the composite conductor being due essentially to the sodium present therein.

833,296. Junction Box. William F. Bossert, Utica, N. Y., assignor to the Bossert Electric Construction Company, Utica, N. Y. Application filed September 15, 1904.

An outlet or junction box formed of metal and having one or more cut and partially displaced blanks connected to the encircling metal by an integral connection, each blank being spread by pressure to engage its encircling walls.

833,297. Lock-out System for Party-line Telephones. William M. Bruce, Jr., Springfield, Ohio, assignor to the Select Telephone Manufacturing Company, Springfield, Ohio. Application filed October 5, 1905.

An electromagnet at each subscriber's station is adapted to be bridged across the line by the main telephone switch. There is a normally open shunt around the electromagnet, including the subscribers' talking instruments, and a circuit-closer in the shunt adapted to be moved to and held in closed position by the electromagnetic force of the magnet and adapted to be released when the magnet is de-energized, the resistance of the magnet and the shunt around the same being such as to absorb the current from the central energy so as to prevent any other magnet on the line from being operated.

833,298. Lock-out System for Party-line Telephones. William M. Bruce, Jr., Springfield, Ohio, assignor to the Select Telephone Manufacturing Company, Springfield, Ohio. Application filed October 23, 1905.

A common-battery lock-out party-line telephone system is disclosed by the invention.

833,312. Trolley. Andrew H. Dreijer, New York, N. Y. Application filed June 6, 1904.

A wheel has an annular channel in its periphery with two or more rollers carried in the channel and adapted to be forced against the trolley wire. There are means on each side of the channel for centering the wire in the rollers.

833,317. Cut-out. Henry Geisenhöner, Schenectady, N. Y., assignor to General Electric Company, Schenectady, N. Y. Application filed May 8, 1903.

An electrical switch comprising a plurality of independent spring-pressed circuit-closing devices, a common contact plate adapted to hold the devices in closed position against the tension of their springs, and a releasing means common to all of the devices.

833,327. Distributing Box. Harry H. Hornsby, Chicago, Ill. Application filed January 7, 1903.

A distributing board provided with a number of apertures in the face thereof has terminals arranged adjacent to the apertures and passageways arranged in the interior of the board and leading from the apertures to the edges of the board, whereby the wires of main and branch circuits may be readily passed through the passageways to connect them with the terminals on the board and whereby the wires are inclosed and fixedly isolated from each other.

833,342. Electric Receptacle. Bert E. Salisbury, Syracuse, N. Y., assignor to Pass & Seymour, Solvay, N. Y. Application filed February 20, 1906.

A receptacle for incandescent electric lamps having integral, opposite segments adjacent to its outer edge and integral, opposite projections arranged inwardly and alternately of the segments. The receptacle has a porcelain body, lamp terminals arranged in the mouth of the body, wire terminals arranged in depressions in the back of the body, and connections between the wire terminals and the respective lamp terminals.

833,353. Trolley Wheel. Gustavus Troxler, Jr., Newark, N. J., assignor of one-fifth to himself, one-fifth to Alexander Ober, one-fifth to Robert Neil and one-fifth to Theodore Perry, Newark, N. J., and one-fifth to Arthur H. Moore, Jersey City, N. J. Application filed October 10, 1905.

A series of posts extend laterally from the opposite sides of the wheel, a radially extending guard arm or finger extends from each post and is rotatable with the wheel, and there are means connected with each guard arm to produce the normally radial relation of each guard arm.

833,357. Electric Furnace. Leonard Waldo, Plainfield, N. J. Application filed June 23, 1905.

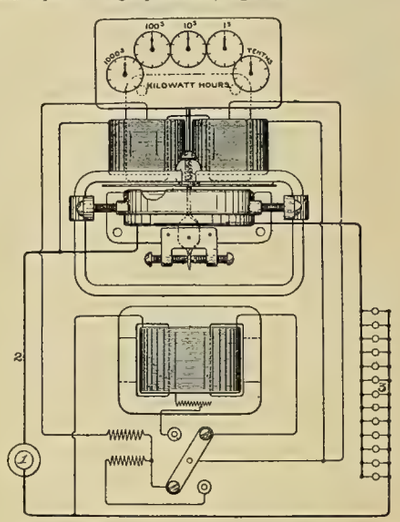
In an induction furnace having a charge-receiving chamber and an inducing circuit for melting the charge in the chamber are means for electrolyzing the melted charge. Electrodes are disposed in the chamber and there is a source of direct current in the circuit with the electrodes. (See cut.)

833,361. Wave and Current Electrical Generator. John T. Wilmore, Denver, Colo. Application filed October 23, 1905.

In a wave or current electrical-generating apparatus are combined a suspended drum revolubly mounted and located on the surface of the water to be acted on by the waves or currents, the exterior construction of the drum being such as to cause its rotation under the influence of the waves or currents. Electrical-generating mechanism is inclosed by the drum, which is formed sufficiently tight to exclude the water. There is a suitable operative connection between the drum and the generating mechanism.

833,390. Spring-jack for Telephone Switchboards. Howard B. Holmes, Park Ridge, and Edward B. Craft, Chicago, Ill., assignors to Western Electric Company, Chicago, Ill. Application filed June 24, 1905.

A jack unit having line and contact springs disposed on edge, insulating strips between the same, the U-shaped metal frame comprising an L-shaped supporting member and a jaw all rigidly secured together.



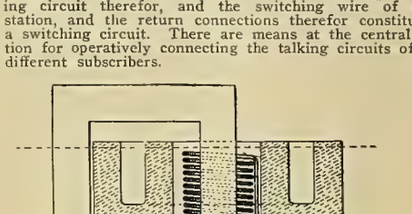
NO. 833,205.—METER.

833,425. Thermal Cut-out and Circuit Changer. Alfred O. Stigberg, Chicago, Ill., assignor to Stromberg-Carlson Telephone Manufacturing Company, Rochester, N. Y. Application filed June 3, 1904.

Combined are a terminal spring connected with one terminal of heat-coil, a second terminal spring, heat-responsive means external to the heat-coil for normally retaining the other terminal of the heat-coil in contact with the terminal spring, and means upon abnormal current flow through the heat coil for causing the heat-responsive means to release the other terminal from the second terminal spring.

833,429. Automatic System of Intercommunication. Anthony Van Wagenen, Sioux City, Iowa. Application filed July 31, 1902. Renewed March 3, 1906.

In an automatic telephone system are a service and a switching wire connecting each subscriber's station with the central station, the latter conductor having return connections independent of the service wire, the service and switching wires of each station constituting a talking circuit therefor, and the switching wire of each station, and the return connections therefor constituting a switching circuit. There are means at the central station for operatively connecting the talking circuits of the different subscribers.



NO. 833,357.—ELECTRIC FURNACE.

833,447. Electric Signal for Weighing Scales. Stephen J. Derbes, New Orleans, La. Application filed November 28, 1905.

The mechanism of the device includes an electric circuit, with an alarm, having its terminal connected with the angle plates, and means whereby the movement of the scale beam may act upon the terminals to close the circuit.

833,449. Telephone Transmitter. Stanley A. Duvall, Elkhart, Ind. Application filed March 5, 1903.

An auxiliary diaphragm is used to supplement the main diaphragm.

833,465. Electrothermostatic Fire Alarm. Jesse M. Knowles and Silas A. Gregory, Stockport, Iowa. Application filed February 26, 1906.

In the device are a number of relatively stationary contact members, a thermostatic element and a movable contact member actuated by the thermostatic element and adapted to engage the stationary members for closing the circuit, the element being adjustable longitudinally of the movable contact member thereby to vary the throw of the member.

833,505. Trolley. Henry B. Burke, Windber, Pa. Application filed December 28, 1905.

A resilient flat spring arm has an integral collar formed at its lower extremity, the arm being bent upon itself and having its other extremity extending outwardly and upwardly; a harp mounted on the upwardly and outwardly extending portion of the arm, the arm being provided with a series of apertures adapted to receive electrical conductors, and means located upon the underneath side of the arm for disengaging the trolley wheel from the conductor, the means comprising a pierced lug.

833,550. Trolley Harp. William K. Richardson, Leavenworth, Kan. Application filed September 1, 1905.

Contact springs have a lower flat portion bearing against the inner sides of the arms and extending above the lower rim of the trolley wheel; an upper flat portion is arranged in a plane parallel to the plane of the lower flat portion and bearing against the hub of the trolley wheel across the entire end of the same. Intermediate oblique portions connect the upper and lower flat portions.

833,556. Incandescent-lamp Socket. Clarence C. Sibley, Perth Amboy, N. J., and George A. Lutz, New York, N. Y. Application filed June 5, 1903.

A lining of insulating material is provided with an appertured projection having a groove or recess without the cap of the socket and a ring to hold the lining in position.

833,567. Flexible Joint for Electric Tubing. William E. Ward, Bayonne, N. J. Application filed December 5, 1905.

A universal joint for joining sections of electric tubing is described, consisting of a coupling piece comprising two pairs of yoke arms projecting from a perforated base disposed in planes at right angles to one another, and co-operating yokes secured respectively to the ends of the section of tubing to be joined and having their arms individually pivoted to the arms of the coupling piece.

833,580. Electrical Insulating Composition and Process for Manufacturing the Same. Charles Clement, Vallorbe, Switzerland, assignor to Société Anonyme Matthey & Co., Vallorbe, Switzerland. Application filed April 21, 1905.

The insulating composition consists of amianthus, sulphate of lime, water, pitch and sulphur, and the process for making consists in mixing amianthus, sulphate of lime and water to a suitable paste, drying the same and then subjecting the product so obtained to impregnation in a bath of pitch and sulphur.

833,590. Multiple Drill. William W. Doolittle, Chicago, Ill., assignor to Crane Company, Chicago, Ill. Application filed November 19, 1903.

An electric motor is provided for operation and there are magnets to anchor the elements in position on the plate during the drilling operation.

833,603. Signaling on Railways. Charles M. Jacobs and Robert J. Insell, Reading; Edward F. Newton, Cardiff, and Ernest A. B. Bowden, Hanwell, England, assignors to the Western Syndicate, Limited, London, England. Application filed October 30, 1905.

The apparatus is for signaling between fixed points on a railway line and a train passing along the line, and comprises a signal on the train, electrically operated restraining means for preventing normally this signal being given, means at each fixed point for invariably rendering inoperative the restraining means, and a device at each fixed point for supplying electric current to the said electrically operated restraining means when desired.

833,689. Apparatus for Duplicating Phonograph Records. Isidor Kitsee, Philadelphia, Pa. Application filed April 20, 1901.

The device comprises a master record, a stylus associated therewith, an electric circuit, a source of current for the circuit, a variable resistance included to the circuit and of which the stylus forms a part, an electromagnet in the circuit, a cutting stylus and a blank in operative relation to the cutting stylus, the electromagnet controlling the action of the cutting stylus.

PATENTS THAT HAVE EXPIRED.

Following is a list of electrical patents (issued by the United States Patent Office) that expired on October 22, 1906:

413,160. Electric Car Lighting. S. H. Barrett, Springfield, Mass.
413,215. Underground Conduit. G. H. Warde, New York, N. Y.
413,220. Holding Attachment for Arc Lamps. T. H. Brady, New Britain, Conn.
413,279. Electric Regulator. W. Hochhausen, Brooklyn, N. Y.
413,280. Switch for Dynamo-electric Machines. W. Hochhausen, Brooklyn, N. Y.
413,281. Electric-pendulum Clock. M. L. M. Hussey, Menlo Park, N. J.
413,287. Contact Trolley for Electric-railway Cars. J. Mitchell, Des Moines, Iowa.
413,292. Electric-measuring Instrument. E. Thompson, Lynn, Mass.
413,293. System of Electrical Distribution. E. Thompson and E. W. Rice, Jr., Lynn, Mass.
413,294. Conduit for Electric Railways. E. Thompson, Lynn, Mass.
413,308. Telephone Receiver. C. Selden, Baltimore, Md.
413,309. Mold for Casting the Plates of Storage Batteries. W. Shapleigh, Camden, N. J.
413,337. Dynamo-electric Machine. R. Eickemeyer, Yonkers, N. Y.
413,338. Magnetic Gage for Testing the Magnetic Conductivity of Metals. R. Eickemeyer, Yonkers, N. Y.
413,339. Secondary Battery. R. Eickemeyer, Yonkers, N. Y.
413,340. Electric Regulator for Pendulum Clocks. J. H. Gerry, Brooklyn, N. Y.
413,345. Galvanic Battery Compound. W. P. Kookogey, Brooklyn, N. Y.
413,353. Method of Obtaining Direct from Alternating Currents. N. Tesla, New York, N. Y.
413,363. Dynamo-electric Machine. R. Eickemeyer, Yonkers, N. Y.
413,371. Telephone Address Index and Advertising Device. J. F. O'Brien, Quebec, Canada.
413,409. Railway-train Signal. D. S. McElroy, New York, N. Y.
413,410. Electromagnetic Railway Signal. D. S. McElroy, New York, N. Y.
413,411. Electromagnet. D. S. McElroy, New York, N. Y.
413,412. Electrically-operated Railway Switch. D. S. McElroy, New York, N. Y.
413,429. Cable Terminal Head and Protectors. E. R. Baker, New Haven, Conn.
413,436. Electric-signaling Apparatus. W. E. Decrow, Boston, Mass.
413,438. Process of Manufacturing Battery Zincs. F. F. Eggers, San Francisco, Cal.
413,442. Incandescent Lamp. E. F. Gennert, New York, N. Y.
413,512. Electric Switch. R. C. Hull, Baltimore, Md.
413,568. Thermostatic Alarm. C. H. Shaffer, Rockford, Ill.
413,604. Electric Railway. R. M. Hunter, Philadelphia, Pa.
413,636. Electric Lamp. J. T. Van Gestel, New York, N. Y.
413,637. Electric-railway System. M. Wheless, Washington, D. C.

WESTERN ELECTRICIAN

EVERY SATURDAY

Vol. XXXIX. CHICAGO, NOVEMBER 3, 1906 No. 18

New Power Station of the Birmingham (England) Corporation.

[From the London correspondent of the Western Electrician.]

As already announced, the new generating station which has been erected by the Birmingham Corporation at Summer Lane was formally opened on October 10th.

HISTORICAL.

Electric lighting in Birmingham dates as far back as the year 1882, when a provisional electric-lighting order was granted by the Board of Trade to some private individuals. This was revoked in 1886, and three years later the Birmingham Electric Supply Company was formed to work another provisional order. The company continued to work with two generating stations until the year 1900, when the undertaking was acquired by the corporation. The generating plant at these two stations, Dale End and Water Street, had a capacity of 1,520 kilowatts and 3,456 kilowatts, respectively. These two stations will continue to be worked in conjunction with the new Summer Lane works, and the general arrangement of districts is shown in Fig. 2, next page.

The old company conducted a purely lighting and power business, and for three years after its absorption by the corporation this condition of affairs continued. But in the year 1903 it was decided to municipalize the tramways when their leases expired and to operate them on the overhead-electric system. This created a new condition of affairs, and when the new engineer was appointed, in the person of Mr. R. A. Chattock, previously with the Bradford Corporation, he was commissioned to reorganize the arrangements generally so that a supply would be available for the tramways, and also in any part of the city for other purposes. The old company had not touched certain districts. How this has been accomplished the following description will tell.

GENERAL.

The site selected was in Summer Lane, which is bounded on one side by the Birmingham and Fazeley Canal, Fig. 3 being a block plant of the works. The principal facade is on Summer Lane, and is executed in hard red pressed brick, with stone-colored terra cotta dressings, presenting a handsome appearance, in common with many of the more recent municipal stations of this type.

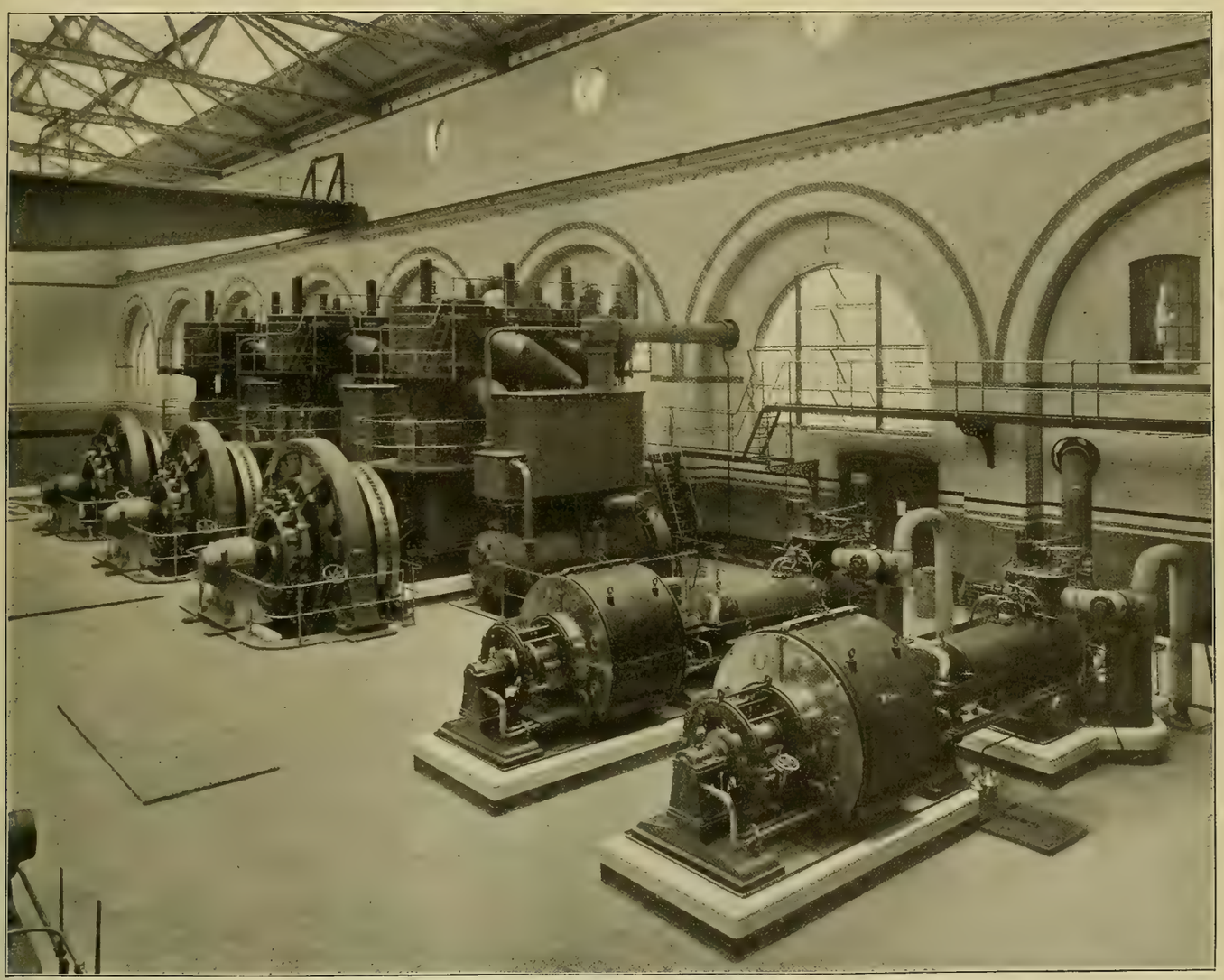


FIG. 1. DIRECT-CURRENT SIDE OF ENGINE ROOM IN SUMMER LANE STATION, BIRMINGHAM.

The building is divided into three bays, viz.: Engine house, 275 feet long by 100 feet wide, on one span; boiler house, 275 feet by 89 feet, and economizer house, 275 feet long by 47 feet wide. The front elevation of the engine house, facing Summer Lane, is the chief architectural feature, a richness of effect being obtained by the introduction of ornamentation, which is concentrated in the tympanum of center gable and the upper portion of pilasters, the massive semi-circular window being a striking feature. Fig. 4 illustrates the building, while Fig. 5 is a cross-section of the plant.

Conditions in Birmingham, with the tramway load coming on and the provision of a supply to some outlying residential districts, are such that the following four classes of supply have to be dealt with, and the plant in the new station has been designed with that end in view: (1) A direct-current supply for lighting and private power purposes in the neighborhood of the station at a pressure of 220 and 440 volts. (2) A direct-current supply through a system of trunk mains to the distributing switchboards at Dale End and Water Street stations at a pressure of 440 volts, in order to deal with the increase in the demand for private lighting and power supply. (3) A direct-current supply to the tramways within a radius of about two miles from the station, at a pressure of 500 volts. (4) An extra high-tension three-phase alternating-current supply to the substations, which have been erected in the outlying districts of the city, at a pressure of 5,000 volts. The plant capacity, for which accommodation has been provided, therefore may bet set out as follows:

Description.	First Equipment.	Ultimate Equipment.
D. C. engines and generators	7,000 K.W.	13,000 K.W.
A. C. engines and generators	4,500 K.W.	13,500 K.W.

ENGINES.

Steam engines already erected or in course of erection consist of the following:

Four Belliss engines, 3,000 indicated horsepower, operating Dick-Kerr 1,500-1,875-kilowatt continuous-current generators.

Two similar engines operating Westinghouse alternating-current generators of same capacity as the continuous-current machines.

Three 1,000-horsepower Belliss engines operating Westinghouse 500-625-kilowatt alternators.

Two 180-horsepower Belliss engines driving the exciting dynamos supplied by the General Electric Company.

The six large engines each have an output of 2,140 to 2,680 B. H. P., the cylinder dimensions being 25-inch, 36½-inch and 55-inch by 33-inch stroke. Steam is supplied at 180 pounds pressure, superheated 100 to 150 degrees F., corresponding to a total temperature of 480 to 530 degrees F. The engines for the direct-current and alternating-current sets are strictly in duplicate, the

only variation being a slightly higher rate of revolution in the alternating-current sets to correspond to 25 cycles per second. The direct-current sets run at 160 revolutions per minute and the alternating-current sets at 166⅔ revolutions per minute, the piston speeds being 880 and 917 feet per minute, respectively. The engines are arranged to run condensing, but provision has been made for exhausting to the atmosphere on emergency through automatic exhaust valves, on a new principle, the valves being designed and constructed by the engine builders.

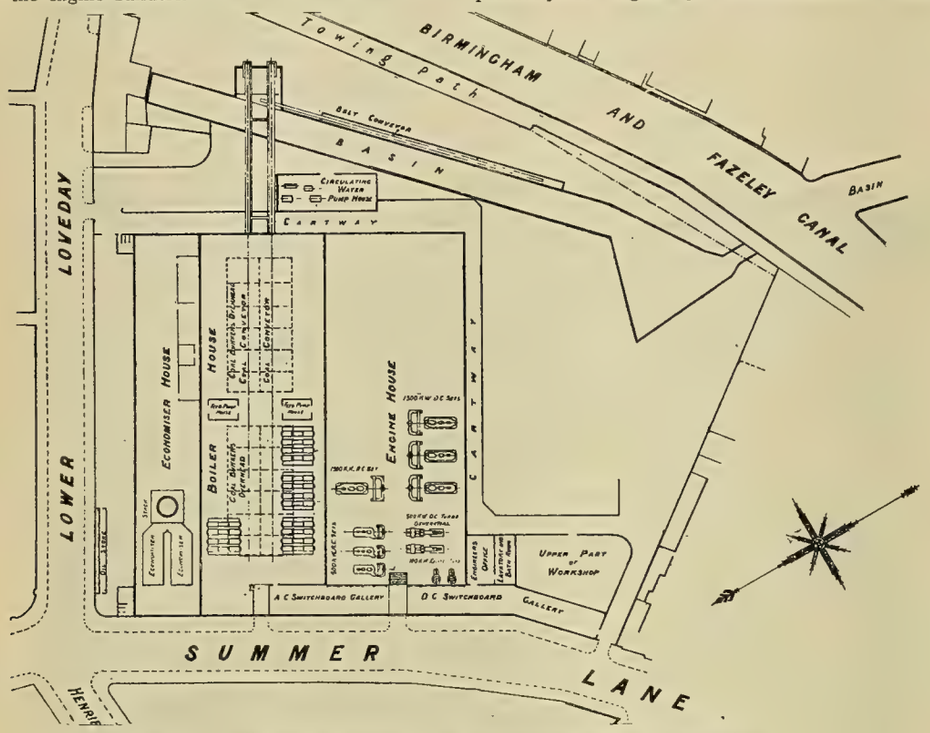


FIG. 3. BLOCK PLAN OF SUMMER LANE GENERATING STATION, BIRMINGHAM.

Especially large and massive flywheels have been fitted to secure the requisite degree of even turning and efficient governing on a traction load, the total amount of stored energy embodied in the revolving parts being 3,400 and 4,600 foot-tons for the direct-current and alternating-current sets, respectively. Another feature of the engines is the variable expansion gear, the cut-off of the high-pressure slide valve being varied by means of a special relay cylinder operated from the governor. On this plan the power is carried at the higher loads by automatically varying the cut-off, and at the lower loads by throttling, a combination which the makers' experience has demonstrated to give the best economy at all loads. The emergency steam stop valves are so designed that they can be worked from the engine-room floor and also from the platform above. Each main engine is provided with its own surface condensing plant.

The remaining large engines, the three 1,000-horsepower units, are of similar design. The cylinders are 17, 24 and 37½ inches, with a piston stroke of 18 inches, the speed being 250 revolutions per minute, driving the alternating-current machines. These three engines exhaust into a common surface condenser. The two 180-horsepower engines are standard two-crank machines, running at 450 revolutions per minute.

Generators and Auxiliary Machinery.

In the four 1,500-kilowatt continuous-current generators an overload capacity of 25 per cent. is provided. These are compound-wound, 16-pole machines, the spider of the armature being extended and bolted direct to the flywheel of the engine. The commutators are very large. It is intended to use these machines as ordinary shunt machines for the lighting supply and as compound machines for the traction supply, the necessary alterations in the connections being effected on the direct-current switchboard.

There have also been erected two 500-kilowatt Parsons direct-current turbo-generators, giving a pressure of 460-520 volts and having an overload capacity of 10 per cent.

The Westinghouse alternating-current generators are two 1,500-kilowatt standard-type revolving-field divided generators, three-phase, 25 periods, 5,000 volts; there being also three 500-kilowatt similar machines. The revolving fields are bolted direct to the engine flywheels.

The 100-kilowatt exciting sets run at 450 revolutions per minute, the voltage being 440 to 480 volts. These are quite standard machines.

There are in addition two 100-kilowatt motor-driven balancers, and two 25-kilowatt motor-driven three-wire boosters, the former dealing with the out-of-balance current on the local lighting network, and the latter giving the necessary increase in pressure on the trunk main supply to the Dale End and Water Street generating stations. These boosters are capable of dealing with a current of 2,500 amperes and will boost up to 10 volts, either positively or negatively. A 200-kilowatt motor-generator is also installed for giving a direct-current supply to the tramway system off the direct-current lighting bus bars during light load at night time after the main traffic has ceased.

It is proposed to install a 200-kilowatt rotary converter and a bank of transformers to enable the extra high-pressure alternating-current supply to be coupled to the low-tension direct-current supply in order to avoid running steam plant on both classes of supply at times of light load. It is further proposed to install a large storage battery and reversible booster for equalizing the load upon the direct-current generators used for supplying the tramways. Fig. 1 shows the direct-current side of the engine room.

Direct-current Switching Apparatus.

Undoubtedly the most interesting part of the equipment is the switch gear. The problem of handling the direct current is unusual on account of the future proposed magnitude of the station, and it is also greatly complicated by the delivery of both a local supply to the network in the neighborhood of the generating station and at the same time a bulk supply by groups of heavy trunk feeders to old centers of distribution in existing power houses at Dale End and Water Street, respectively. The problem is still further complicated by the nature of the site of the power house (Fig. 3), which has necessitated locating the switch gear across one end of the building in order to bring out the large number of feeders properly to the distributing conduits, the space available being so limited, compared with the amount of gear required, that the switchboards have to be double-decked and in part mounted in two rows facing each other. In spite of this, such care has been taken in the relative locations of the different parts that the heavy cable runs are remarkably clear of entanglements with each other or with bus bars, heavy connection strips, rheostats, gallery steelwork or window interferences, everything considered.

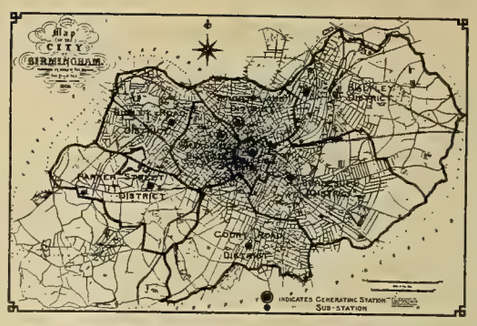


FIG. 2. ELECTRIC SUPPLY DISTRICTS IN BIRMINGHAM, ENGLAND.

Each of the main 1,500-kilowatt direct-current generators is connected to its panel in the switchboard gallery by nine cables—three positive, three equalizers or lighting negatives and three traction negatives. All switches are mounted on the generator panel, which is seven feet six inches high, and is built up of three sections of 2½-inch black enameled slate. These panels have the somewhat unusual width of four feet six inches on account of the number of switches required, the size of the copper connections, and the large clearance maintained between opposite polarities and between copper and earth, this being held up to four inches on all bus bars and main machine connections wherever possible. This unusual clearance has been considered advisable on account of the enormous arc and consequent risk to operators which would arise in case of a fault across the bars.

All the heavy leads from each of the large generators, consisting of three 1.5-square-inch cables per pole, are carried about the panel in the form of three five-inch by three-eighths-inch rolled copper bars in parallel, giving a cross-section of over five square inches, and a current density of

FIG. 4. STREET FRONT OF SUMMER LANE GENERATING STATION, BIRMINGHAM.

only 700 amperes per square inch at an overload of 4,000 amperes per machine. These bars are separated by three-quarter-inch air spaces to add to the ventilation and to give room for three-quarter-inch contact nuts on all switch and circuit-breaker studs and other connections. These studs are all 2½ inches in diameter, with four nuts per stud, five inches across corners, giving a very low contact density. On a 4,000-ampere continuous heat run the average drop between contact bar and switch stud was 1.5 millivolts, equivalent to the drop along 3½ inches of copper at 700 amperes per square inch, and the temperature rise around all parts of the panel gear (the ammeter shunt, of course, excepted) was barely appreciable to the hand.

The main positive lead from each generator passes through a carbon-break circuit-breaker without overload, but with reverse-current attachment, and also through a 5,000-ampere ammeter shunt with laminations in a vertical plane to give maximum cooling effect, and with ends on the same horizontal line to minimize temperature errors.

All indicating instruments throughout the switch gear are of the vertical edgewise type, with 12-inch scales and illuminated dials. No voltmeters are used across any generators or in general for comparing the voltage of any unit with that of the bars or of any other unit. Each main bus bar has its voltmeter or meters. Each main generator is provided with multipole switches for simultaneously transferring both the positive and negative from the traction to either of the lighting bars. Two such switches are required on account of the use of three sets of bus bars, and these are connected in tandem, i. e., the up-throw of the first transfer switch connects to the traction bus bars, while the down-throw connects to the center studs of the other multipole switch, which, when thrown up, connects to the upper lighting bus bars, and when thrown down, to the lower lighting bus bars. On this account it is impossible to parallel either pole of the traction with any of the lighting bars. The first transfer switch is triple-pole and the other double-pole.

It will thus be seen that no little labor was involved in laying out the generator panel alone. The remainder of the board, with some exceptions, was comparatively easy in this respect, as feeder panels were kept of one polarity, positive, negative and neutral feeders being kept apart. The heavy trunk main booster panels were similarly arranged with opposite poles on separate panels.

Main bus bars are built up of five-inch by three-eighths-inch copper, the largest at the present time consisting of six such bars per pole, but provision has been made for extending several of the bars up to 15 square inches. The two main lighting bus bars may be connected together by two 10,000-ampere bus-junction switches of the brush toggle type for use when two lighting voltages independently generated are unnecessary. One set of the main bus bars is sectionalized by bus-bar section switches, thus enabling the main length of these bus bars to be shut down at times of light load for extensions or alterations. At times of light load, too, the local lighting may be supplied from the turbo-generators, through the lighting feeding boosters, which are fed from one side of the bus-bar section switches. Thus the main local lighting bus bars may also be similarly shut down. This principle, which has been largely adopted in extra high-tension work, is not believed to have been adopted to this extent in any direct-current station. It should also be noted that the balancers are similarly connected one on each side of the bus-section switches.

All of the lighting feeders, including the trunk supply to the other stations, are protected by automatic cut-outs, for the reason that no fuses were to be found on the market which were considered suitable for the heavy service required. Circuit-breakers were not considered advisable on account of the very rare occurrence of trouble and the inability to test the tripping gear by occasional opening of the breaker. The certainty of operation and the time-limit feature of the fusible cut-out were combined with the circuit-opening capacity of the usual breaker by a novel construction developed by the British Thomson-Houston Company, which supplied the switch gear, consisting of a carbon-break circuit-breaker held shut by a short copper link fuse, which carries the main current. When this fuse is blown the arc is shunted by the carbon contacts, which open with the usual speed of a breaker and clear the circuit with a minimum of fusion of the link.

ALTERNATING-CURRENT SWITCHING APPARATUS.

This is considerably more simple than the direct-current gear described above, owing to the much simpler conditions of distribution to be met, and the consequent absence of boosters and similar apparatus. There are to be seven sub-stations, containing converters feeding the lighting and traction systems. To each sub-station three three-core feeders will be run, one for lighting, another for traction, with the third as reserve. There are three feeder bus bars in the generating station. The generators will be connected to one main bar sectionalized by an oil switch, so that the traction and lighting may be kept separate, or any machine run on lighting and traction in parallel.

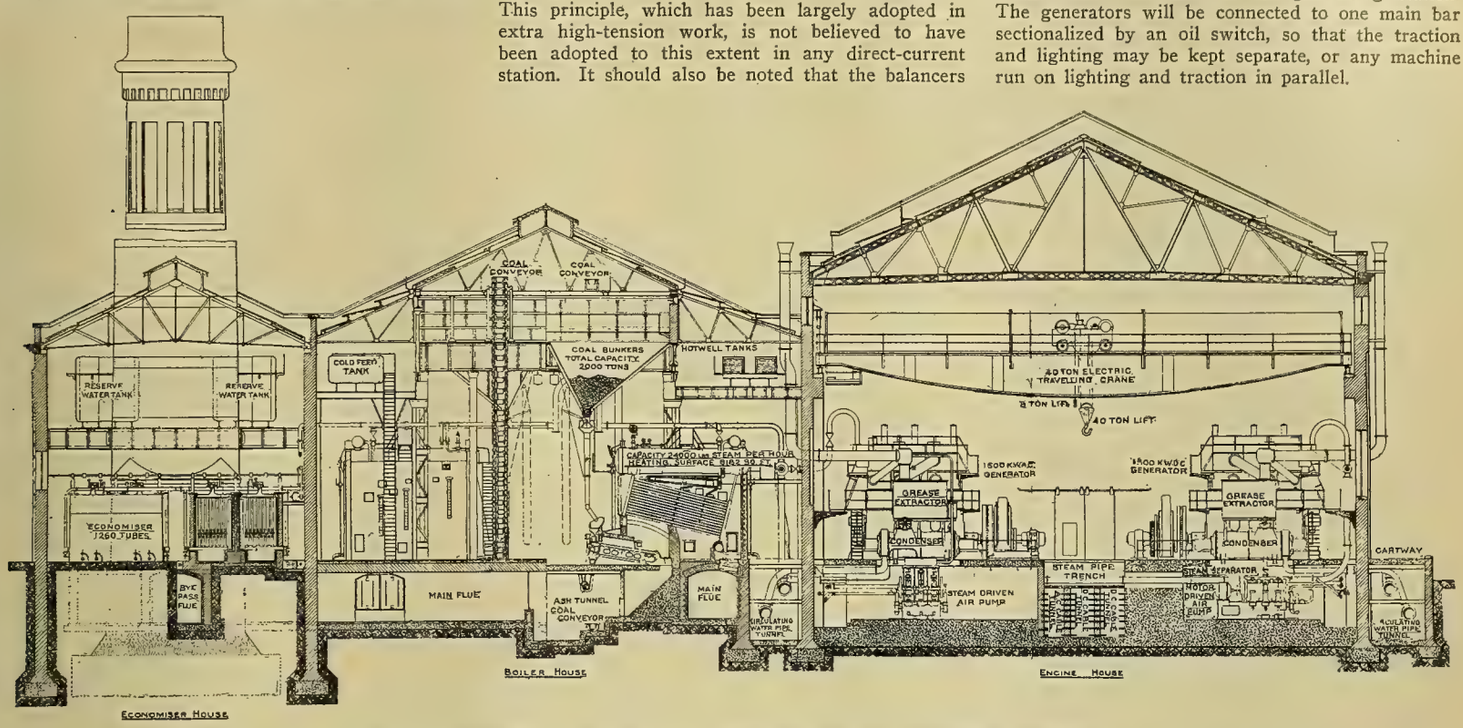


FIG. 5. CROSS-SECTION OF SUMMER LANE GENERATING STATION, BIRMINGHAM, ENGLAND.

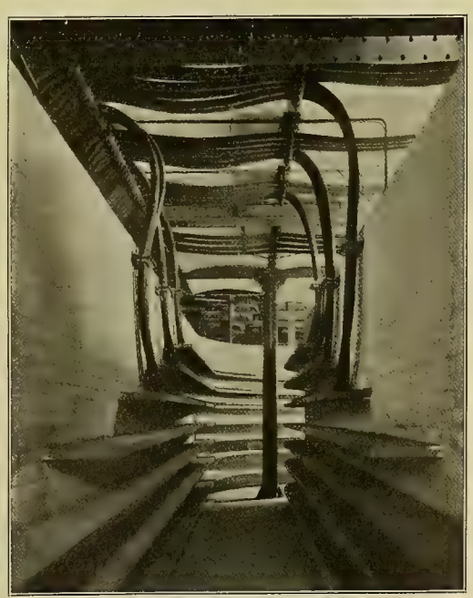


FIG. 6. VIEW IN CABLE TUNNEL IN SUMMER LANE POWER STATION, BIRMINGHAM, ENGLAND.

On account of the insufficient space on the switchboard gallery all generator switches have been mounted in the basement below the engine-room floor. The generator bars and main feeder group oil switches are also in the basement, and are electrically actuated. They are mounted in cells of artificial stone. The current is taken from the group-feeder switches through brick uptakes to the switchboard gallery, on which are mounted the feeder bus bars and oil switches in similar artificial-stone compartments. These are of the triple-pole type and are hand operated. The feeder switches are the largest and longest in stroke of any hand-operated switches manufactured in this country, and in the contingency that a fault should occur, the motor-operated feeder group switches will clear any section from the rest of the load and enable the spare feeders to be promptly put into service.

All the ammeters on the feeder panels are edgewise instruments. In the protection of the feeders, relays are avoided, the series transformer secondaries being carried directly to the tripping coils of the switch handles. The generator section of the switchboard is of the bench-board type. Separate subways carry the cables from the direct-current switchboard to its generators, and from the alternating-current board to its generators. Fig. 6 shows the cable tunnel beneath the switchboards.

BOILER ROOM.

There are at present installed 10 Babcock & Wilcox "land" type water-tube boilers, evaporating 240,000 pounds per hour. Each boiler has 6,182 square feet heating surface, constructed for a working pressure of 180 pounds per square inch, and containing 280 tubes, arranged in 20 sections. Each boiler is fitted with a B. & W. superheater and a B. & W. chain-grate stoker. In the latter, gear is provided to enable the whole stoker to be brought out clear of the boiler. The stokers are provided with two means for driving the shaft, viz., either by a steam engine or by electric motor. Each boiler, with stoker and superheater, is estimated to evaporate 24,000 pounds water per hour with three-quarter-inch natural draught, with coal of at least 10,000 British thermal units. The ultimate capacity of the boiler house will be 24 boilers, evaporating 576,000 pounds water per hour.

There are four feed pumps, each of 8,000 gallons per hour capacity. They are single-cylinder, double-acting and vertical.

The coal-handling plant consists of a 24-inch Robbins band conveyor, which carries the coal from barges and feeds it into a hopper on the ground level after weighing. From this hopper

the coal is fed by means of chutes to the filling apparatus of the two gravity-bucket conveyors, which have been installed. The coal bunkers contain 2,000 tons, but accommodation for a further 3,000 tons is being arranged for. The conveyors are driven electrically, there being two 16-horsepower motors for the gravity bucket conveyors and a six-horsepower motor for the band conveyor.

The feature of the steam and feed pipe arrangements is that all branches are electrically welded on.

CABLE SYSTEM.

The lighting and private power supply is divided up into districts, each being served by a generating station or sub-station; and they are kept entirely distinct from one another. The extra high-tension cables are three-core, paper insulated, lead covered and armored, the armoring consisting of galvanized-steel wires laid around the lead. The armoring is earthed every 100 yards to a cast-iron pipe laid vertically into the ground beneath the cable and packed round with loose coke. Three such cables run from the Summer Lane station to each sub-station, the capacity of each cable being approximately 1,000 kilowatts. The tramway cables and the other low-tension cables are laid on the "solid" system.

SUB-STATIONS.

The sub-stations, shown on the map, are equipped with static transformers, rotary converters, boosters and balancers. The extra high-tension switchboard is on a gallery down one side and the low-tension board is on a similar gallery opposite. A storage battery is situated above, and it consists of 256 cells, arranged across each side of the three-wire cable network. The rotary converters are of 300-kilowatt capacity, the static transformers being arranged in groups of three single-phase transformers, each group being sufficient to supply energy to one of the rotary converters. At present two of the latter are arranged for giving a direct-current tramway supply at 550 volts, the fields being compound wound for this purpose. Another is arranged for private lighting and power supply. The fourth is in reserve.

CONCLUSION.

The noticeable features of the works are, of course, the use of reciprocating engines (one reason for which may be that the works were planned in 1903) and the complicated switch gear. The total capital expenditure upon the scheme will be $2,500,000. Mr. R. A. Chattock acted as consulting engineer in addition to being responsible for the running of the works after completion. My best thanks are due to this gentlemen for providing the material contained in this article with the greatest possible courtesy.

New Court House in Chicago to Have Central-station Service.

Cook County is building a $5,000,000 court house in Chicago, and it is interesting to note that by a contract recently executed it will be supplied with light, heat and power by the Chicago Edison

NEW COOK COUNTY COURT-HOUSE.

Company. Few municipal buildings of such large size are supplied from central-station mains, and this fact makes the contract more noteworthy. Low-pressure steam will be used for heating and electricity for light and power. The building will contain about 15,000 incandescent lamps, mostly of 16 candlepower, 14 electric elevators, and motors for operating blowers for indirect heating, pumps, ventilating fans and the like. The steam boilers for heating will be installed by the county but operated by the Illinois Maintenance Company, which is an adjunct of the Chicago Edison Company.

As the illustration shows, the edifice, which is to be completed next year, will be dignified and massive. It will be the largest county building in the United States and the first one designed as an office structure especially to meet the requirements of those who will occupy it and of the public. The frame is of steel and the exterior columns and walls of granite. The colonnade is of the Corinthian order of architecture, the columns being 94 feet high. There will be 30 large court-rooms, with the necessary consultation, attorneys' and jury rooms. The building fronts 374 feet on Clark Street and 157 feet each on Washington and Randolph streets. The highest point of the roof is 218 feet above grade and the lowest floor is 38 feet below the street level. Worked into the building are 11,000 tons of structural steel and 14,000 tons of granite. This great weight is sustained by 130 concrete caissons extending to solid rock 115 feet below the street grade.

Adjoining the County Building on the west is the City Hall, and it is hoped ultimately to replace the present building with one conforming to the new court-house in general exterior design.

Edward J. Brundage is president of the Board of Commissioners of Cook County, and Holabird & Roche are the architects of the new building.

A New Thermo-dynamic Cycle.

While it is undoubtedly true that the useful heat recovered in the form of work bears a greater proportion to the total available heat in the so-called "internal-combustion" engines than in either the reciprocating or turbine engines, using saturated or superheated steam expansively, the heat losses are so considerable that engineers are constantly striving to discover methods of increasing the efficiency of gas engines. In any heat engine the efficiency is represented by $\frac{T^1 - T}{T^1}$, in which T^1 and T are the absolute temperatures of the medium at its upper and lower limits. With the very high initial temperature of explosion engines there is little to be gained by trying to increase that, hence the goal of the inventor must be to reduce the temperature of the discharged gases and to reduce internal losses by radiation.

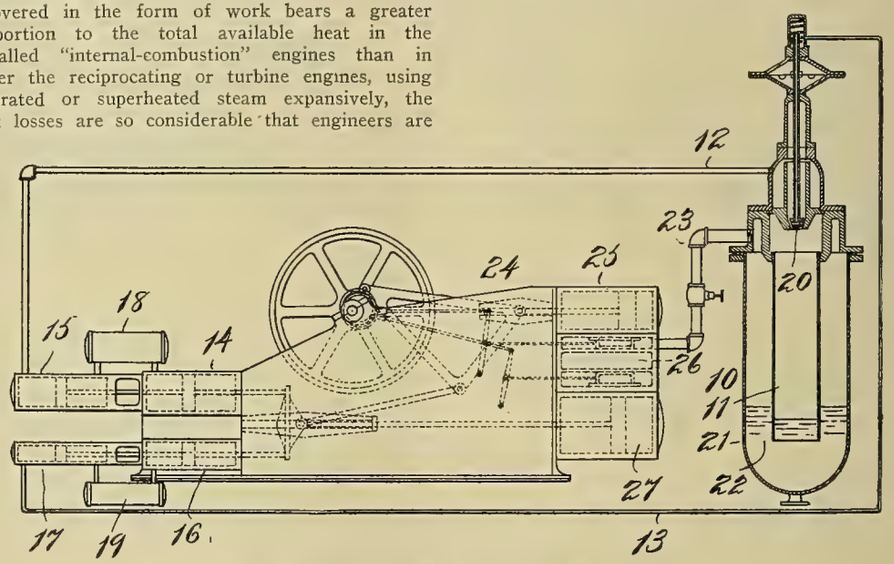


FIG. 1. REEVE'S COMBINED GAS AND STEAM ENGINE.

A system invented and recently patented by Mr. S. A. Reeve of Worcester, Mass., presents a radical innovation in this field both in the general scheme of operation and the means of reduction to practice. In describing his system Mr. Reeve reviews the existing thermo-dynamic cycles, then describes his own, and finally the apparatus which he purposes to use. As the treatment, while novel, is readily intelligible if described in terms of what actually is done, without unnecessarily obscuring scientific verbiage, the machine is here first described, and then the reasons for its use are given.

Referring to Fig. 1, the generator (10), which includes a combustion tube (11), receives through pipes (12) (13) a mixture of air and gas from two-stage compressors, each composed of low and high-pressure cylinders (14), (15), (16), (17) and intercoolers (18), (19). The admission valve (20) is controlled differentially by the pressures initial and terminal to it for maintaining a velocity of flow. By a spark or other suitable means the mixture of air and gas is exploded, the hot products of combustion pass down combustion tube (11) into a body of water at the bottom of the generator, which water is vaporized by the hot gases and passes as steam with the gases into the eduction pipe (23). Thence it passes into high-pressure cylinder (25) of an engine similar to the ordinary reciprocating steam engine and which drives the shaft furnishing the useful work external to the system. The expanded gases next go through a further expansion in low-pressure cylinder (27), where they do the work necessary to drive the compressors, thence they are exhausted into a condenser or into the atmosphere. Presumably intake valves are provided on the suction side of the first stage compressor to make up the leakage loss of gases on their passage through the system. It will be seen that Mr. Reeve practically drives a steam engine with a mixture of high-pressure steam, air and the combustion products of hydrocarbon gases.

These arrangements are not haphazard results of experiment, but are produced by a consideration of the defects in thermodynamic cycles of existing internal-combustion engines, as will be seen. Incidentally one is indebted to Mr. Reeve for a comprehensive and lucid definition of a much-used expression. He designates as "internal-combustion engines" "all those devices in which the combustion occurs in a pressure chamber occupied by the fluid medium which receives heat energy and by a subsequent expansion converts a greater or less portion thereof into mechanical energy."

It is well known that the processes of all heat engines are carried out in a series of steps making up a "cycle," and that different cycles have been proposed and utilized in practice. Most of the existing gas engines work on the "Otto" cycle, diagrammatically represented in Fig. 2, in which ordinates represent absolute temperatures of the medium and abscissæ represent entropy or (loosely and popularly speaking as respects the latter) the "heat weight" or factor of extent. To explain this term reference must again be made to Fig. 1, representing a complete cycle. For any closed cycle we have for the total heat the expression $\int \frac{dQ}{T} = 0$, in which Q is quantity of heat and T is the absolute temperature and hence a variable. If in any different cycle the different quotients are added together the total will be composed of positive and negative elements cancelling each other. That is to say, if these different quotients be added or subtracted along a straight line according to their positive or negative value the sum will be equal to zero. Or, in other words, the initial point of the curve will coincide with the point of closing.

But if instead of completing the cycle we take only a portion (C^1 D), Fig. 2, of the curve the sum will have a value depending on the law of the application of heat to the body and its temperature during the operation. Hence there is a function S, which for points (C^1) and (D) has the values S_{C^1} and S_D, and we have $S_D - S_{C^1} = \int_{C^1}^{D} \frac{dQ}{T}$. To this function S Clausius gave the name of entropy; dS or $\frac{dQ}{T}$ is its differential, which is + or — with dQ, while T_1, the absolute temperature, is always +. $S_D - S_{C^1}$ is the change of entropy when the body passes from the condition (C^1) to condition (D). Temperature × entropy = thermal units supplied. (O B) represents the difference in temperature between absolute zero and the initial temperature at which the practical cycle begins. The gas is compressed to temperature (O C^1) and then exploded,

(C^1 D) representing the rise in temperature and entropy due to the combustion under constant volume, and (D E^1) the drop in temperature due to the expansion to the original volume of the charge before compression. The area (B C^1 D E^1) represents the portion of heat energy returnable as mechanical work out of the entire amount of heat energy represented by the area (O C^1 D e). This means that there is considerable heat energy which goes into the exhaust and which, theoretically, might be utilized if means could be provided to permit it to expand against a piston to a volume still greater than the volume of the original charge before compression.

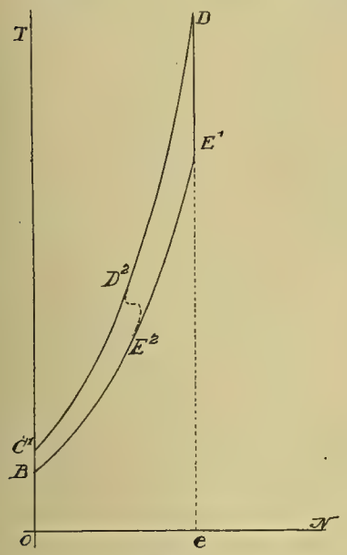


FIG. 2. OTTO THERMO-DYNAMIC CYCLE.

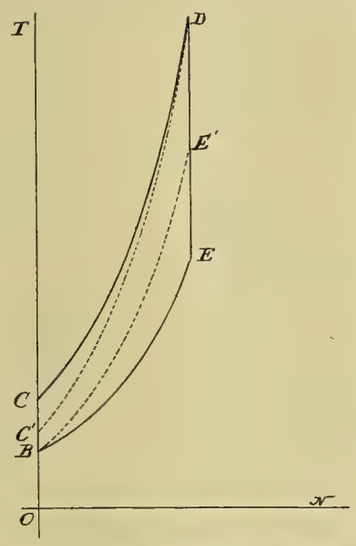


FIG. 3. JOULE THERMO-DYNAMIC CYCLE.

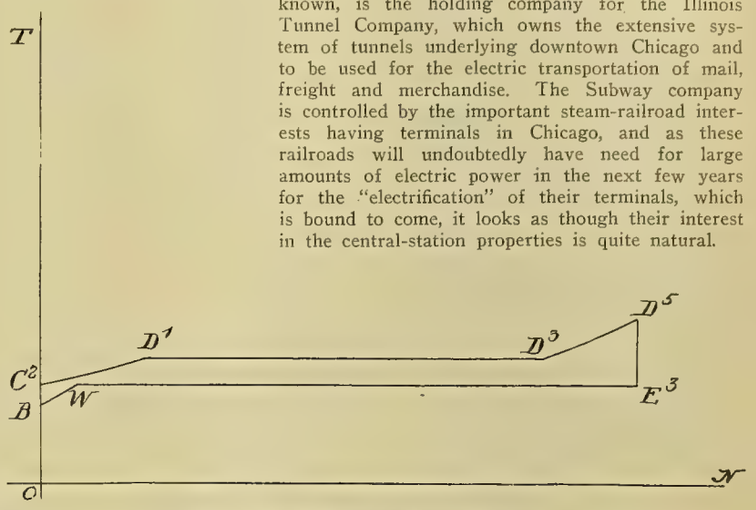


FIG. 4. REEVE THERMO-DYNAMIC CYCLE.

Considering, on the other hand, engines working on what is known as the "Joule" cycle (see Fig. 3), it will be evident that the situation is different. This cycle may be said to consist of (1) adiabatic compression to full working pressure, represented by (B C), which is seen to be much greater than the compression (C^1 B), feasible in the Otto cycle; (2) addition of heat under constant pressure, shown by the line (C D); (3) adiabatic expansion to atmospheric pressure, represented by (D E); (4) abstraction of heat at atmospheric pressure, shown by line (E B), showing abstraction of heat under constant pressure. The area (B C D E) represents the portion of heat energy returnable in the form of mechanical work, and it is manifestly considerably greater than that of the Otto cycle in Fig. 2. In Fig. 3 the Otto cycle is represented by the dotted lines.

In this cycle the pressure in the cylinder does not rise above the pressure of the compressed charge, and the heat of combustion (which is a slower non-explosive combustion) is expended about as it is developed in expanding the volume of the charge, but without increase of pressure as is the case when the charge explodes in an Otto-cycle engine. Since the Joule cycle cannot be imagined as conducted with a single cylinder, performing both compression and expansion, it will be seen that the charge intake to the compression department is not of necessity an engine cylinderful in volume, and hence it is possible to expand within the engine cylinder or cylinders to atmospheric pressure and to a volume much larger than the original intake volume with consequent superiority in efficiency over the Otto cycle at its latter end.

Convinced of the superiority of the Joule over the Otto cycle, Mr. Reeve has been guided in his inventions by the idea of making the Joule cycle practically available. To this end he has adopted as an initial pressure from 250 to 500 pounds per square inch, and produces, by means of the apparatus described, a new cycle, the Reeve cycle, which is here shown in Fig. 4.

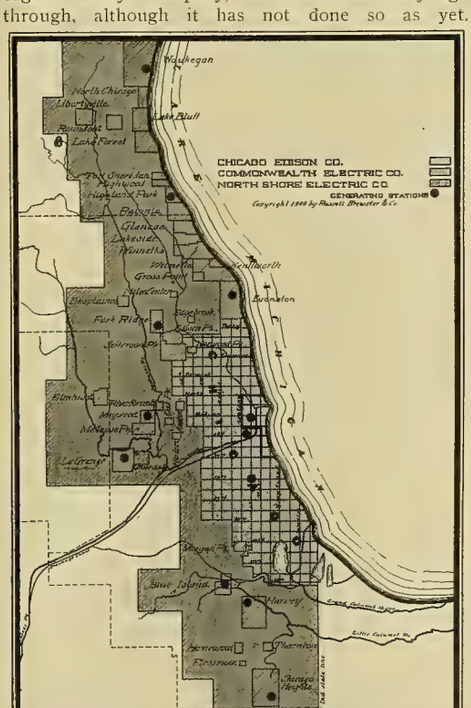
Here (B C^2) represents the rise in temperature due to the compression. Then follows the combustion, which in the unmodified Joule cycle would raise the temperature along the line (C D), Fig. 3, and, in fact, does so in this cycle at the moment of combustion; but by the subsequent conversion into steam the temperature line (C^2 D^1) is turned at the point (D') into a horizontal line, thus representing a constant temperature; but since it does not represent a diminution of the total heat energy it is extended to the right to (D^5) to embrace a heat area comparable to that embraced by the line (C D). The rise of temperature by superheating is indicated by the line (D^3 D^5). (D^5 E^3) represents the drop in temperature due to expansion at constant pressure. (E^3 W B) represents the exhaust line, most of which is horizontal, because the steam in the exhaust condenses at constant temperature. (W B) represents the drop in temperature of the fixed gases after the steam has condensed.

It will be plain from what has been said, according to Mr. Reeve, that the areas (Figs. 2 and 3) described as representing the heat energy theoretically available in the Otto and Joule cycles, involving, as they do, a very high temperature, must be modified in practice. In the Otto cycle the only known practical means for restricting this high temperature is the abstraction and rejection of heat by the water jacket or its equivalent, and there is available only an area like (B C^1 D^2 E^2) in Fig. 2. In the Reeve cycle, however, the high temperature is taken up by the conversion into steam instead of being lost in the water jacket, and the entire area (B C^2 D^1 D^3 D^5 E^3 W) is actually returnable in mechanical work. This cycle, therefore, has the capacity of the Joule cycle of increased efficiency by increased pressure, and it has in addition the capacity for making that possible efficiency practically available.

Possible Transfer of Chicago Edison Properties to Subway Interests.

There appears to be some foundation for the widely published newspaper statement that the Chicago Edison central-station properties are to be leased or sold to interests identified with the Chicago Subway Company, and the deal may go through, although it has not done so as yet. Negotiations have been under way for some time, it is believed, and a recent trip of President Samuel Insull and Director John J. Mitchell to New York attracted much attention. It is reported that the Edison people are not dealing with the Subway company, but with the people who control it, headed by E. H. Harriman; but the two properties will be operated in conjunction if a deal is made. The final plan may involve a security-holding company to take over the stocks of both concerns.

The Chicago Subway Company, as is well known, is the holding company for the Illinois Tunnel Company, which owns the extensive system of tunnels underlying downtown Chicago and to be used for the electric transportation of mail, freight and merchandise. The Subway company is controlled by the important steam-railroad interests having terminals in Chicago, and as these railroads will undoubtedly have need for large amounts of electric power in the next few years for the "electrification" of their terminals, which is bound to come, it looks as though their interest in the central-station properties is quite natural.



MAP SHOWING TERRITORY SERVED BY CENTRAL-STATION COMPANIES IN CHICAGO AND VICINITY.

If the deal goes through, it will include the Commonwealth Electric Company, owned by the Edison interests, and probably also the North Shore Electric Company, likewise in friendly hands. These three companies constitute a fine bunch of central-station properties, as may be judged by the map. The Chicago Edison Company has the central district in Chicago, the Commonwealth the remainder of Chicago, and the North Shore the suburban districts to the north, west and south of the city. Samuel Insull is president of all three companies, and will undoubtedly continue at the head of the central-station business of Chicago if the transfer goes through.

Organized in 1887, the Chicago Edison Company has about $13,000,000 stock outstanding and $19,000,000 in bonds, a total of $32,000,000 in securities. It has paid an eight per cent. yearly dividend since 1889. The capacity of its power stations is over 40,000 indicated horsepower, the largest being at Harrison Street. The company's franchise will expire in a few years, when it will undoubtedly be merged into the Commonwealth Electric Company, which is under the same control.

The Commonwealth Electric Company has issued about $15,000,000 in securities, about equally divided between stock and bonds. It was organized in 1898 and has a 50-year franchise covering every part of the city of Chicago. Its Fisk Street power house is one of the most notable in the country, with an ultimate capacity of about 200,000 horsepower, and machinery installed of about 70,000 horsepower in maximum capacity. This company supplies current to the Edison company at a low rate and has not paid dividends.

The North Shore Electric Company began its service in 1902. It now serves more than 30 suburban cities and villages in Cook, Lake and Du Page counties. It has issued securities to the amount of about $5,000,000, about equally divided between stocks and bonds.

The growth of the central-station industry in Chicago is well illustrated by the fact that in 1892, when Mr. Insull came to Chicago from New York to assume the presidency of the Chicago Edison Company, the total issue of securities of that company was about $1,000,000, whereas it now stands at $32,000,000.

A report to the Navy Department from the Pensacola (Fla.) space-telegraph station says that that plant has been able to keep in constant communication with the United Fruit Company's steamer Preston from the time that vessel left New York until it arrived at Honduras. A curious fact is that the Pensacola station has not been able to repeat this performance with any other steamer than the Preston, notwithstanding the fact that the plants are alike on all the United Fruit boats.

WESTERN ELECTRICIAN

EVERY SATURDAY.

PUBLICATION OFFICES:

507 Marquette Building, - CHICAGO.

TELEPHONE, MAIN 1746.

Eastern Office, 150 Nassau Street, New York.

Telephone, 5220 Beekman.

Trade Supplied by Western News Co.

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SUBSCRIPTION, in advance, postage prepaid, $3.00 for a full year of 52 numbers; in clubs of four or more, $2.50, with free extra copy for eight subscriptions; foreign countries, $5.00 a year; single copies, 10 cents. When change of address is requested, the **old address** as well as the new should be given.

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WHEN the education committee of the London County Council recently made a recommendation that electricity at 7½ cents a kilowatt-hour be supplied for lighting a school in South London some inquiries were made as to the relative cost of gas and electricity. In reply to the suggestion that gas was cheaper one of the members said that electricity was cheaper in the long run for indoor lighting, because any slight advantage of gas over electricity in running expense was offset by the fact that decorations require more frequent renewal where gas is used. This is an important point to consider in planning any indoor lighting, although, while frequently pointed out, it is often overlooked. Then, too, in any institution where study is carried on by artificial light, as in a school having evening classes or in a city like London having frequent gloomy days, the best illuminant should be secured for the benefit of the pupils' eyes, and particular regard should be had to the vitiation of the air by products of combustion. Both of these considerations also point to the use of electricity.

TURKEY is the most backward country in Europe in respect to electrical development, but it is reported from Constantinople that the sultan has at last abandoned his opposition to the introduction of the electric light in that city. Ten years ago, as noted by the Electrical Review of London, the employment of electricity, except for telegraphic purposes, was in principle prohibited in Turkey, but lighting stations and electric tramways have already been sanctioned for Beyrout, Damascus and Salonica. In Constantinople itself the electric light has so far only been introduced in some of the embassies and in the government buildings, but official circles have hitherto opposed the starting of a public electric supply, the establishment of a telephone service, and the transformation of the existing horse tramway to electric traction. It is said that two groups of capitalists are now endeavoring to secure the electricity concession in Constantinople—one American and one German. Apparently that one will be successful which "puts up" the greater amount of backsheesh.

PATENT COMMISSIONER Allen, in his annual report to Congress, says that the great increase in the number of applications for patents and trade-marks has overtaxed the present force of the office so that it is not able to keep the work in those two divisions up to a satisfactory state of promptness under the existing conditions. He points out that the surplus for the year 1905 amounts to $327,124.92 and is of the opinion that some of this money should be devoted to increase the force so that it may be able to meet the increased demands upon it.

In asking for more money to pay for increased help Mr. Allen is simply repeating the complaint of many of his predecessors. The inventors of the country support the Patent Office by paying liberal fees, and the bureau has shown a surplus, usually a handsome sum, for every year since 1861. Nevertheless the work of the office is not kept up to "a satisfactory state of promptness," as the commissioner mildly puts it. In fact, the delays are often exasperating. It is greatly to be desired that the work of the Patent Office be performed promptly as well as carefully, and Congress should give the increased appropriation and increased office space which the commissioner asks. It is difficult to see why this bureau, with millions to its credit in the Treasury, is yet cramped for funds.

SINCERE SYMPATHY will be extended both to the sufferers and the Pennsylvania Railroad Company as the result of the terrible railroad accident at Atlantic City on October 28th by which 55 lives were lost and a number were injured. A three-car train on the West Jersey and Seashore branch of that railroad was derailed on crossing a drawbridge over an arm of the sea on the outskirts of the city named, and two of the cars plunged into the water. This branch line had recently been electrically equipped on the third-rail system, which gives the accident a more particular interest to electrical men, but at the present time it does not appear that the electrical equipment was in any wise at fault. This equipment was modern and high-class in every respect, as will be shown in an illustrated article which we hope to publish next week. The general manager of the road says simply that he doesn't know what caused the accident, but that the cause may be revealed when the submerged cars are raised and carefully examined. The drawbridge was also new and modern, so that at the present writing both the railroad and public officials are at loss to account for the disaster. Somebody blundered or something gave way. If the motorman was at fault the poor fellow paid the penalty with his life, for he stuck to his post and was drowned. But there is no evidence at present to show that he was to blame nor any disposition to shift the responsibility to the shoulders of a dead man. The coroner will make an investigation, of course, and the result of this inquiry will be awaited with deep interest.

SECRETARY TAFT, in the public hearing which he will hold in Washington on November 12th on the question of transmitting electric power from Canada to the United States at Niagara Falls, will be materially assisted by a complete and valuable report made to him by Captain C. W. Kutz of the corps of engineers of the army after carefully investigating the subject. Captain Kutz considers each of the three Canadian power companies in detail. These are the Ontario Power Company, Electrical Development Company and Canadian Niagara Power Company. The gist of the report seems to be contained in the following extracts:

"All three of these power developments were undertaken in good faith several years ago and long before the agitation in Congress which led to the passage of the present law, and there is no evidence that any of their subsequent transactions were made with the object of securing rights which they have not always intended to claim."

"The total capacity of the generating machinery installed and ordered for the three plants is 171,000 horsepower. The probable demand in the near future from Canadian markets will not exceed 40,000 horsepower, leaving 131,000 horsepower for sale in the United States. The granting of permits for this amount would permit the utilization to its full capacity of all machinery now installed or ordered, but would not permit any further development and would not afford a reasonable return on the moneys now invested unless the price to the consumers was measurably increased. In order that such relief as is now possible may be afforded, it is recommended that permits be granted for 157,500 horsepower, the maximum amount under the first limitation, less 2,500 horsepower reserved for the International Railway Company."

"As to the question of granting transmission permits for amounts additional to the first 160,000 horsepower, it is believed to be the intent of the law to delay the issue of such permits until it is known what appreciable effect, if any, will be produced on the Falls by the diversion of the amount of water that will be used under the first limitation. If this interpretation of the law is correct, the granting of such permits will be a matter for the future, as it will be fully a year before the companies will be in a position to develop 160,000 horsepower in addition to the amounts sold in Canada."

Captain Kutz recommends that the Niagara, Lockport and Ontario Power Company be permitted to transmit 60,000 horsepower into the United States; the Niagara Falls Electrical Transmission Company 37,500 horsepower, and the Niagara Falls Power Company 60,000 horsepower, making a total of 157,500 horsepower. In this recommendation the American members of the International Waterways Commission concur, but say they see no reason why revocable permits should not be issued.

One interesting statement in the report is that if the three companies be limited to the output of generating machinery now actually installed or ordered, their investment in power plant per horsepower, exclusive of franchises, will range from $89 to $125. But if they are allowed to develop to the limit of their approved plans, these investments will be cut down to from $60 to $68 per horsepower developed. Naturally, the companies are anxious to secure the benefit of these lower investment costs; and, proceeding cautiously and gradually, so that any excessive diminution in the Falls may be observed and checked, it will probably be wise to permit them to do so.

The Audion—a New Receiver for Wireless Telegraphy.[1]

By Lee De Forest.

"The story of the development of a device of a distinctively new order, from its first inception to its practical reality, adds a human interest to its description which is perhaps too often lacking among scientific records. In 1900 when I was beginning experiments on the electrolytic responder, it was my good fortune to have to work upon it at night in my own room, at a table beneath a solitary gas burner with Welsbach mantle. My source of Hertzian waves was the discharge of a small induction coil placed in an opposite corner and set into operation by a key closed by pulling a string."

The author relates how he noted that the sparking of the coil affected the gas burner to a noticeable extent, and although disappointed by finding that the sensitiveness was responsive apparently only to the sound caused by the spark and by other sounds, he started investigating the effects of the Hertzian vibrations upon a Bunsen burner and other flames under various conditions. He continues:

"In the coal-gas flame the exterior luminous portion is positively electrified, the interior negatively. To render these flames sufficiently conducting, salts of the alkali metals were introduced. Of these the cæsium, potassium and sodium salts are the most conducting, and in the order named. These salts were either injected into the flames as solution, or preferably put in a little platinum cup held in the luminous part of the flame (Fig. 1) and made the cathode of the telephone circuit.

"A platinum wire or disk held about two millimeters above this cup acted as anode. The antenna and earth connection, or the two terminals of the oscillating receiving circuit, were connected

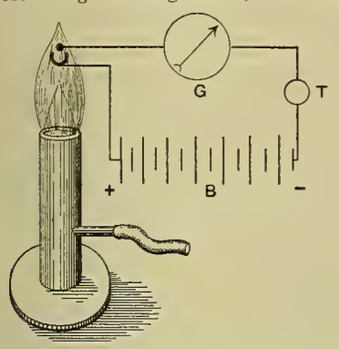


FIG. 1. THE GAS-FLAME AUDION.

to these platinum electrodes. An electromotive force of six to 18 volts, supplied by a battery of dry cells, was sufficient to give a current of several milliamperes through the colored flame.

"This early form of audion, the flame receiver, was remarkably sensitive to weak high-frequency oscillations. The sound heard in the telephone was an exact reproduction of that of the transmitter spark, in pitch, variation of intensity, etc."

Mr. De Forest then discusses his observations of the gas-flame audion and finds that the current does not follow Ohm's law; does not rise with the electromotive force until a certain point when the field itself is enabled to ionize the gas. The negative ions cause the conduction through flames and their velocity increases rapidly with the temperature. Referring to his next experiments, the writer says:

"I next sought the phenomenon in the hot conducting gases of the electric arc. If a wire be connected to the positive carbon of the arc and led through a telephone to a third electrode, platinum or carbon, which is inserted into the border of the arc, a considerable current passes through the telephone. If these two electrodes are now connected to the terminals of the receiving oscillating circuit, the conduction of the leak current across the gas to the third electrode is sensibly affected by the arriving Hertzian oscillations, if sufficiently intense. A local battery can also be inserted in series with the telephone, but the voltage drop across the arc is usually too great to require this.

"Even when the arc is fed from a storage battery and cored carbons used, the hissing and frying noises in the telephone (probably due to the oxidation of the terminal by the air) are generally too troublesome to allow a clear reading of weak signals with this form of audion."

"Inasmuch as the gases ionize more readily at lower heats and are in their most mobile, delicate and sensitive conditions in vacuum, it seemed to me certain, after experiments with the flame, that the attenuated and ionized gases around an incandescent filament would undergo very considerable changes when subjected to Hertzian oscillations."

"The electrification produced in the neighborhood of an incandescent wire is a complicated effect; it depends on the temperature and nature of the filament, and on the nature and pressure of the gas. It furthermore depends upon the electric and magnetic forces to which the vessel is subjected; and I have found that the shape and area of the plate or plates, the condition of its surface and edges, as well as its distance from the filament, are very important factors.

"If the metal plate be connected by an outside wire to the positive terminal of the hot filament, a leak current from the plate to the filament through the gas will be set up, as Elster and Geitel first found, passing mainly to that portion

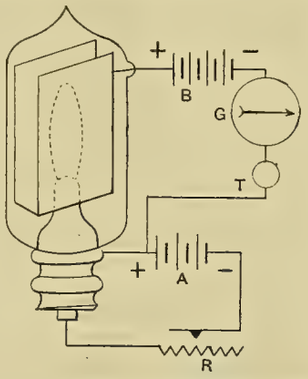


FIG. 2. AUDION WITH PARALLEL WINGS.

of the filament near its negative terminal. If the resistance of the lamp filament and the lamp's voltage be high, a very considerable leak current may thus be set up.

"A battery of from three to 18 dry cells is connected between the positive end of the filament and the platinum plate, the latter being connected to the positive pole. The saturation current increases rapidly with the heating current through the filament, which also increases the velocity of the negative ions, as does also an increase in the applied electromotive force between plate and filament.

"The rate of discharge of negative electricity from glowing carbon greatly exceeds that from platinum, while that from tantalum and other of the newer filaments, given the same heating current, surpasses the rate of discharge from carbon."

"In the form of audion illustrated in Fig. 2, I employ two platinum wings parallel to the plane of the bowed filament and about two millimeters on either side of it. These wings are soon coated with an iridescent deposit from the metal filament, especially at the portions opposite to the negative half of the filament. They become quite hot at this short distance, but not sufficiently hot to take part in the ionization of the gas.

"When connected in the oscillation circuit, as shown, properly attuned to the receiving electromagnetic impulse from the antenna, the audion, under proper adjustment of heating current and battery (B) potential, is extremely sensitive, giving response in the receiving telephone several times as loud as any other form of wireless receiver when subjected to the same impulses. It is, however, less sensitive to atmospheric or static

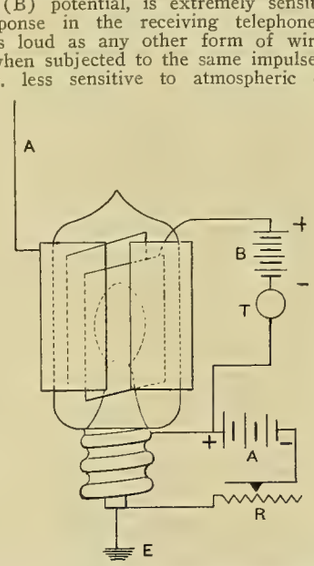


FIG. 3. AUDION WITH WINGS AT RIGHT ANGLES.

disturbances, which are strongly damped or aperiodic.

"I find the device extremely closely tuned with the syntonizer, for its operation seems to be dependent upon the sum total of the energy received from the complete wave train rather than upon the maximum first impulse of the train. In other words, while instantaneous as far as our senses or instruments can perceive, its action is sufficiently sluggish to be determined by the additive effect of the entire received electro-radiant energy through a short time interval.

"When the filament is first lighted, an appreciable interval, about one-quarter second, elapses before the full sensitiveness is established. Before the flux reaches a steady state there is a period during which the number of ions is steadily increasing. As result of the colliding of the initial ions with the gas molecules the number of ions and the current rapidly increase, until an equilibrium is finally attained.

"The audion, to a greater extent than any other responder, is self-tuned. I mean that by regulating the heating current, the potential between wing and filament, or the distance between these, the audion can be made to a great extent selective per se to certain received impulses. And the determining factor here is not merely the frequency of the electrical oscillation; the spark frequency, or factors determining the total amount of energy received during a very brief unit of time, determine to an extent the amount of its response. Thus, with 12 volts across it, it may give a loud response to a transmitter (A); and with 10 volts 'bring in' another transmitter (B) to the almost complete exclusion of (A), although (A) and (B) are of equal power and of approximately the same wave length, but differing considerably in spark frequency. Similar discrimination can be produced by adjustments of the heat of the filament, which also governs the amount of flux through the gas.

"This flux is generally reduced when the audion is placed in a strong magnetic field, especially when the lines of force pass through the gas parallel to the plane of the wings at right angles to the electric field (Fig. 3). By this means also a tuning can be effected.

"Again it is not necessary to connect the anode to a terminal of the oscillating circuit. One terminal may be attached to a metal sheath or ring surrounding the glass vessel, thus forming a con-

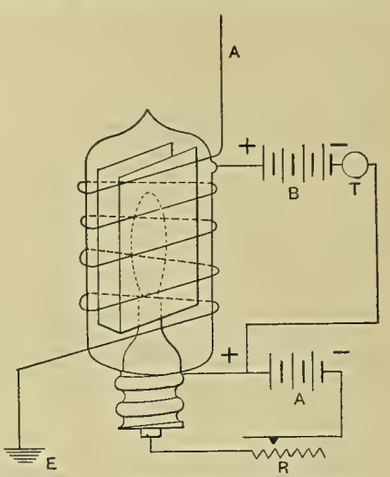


FIG. 4. AUDION WITH COIL OF WIRE.

denser with the filament or conducting gas within the tube. In this case the adjustment of the syntonizer is generally different from that required for the same oscillation frequency, when the interior wing is directly connected in the oscillation circuit. In this condenser arrangement also the sound heard in the telephone changes its quality to an extraordinary degree, being of a dull muffled nature rather than sharp and staccato. Signals of this quality are doubtless much more readily distinguished from the 'static' disturbances which so frequently render wireless signals difficult to read. The operator has thus a ready means of changing the quality of the received signals to suit the conditions. The latter type of audion is one I have found most serviceable in practice.

"The audion may even be placed in the space between two plates of an air condenser in the oscillating circuit. A flat-walled type of tube is preferred for this arrangement. Again the electrical oscillation may be led through a coil of wire wound round the outside of the tube (Fig 4), and not through the audion at all, or through a flat coil brought up close to the tube, with its axis perpendicular to the filament. In this arrangement it is chiefly the electromagnetic component of the passing oscillation which affects the motion of the ions within the vessel. The ions are readily influenced by a magnetic field. By shifting the syntonizer connections from the wings to this helix, I have been able to cut out completely signals from a transmitting station so near as to baffle all attempts with the ordinary tuner methods, and to bring in other relatively faint signals.

"The audion has the further advantage of entire absence of adjustment in the receiver itself. It gives no evidence of fatigue under any conditions of use. Furthermore, it requires no protection from the violent impulses of the transmitter at its own station, whereas the sensitiveness of the electrolytic receiver is completely destroyed by one such violent impulse, unless its small electrode is protected by a shunting switch."

"I have arrived as yet at no completely satisfactory theory as to the exact means by which the high-frequency oscillations affect so markedly the behavior of an ionized gas. Fleming points out that when the cold plate of the Elster-Geitel tube

1. Extracts from a paper presented at the meeting of the American Institute of Electrical Engineers, New York, Ocobter 26, 1906.

is connected to the positive end of the filament, and the two put in a high-frequency oscillation circuit, only the positive half of the oscillation can pass from the plate to the filament across the gas. He uses this principle to rectify the Hertzian oscillations, and applies the unidirectional currents of the oscillations themselves to operate a sensitive galvanometer or direct-current instrument for quantitative measurements over very short distances.

"When an independent external source of electromotive force is applied, in the manner I have described, the action becomes quite different. It then operates as a relay to the Hertzian energy instead of merely rectifying this energy so that it can be used directly to give the sense signal.

"The audion therefore is tremendously more sensitive and available in practical wireless. A sensitive direct-current instrument in the (B) circuit shows a steady deflection varying not a whit, by increase or decrease, during the reception of strong 'wireless' signals. An electrolytic receiver or 'polariphone' under similar conditions would cause a great deviation in the deflection of a milliammeter, although the signals in the telephone with the electrolytic are not so loud as with the audion.

"I have connected two audions in series in opposition in the oscillating circuit, each with its separate heating circuit, and still heard the signals in the telephone connected to the second audion equally well whether the wing in the first be connected to the wing or to the filament of the second.

"When one of the tubes is unlighted, or if lighted its (B) circuit is open, no high-frequency impulses pass through it unless the wing and filament are very close together. When cold it acts merely as a condenser whose armatures are the wings and filament and whose capacity is extremely small."

The writer discusses the "potential gradient or 'variation' layers which exist near the surface of the electrodes when the external electromotive force is considerable," and points out the striking similarity between the audion and the cathode-ray tube, making the following observation:

"In Humstedt's experiments, where a cathode-ray tube was exposed to high-frequency oscillations the width of the cathode drop layer, or dark space, diminished as the frequency of the oscillations increased; as if there might be some connection between the period and the time involved in the immigration across. And many facts observed in connection with the audion otherwise difficult to explain tempt one to suppose that here the degree of response is connected with the relation between the product of velocity of the ions by the distance between the electrodes and the period or half period of the electrical oscillations received."

The next part of the paper speaks of his observations of the alterations of the flux current in the audion and the decided hysteresis effect noted. Mr. De Forest says of the latter: "This hysteresis effect is very like that obtained when the molecular structure of iron is altered under a changing magnetic field. Doubtless it is here due to a reluctance of the ions to accommodate their paths and velocities to the impelling electric forces. The area included between the two curves represents the work lost in accomplishing this conformation."

"In framing any theory of the action of electric oscillations in the audion a variety of complex, contradictory phenomena are met with, exceedingly puzzling to explain. An example is the fact that a continuous-current instrument in either the (A) or the (B) circuit shows absolutely no change of deflection, either of increase or decrease, when (B) is large and the audion in its most sensitive condition. If only tne positive halves of the oscillations pass from anode to filament these should increase the reading of a milliammeter in the (B) circuit during the passage of a long series of wave trains of sufficient intensity. Or else the negative halves of these oscillations might be expected to diminish to a greater degree the positive charge on the anode, and result in a diminution of the (B) circuit. Or if both of these acted equally and oppositely no signal would be obtained at all, for the telephone diaphragm is utterly incapable of following such rapid increase and decrease in the (B) current, even if its impedance would allow these pulsations to pass through the circuit. Neither would the ear detect such vibrations.

"If on the other hand the integrated effect of a complete Hertzian wave train were either to increase or decrease the (B) flux, a long succession of such effects, all of which must be of the same sign, ought to cause a change in the needle's deflection, as when a long Morse dash is sent out from the transmitting station. We have no reason to suppose that one wave train, the result of one spark, would produce a momentary decrease in the (B) flux, indicated by a click in the telephone, and that the next succeeding wave train from the next spark would cause an opposite increase in the (B) flux, and another similar click in the telephone. Such action would, of course, explain why a loud sound in the telephone might not be accompanied by any change in the sluggish ammeter reading, similar to the case of the magnetic detector.

"The following explanation of the phenomena which seems to account for many of the peculiarities of this paradox has been suggested. It should be remembered that if the negative half of the electric oscillation cannot pass through the gas from cold anode to the filament, the audion electrodes during that half period will act merely as the two armatures of a condenser. Even when close together their mutual capacity, when the gas is cold, is exceedingly small, and only a very small positive charge can be held bound on the filament; or if there are sufficient free positive ions in the hot gap the complimentary positive charge will be held just on the outside of the 'variation layer' at the anode.

"The falls of potential across the variation layers at anode and cathode are proportional to the squares of the velocities of the positive and negative ions; and the ionic velocities are proportional to the electric forces acting upon them. Supposing then that during the positive half of the electric oscillations the velocity of the positive ions is increased at the anode layer, and during the other half period the velocity of the negative ions is increased, due to the changes in the electric force acting upon them. Then, regardless of the sign of the change of the velocities, the potential drop across the variation layers (which varies with the square of these changes) will be increased during the entire passage of the oscillation train.

"The layer will act during this interval like a condenser, the potential drop across which is momentarily increased, which momentary increase will disappear with the passage of the wave train. It will be as if the plates of a charged air condenser were suddenly further separated and then brought suddenly back to their normal positions; or as if the specific inductive capacity of the dielectric were decreased and then increased. This operation being repeated for every spark at the transmitter, a listener in the telephone in the (B) circuit will hear a sound whose pitch is exactly that of the spark, while a milliammeter in that circuit will show no variation in its deflection."

After continuing his observations upon these subjects the author takes up the "magnetic effects" and states:

"In general it can be assumed that in a strong magnetic field the ions tend to follow the lines of magnetic force. The smaller the velocity of projection the more nearly does the path of the ion coincide with a line of magnetic force. In cathode-ray tubes the boundary of the negative flow may coincide with the lines of magnetic force.

"In the case of the audion, if the lines of a strong magnetic field pass through the gas parallel to the plane of the anodes, a marked reduction in the flux is obtained, sometimes amounting to 20 per cent. This effect is greater when the south pole of the magnet is nearest that leg of the filament which is attached to the negative terminal of battery (A). The negative charge on this leg is, of course, greater than on the other, for the negative charge on the other is the resultant of the negative potential of battery (B) and the positive potential of battery (A). And when the lines of magnetic force are so directed as to tend to sweep some of the negative ions off from the parts of the anode nearest to the filament leg which carries the greater negative potential, the reduction of the flux across the gas will be the greatest possible. Hence the magnetic polarity observed."

"In general the flux will be diminished by the magnetic field. When the magnetic lines pass perpendicular to the plane of the wings the negative ions which are traveling in the direction of the magnetic force, from filament to wing, will be accelerated, but those originally traveling out from the filament in the opposite direction will be bent around or deflected from their direct paths; so the resultant will be a decrease of the total current flux."

The writer finds that when the field is intense there is a marked hissing sound in the telephone which is more violent when the surfaces of the anode are punched full of little holes. In conclusion he says:

"The manner in which the audion should be located in the oscillating circuit, as well as many other considerations, shows conclusively that it is a 'potential-operated' rather than a 'current-operated' relay receiver. At the same time its advantageous sluggishness of action, as explained above, renders it additive in its response to the energy of an entire wave train or even of a series of wave trains. Hence its excellent and marked selective qualities.

"A large number of experiments have been carried out with a view to reducing the filament heat necessary to give the enclosed type of the audion the extreme sensitiveness which now characterizes it. This is now attained at normal brilliancy of the filament, or a little below; never at excessive heats. Thus the life of an audion should be that of an incandescent lamp of the same class of filament and voltage.

"Filaments have been coated with alkali metals or salts, or vapors of these introduced into the tubes. Experiments along these lines and with various dissociable gases are being pushed with gratifying promise of our soon being able to achieve the present marked sensitiveness even at red heats; or of still further multiplying the sensitiveness.

"Radioactive compounds, applied for example between juxtaposed metal disks and heated, give little encouragement. At the low voltages used no increase of conductivity by their means has been observed, although Swinton has found that a radium-coated cathode in a cathode-ray tube has a marked action in facilitating a luminous cathodic discharge, when the cathode is heated to redness. The mere presence of radium salt in the tube is insufficient to produce the effect.

"Spontaneous ionization, that is, the ionization independent of the electric field, as for example that produced by the X-rays, does not increase the current flux. Only the ions produced by the electric field itself close to the cathode, and by the heat of the cathode, are effective.

"It is required that the audion be made with scrupulous care; a trace of impurity in the gas may produce surprisingly large effects in the potential drop across the variation layers. The presence of a mere trace of moisture may cause great difference in the behavior of a tube.

"In all this work a bewildering host of new and puzzling phenomena is continually encountered. By its nature clean and pretty, fascinating in its ever-new phases, gratifying in the efficiency with which it responds to the difficult demands of a new and intricate art, the audion combines infinitely delicate matter and forces, at once offering rich fields for study to the physicist and delight to the practical man."

Discussion (in abstract).

Dr. M. I. Pupin of Columbia University opened the discussion by explaining that his knowledge of wireless telegraphy was only indirect, having had no practical experience in connection with it. He dislikes the idea of coining new names for everything that comes up in the development of the art and is not much impressed with the name "audion." He says that it is "a Latin word with a Greek ending." He continued:

I should have been very glad if Dr. De Forest had given a brief historical account of the subject, and then a brief statement of the physical theory of the whole thing. I think the paper would have been very much more easily understood by those who are not well acquainted with this part of electrical science, and I think you all feel that the subject is somewhat more outside of your ordinary line of work; it is a new subject, a subject that has been so far mostly in the hands of physicists and not electrical engineers.

What we have here is the hot electrode from which negative ions recede, and then we have the cooler plate, which is negatively charged, is negative with respect to the hot anodes, and we have electrical tension applied to these points and a leakage current. We call it a leakage current for want of a better name; it is an electrical current. Now, that electrical current is steady, according to Dr. De Forest, and that in fact is the most remarkable point in his paper; it is steady under all conditions, no matter whether electrical waves strike the oscillating circuit of which the tube is a part, or not. It is steady as far as a milliammeter can tell. It is not steady as far as the telephone can tell.

Well, now, if the effect of the Hertzian waves is to produce a uni-directional current, or rather if the effect of the wave is this, namely, to rectify the Hertzian waves, to let either the positive or negative parts of the wave pass through unhindered, why should we be expected to perceive that in the milliammeter? We do not perceive it, and therefore we cannot suppose that these waves are rectified. The only other things we can guess, as possibly happening, is that the oscillation passes through the whole circuit, but on account of some effect upon the gaseous part of the circuit, the resistance, or the diminution or increase of some of the other reactions, the original current is strengthened very much at certain intervals during one-half of the waves, and weakened during the other half, or strengthened during each side of the wave. That, as Dr. De Forest points out, is also impossible to believe, because the oscillations, being so rapid, could not very well pass through the winding of the telephone in the first place, and in the second place could not be expected to produce a very large magnetic effect upon the diaphragm, because magnetism and demagnetism of the permanent magnet in the telephone would not follow these very rapid oscillations. That seems to me to be one of the most difficult points to understand in the paper.

I have employed a telephone in my work for quite a number of years for detecting faint sounds, faint differences of potential, and faint currents, and I find the telephone is one of the most tricky instruments you can use. It will mislead you and lead you to draw false conclusions. The most misleading point in the telephone is to distinguish between electromagnetic effect and electrostatic effect. The sensitiveness of the telephone has been estimated variously by different authorities, some placing it at as high as one-millionth of a volt. Now that is a very high degree of sen-

sitiveness. It would be if it were correct. It is not correct; the telephone is not as sensitive as that, and I believe that those who made measurements did not measure the right thing. If they had measured the current when they were determining the sensitiveness of the instrument, they would have found that the thing measured was not the current passing through the telephone coils, but that it was the current which went through the body, all along the floor, the leakage current which affected the magnetic current in the telephone which produced the sound. I have been misled that way quite a number of times.

Percy H. Thomas: In the audion, we have a means of producing ions. In the first place we have a vacuum, which allows a more or less free movement. We have a means of controlling and directing these ions, that is, this additional battery electromotive force, and then we have further the waves which come in on the transmission circuit, which, in some way or other we do not understand, so affect the action of the corpuscles which we have as to make a sound in the telephone. I have spoken of corpuscles as though they alone were the important action here, while in the paper ions are spoken of. Perhaps it is impossible to say whether it is the corpuscle itself or the corpuscles attached to one portion of the gaseous molecule which is there and forms an ion. The determination as to which it is is perhaps not very important. The explanation that is suggested for the curious action of the telephone, that it depends upon a virtual change of dielectric, is certainly an ingenious one and might turn out to be the correct one.

Sewall Cabot: There are two points in connection with the paper I should like to consider and ask Mr. De Forest to explain. He says: "The audion, to a greater extent than any other responder, is self-tuned." I would ask whether that condition of self-tuning refers to being able to alter the electrostatic capacity of the audion, per se, in the resonant circuit, we will say, opening the inductance and capacity, which would be a tuning circuit, and therefore altering the tuning of the circuit by altering the electrostatic capacity of the audion, or does it simply refer to the tuning of the spark frequency, that is, by changing the battery potential, having the audion more or less responsive to relatively slow frequencies, of, we will say, 400 to a second, which might be said to correspond with the spark frequencies?

Dr. De Forest: There really are both effects present. Where the tuning of the audion is regulated by changing the resistance betwen the two electrodes, as in the last case described, where the two wings are hinged and drawn to and taken from the filament by a magnet, we have there the change of capacity, intensity; in the other case, where the resistance between them and the heating current or the filament remains unchanged, we merely vary the potential across the gap.

Mr. Cabot: Is it true that the capacity of the audion may be changed through relatively large values so as to produce a considerable difference of resonance in the closed resonant circuit across our condenser? The capacity of the audion would presumably be very small with regard to its capacity to bring the closed resonant circuit to the point of resonance.

Dr. De Forest: Yes, the capacity of the audion measured in that way is very small; a very small condenser put in shunt across it takes away the resistance.

Mr. Cabot: So that presumably a considerable separation of the wings would not relatively change the tuning of that specific closed resonant circuit greatly?

Dr. De Forest: No, not greatly.

Mr. Cabot: The principal effect in tuning, then, is with regard to the spark frequency.

J. B. Taylor, E. P. Thompson and Frank J. Vreeland participated in the discussion. At the end of his remarks, Mr. Vreeland said: Is it not possible you did have a uni-directional polarized current sufficient to affect the telephone and not sufficient to affect the instrument you were using?

Dr. De Forest: It might have had that effect, but at the same time I got signals which could be described as tremendously loud in the telephone, and no change of deflection, so I had no reason to suppose that as these signals got weaker in the telephone they would become uni-directional, or if so, there was no reason to suppose they should when they are weak give an effect entirely lacking when they are strong.

Mr. Vreeland: Then you incline, as I understand it, to the belief that the currents from the telephone were really alternating currents and did reverse?

Dr. De Forest: Yes.

Dr. De Forest: Dr. Pupin's opening remarks may serve as an argument why the study of Greek and Latin should be thoroughly introduced into our engineering schools. My knowledge of Greek is almost nil; I knew, however, that aud was of Latin, and ion of Greek derivation, but they are both expressive. Where we use a term 100 times a day it is necessary to have something brief; we could not expect the wireless telegraph operators to use a long, technical description of the apparatus in speaking of it.

I hope to have the privilege of showing the audion in operation to the members of the institute and letting them hear the signals. I would like Dr. Pupin especially to hear them. The intensity of them is at times so great that he must admit that they are caused by an electromagnetic current flowing through the telephone and not electrostatic effects in the telephone between the core and the diaphragm, although the latter undoubtedly exist, and under certain conditions may predominate, but in the intense signals of which I speak the quality of the tone is exactly the same as we get when we know we are alternating the current through the telephone.

QUESTIONS AND ANSWERS.

Dimensions for a Searchlight.

D. K., West Duluth, Minn.: What are the dimensions for a simple electric-arc searchlight, throwing, say, about a mile of narrow light, for 110 volts, with any amperage?

ANSWER.

The actual efficiency of a searchlight is influenced greatly by atmospheric conditions. To throw a narrow beam about a mile on a dark clear night a projector having a nine-inch lens and operating at 12 amperes on 110 volts would probably be found satisfactory. But in foggy weather the penetrating power of the light is greatly decreased.

Resistance for Ruhmkorff Coil.

W. W., Leon, Iowa: I wish to operate a Ruhmkorff coil from a 110-volt circuit. The coil requires 10 amperes. What resistance must I use to reduce the current to the proper strength to work the coil without burning the contact points? How large must a German-silver wire be to carry 10 amperes without overheating?

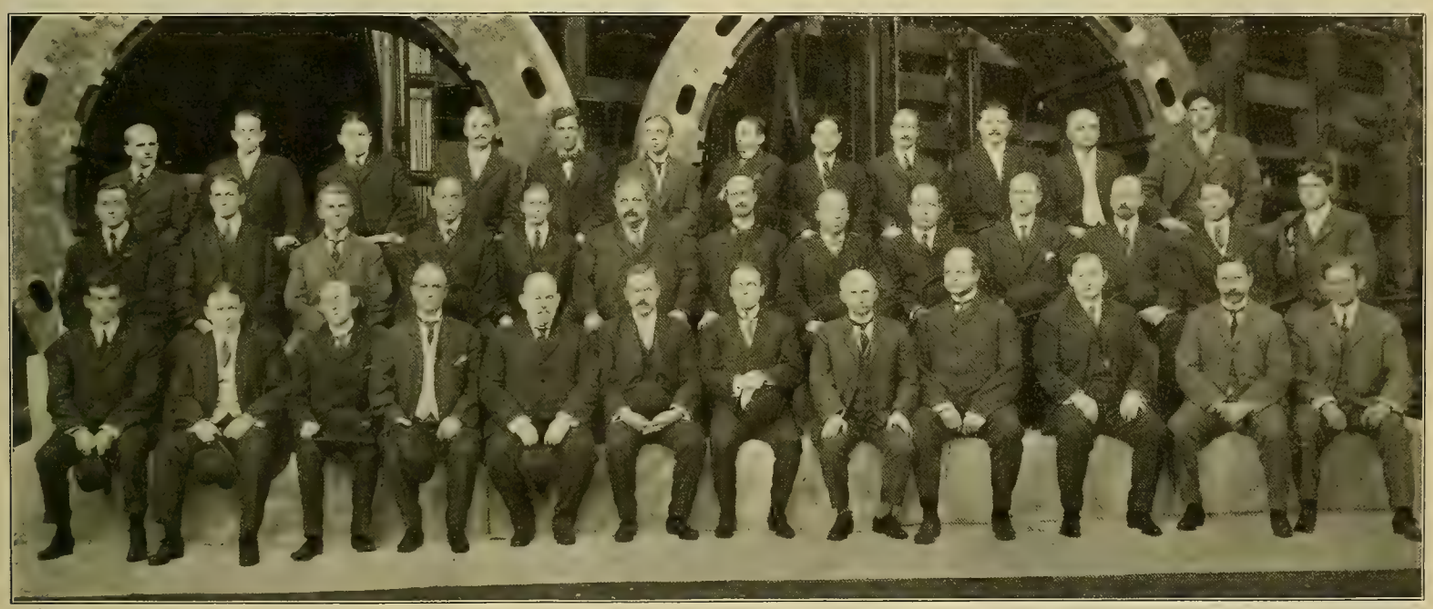
ANSWER.

As the resistance of the primary coil is low, possibly only a fraction of an ohm, a resistance of 11 ohms introduced into the circuit will give a little less than 10 amperes. A No. 10 B. & S. gauge German-silver wire will carry the current safely. For short periods, however, it would be safe to use a No. 12 B. & S. gauge wire.

Westinghouse Managers' Meeting.

The annual convention of the sales managers of the Westinghouse Electric and Manufacturing Company was held at the East Pittsburg works during the week ended October 27th. The meetings were conducted by Mr. E. M. Herr, first vice-president, and Mr. L. A. Osborne, second vice-president, assisted by C. S. Cook, manager of the railway and lighting department; S. L. Nicholson, manager of the industrial and power department; C. B. Humphrey, manager of the detail and supply department, and Walter Cary, general manager of the Sawyer-Man Electric Company.

On Wednesday evening, October 24th, the officials of the company gave a banquet to the visiting managers at Hotel Schenley, at which there were present, in addition to the officials and managers of the electric company, prominent officials of associated interests, including Col. H. G. Prout, vice-president of the Union Switch and Signal Company; Mr. John F. Miller, fourth vice-president of the Westinghouse Air Brake Company, and Mr. E. H. Sniffin, third vice-president of the Westinghouse Machine Company.



OFFICERS AND DISTRICT MANAGERS OF WESTINGHOUSE ELECTRIC AND MANUFACTURING COMPANY.

These annual meetings of the Westinghouse company were inaugurated a number of years ago and give an opportunity for the mingling of ideas of the managers from all parts of the country, working under almost every known commercial condition. The convention closed on Saturday, when the managers returned to their respective territories.

Reading from left to right, the gentlemen shown in the accompanying group are as follows:

Top row—G. B. Dusinberre, manager Cleveland office; H. D. Shute, assistant to second vice-president; J. S. Tritle, acting manager Kansas City office; H. F. Baetz, assistant treasurer; William J. Clegg, Jr., acting manager St. Louis office; W. F. Fowler, manager Pittsburg office; S. L. Nicholson, manager industrial and power department; J. A. Brett, manager Cincinnati office; C. F. Medbury, manager Detroit office; W. H. Masters, sales department; S. J. Keese, manager Los Angeles office; H. P. Davis, chief engineer.

Middle row—G. Brewer Griffin, assistant manager detail and supply department; H. H. Seabrooke, manager Baltimore office; H. F. Cameron, acting manager New Orleans office; T. P. Gaylord, manager Chicago office; J. J. Gibson, acting manager Philadelphia office; C. S. Cook, manager railway and lighting department; L. M. Cargo, manager Denver office; W. W. Briggs, manager San Francisco office; Walter Cary, general manager Sawyer-Man Electric Company; C. W. Underwood, manager Buffalo office; D. E. Manson, manager Boston office; G. E. Miller, railway and lighting department; J. D. Michel, acting manager Syracuse office.

Bottom row—T. J. McGill, manager Minneapolis office; W. C. Webster, manager New York office; G. Pantaleoni, general southwestern manager; J. R. Gordon, manager Atlanta office; W. M. McFarland, acting vice-president; E. M. Herr, director and first vice-president; L. A. Osborne, second vice-president; Maurice Coster, manager New York export office; C. S. Powell, general agent, New York; F. F. Rohrer, correspondence department; C. B. Humphrey, manager detail and supply department; M. R. Randolph, manager Seattle office.

Importation of Electric Current.

At 11 o'clock on the morning of November 12th, Secretary of War W. H. Taft will hold a hearing in Washington, D. C., on the question of transmitting Canadian power into the United States at Niagara Falls. The hearing will be governed by the facts contained in the report made to the secretary by Capt. Charles W. Kutz, Corps of Engineers, who visited Niagara Falls during the summer and made a very thorough investigation of all the power plants and the projects for transmission.

SELLING ELECTRICITY.

Under this heading will appear, from time to time, articles, suggestions and examples which will be of assistance in the constant effort to increase the existing demand for electric current and to create new demands.

The New-business Story of a Small City.

Among the papers submitted in the recent prize competition of the Co-operative Electrical Development Association, the subject being "Organization and Conduct of a New-business Department Suitable for Central Stations in Cities of 50,000 Population and Under," was one by Charles Nathan Jackson, commercial manager of the Toledo (Ohio) Gas, Electric and Heating Company, which was accorded honorable mention. It is written in a different vein than the other papers so far made public and purports to tell a connected story of actual occurrences. Readers of The Western Electrician will be interested in the following condensation of this paper.

I have always lived in a small city of about 30,000 inhabitants in central Ohio. I have been in the banking business for several years, and was interested, to a certain extent, in our local electric-light plant. In course of time, however, I purchased the entire property. We had a total generating capacity of 600 kilowatts and did not do the municipal lighting. The revenue was about $30,000 a year and the plant was loaded to its utmost capacity about five o'clock in the December afternoons. The manager in charge was a very capable operating man and had several years of experience at operating plants. He was drawing a salary of $2,000 a year but did not seem to know much about hustling for business. When I asked him what we had better do to increase the revenue, he said, "Hire a solicitor and install more machinery." We finally secured a young man who had sold electricity in another town and started him to work and then began to make plans for increasing the capacity of the plant.

We were charging 10 cents per kilowatt-hour, and the young man had not been at work very long before he secured a contract for a wholesale house that would use about 25 arc lamps. He also got contracts for several factories and I began to think that there was a good prospect of his building up quite a business. However, I did not see any increase in the receipts, but the manager told me to wait until next winter and all these new customers would then be using the light. Of course, we could not expect much in the summer, as they did not need it. Gas was selling at $1 a thousand cubic feet and a walk through the business district at night showed all the saloons, drug stores, restaurants and hotels using gas. Upon inquiry I found that the price of electric light to such consumers was about three times the cost of gas, and of course they could not afford to pay the difference. The solicitor's business soon began to drop off and in a few months his orders were very few and far between. He merely said that he had secured every customer that he could and could not possibly get any more.

One day, in answer to a letter of mine, a Mr. Johnson called to see me and in answer to my question as to what he could do, he replied that he did not know, but that if I would give him a guide and a right to ask a few questions he could soon tell me. I did so and the next day he returned and said, "I find that you have loaded your plant down with 'short burners.' About the only revenue you get is on the peak in the winter. I can increase your net profits from twenty to thirty thousand dollars a year, and you need not purchase any more machinery. There are a great many concerns, such as saloons, drug stores, restaurants, hotels and other 'long burners' that you ask to pay at your present 10-cent rate $200 per year per kilowatt demanded, which is much too high. Imagine a drug store having 40 16-candlepower lamps paying you $400 a year! Their gas bills are not over $150 a year. But you will let a wholesale store that closes at 5:30 p. m. burn 40 16-candlepower lamps and only pay you $50 a year and they cost you nearly as much as the drug store. All of your fixed expenses are the same for both, but the drug store uses about 4,000 kilowatt-hours and the wholesale store 500 kilowatt-hours. As your coal bill is not over one-half cent per kilowatt-hour, you can see the drug store would cost for coal $20, the wholesale house $2.50. So you are either making a large profit on one or losing a lot on the other."

He said that the town was not large enough for him to spend his entire time with us, but that he had in training several bright salesmen, any one of whom was capable of going into the town and working up the business under his supervision. Of course, it would oftentimes be necessary for him to help the solicitor on some big contract, and that he would charge me $1,800 a year for the services of his solicitor, and for his own services he would ask 25 per cent. of the increased profits during the first two years.

He at once came on the ground to give us a start, and first got a friend of our company to agitate a rate ordinance, which was passed. It prohibited a charge in excess of 50 cents per month per 16-candlepower lamp to customers using light not over 10 hours a day. The "long burners," of course, were pleased and boosted it along. The "short burners," never dreaming that it would affect them, said nothing. He then sent for the solicitor, who was instructed to charge a flat rate of $5 a month per kilowatt demanded and an extra charge of two cents per kilowatt to all light customers, except residences, who were to pay 10 cents per kilowatt-hour, $1 minimum. Lodge rooms, churches and hotels were to receive a special rate.

The solicitor had no trouble in securing contracts with all the "long burners" and at the same time kept an eye open for unprofitable "short burners," and raised their price to the new rate. The wholesale houses, when asked to pay $10 a month plus two cents per kilowatt-hour, threw up their hands in horror and said that

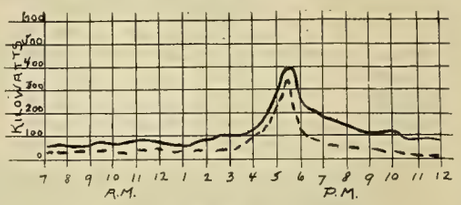


Fig. 1. October Load Curves.

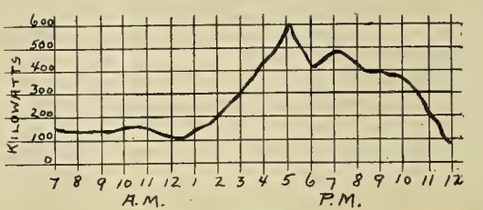


Fig. 2. December Load Curve.

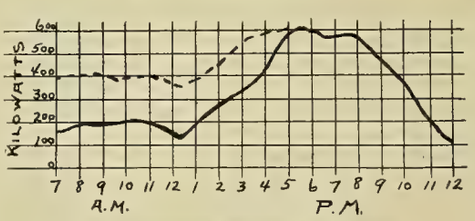


Fig. 3. Improved December Load Curves.

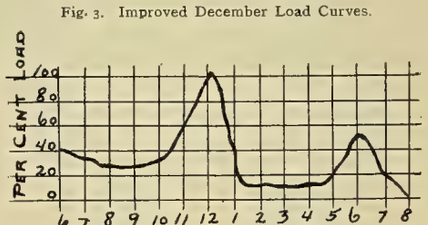


Fig 4. Electric Cooking Load Curve.

THE NEW-BUSINESS HISTORY OF A SMALL CITY.

they would not stand for any such "hold-up," so they put in gas.

In October the load curve of the station looked like the solid line in Fig. 1. The load curve before looked like the dotted line. Mr. Johnson said: "You will notice that the load drops off a little after six. If we don't do something we will have a curve like that of Fig. 2 in December. You will notice in Fig. 2 that it will begin to drop off at five o'clock. I am going to start a strong campaign on residence lighting, churches and lodge rooms, which commence to burn at five o'clock and get heavier as the other load goes off." He engaged two bright young fellows and started them after residence contracts at the old price of 10 cents per kilowatt-hour. They would turn the names of all prospective customers over to a stenographer, who would mail them a series of letters and advertising matter on electricity for home use. In that manner they would get from two to four contracts a day. All that time the solicitor was getting all the churches and lodge rooms he could, at a six-cent rate. It was not long before I could see a change in the load curve. It began to fill out after six and by Christmas it looked like the solid line in Fig. 3. He was not satisfied with that but said he wanted one to look like the dotted line, and that he would get it with power business.

He began to push power business at three cents to large and small customers alike. As there was no firm in town that handled motors, we sold them to our customers at cost. Such a low price on power secured a great many small power customers and a few large ones. Our receipts in March were $5,000, which made me feel pretty good. About that time a big cold storage plant was being built and Johnson went after the business, quoting a two-cent rate. He told me that they would require 100 horsepower about 600 hours a year, which, at two cents per kilowatt-hour, would give us a revenue of $9,000, of which about 75 per cent was profit. They would agree not to use power after four o'clock in November, December and January, so the only time they came near our full load was Saturday night in the summer time, and then our load is never more than 400 kilowatts. We would not have to put in any more machinery to carry the load and required no more men to run the plant. Coal was the only added expense, which cost one-half cent per kilowatt-hour. We secured the business.

When summer came our receipts held up to about $4,000 a month. All the stores were paying their flat rate. The power customers were paying more than they did in the winter, the refrigerating plant was paying us nearly $1,000 a month, and I began to see visions of a good paying property.

Johnson had an office system that was very thorough and yet very simple. After a visit, where anything of importance was said or done, he would dictate a "report" and file it. He taught his solicitors never to use their memory but to keep the system in first-class shape. He said that a good man could solicit at one time 50 large deals whose business would run from $3,000 to $20,000 a year, and could tell any detail of any one of them in a very few minutes. After a call on a prospective customer, he should decide when he would call again, make his notes and then forget that such a deal was on.

At the end of the second year the results showed that our revenue was $62,000 a year, and about the only increase in operating expenses was for coal.

We made a special rate of three cents per kilowatt-hour, with a minimum of five cents a month per two-candlepower lamp, on signs, the customers agreeing not to light them before 5:30 p. m. As they came on after our five o'clock peak our cost was only one-half cent per kilowatt. As the sign load would give us a revenue of nearly $60 a year, per kilowatt, we considered it the best kind of business. Johnson showed me that if we charged six cents for sign lighting, we would, as a rule, not get over $60 per kilowatt a year, and as they would light them at 4:30 during the holidays, and be on our peak, there would be no profit to speak of, while at the three-cent rate with the 5:30 start, it was nearly all profit.

We advertised complete electric cooking outfits for $80 on time payments, and would sell current for them at two cents per kilowatt-hour. By advertising we had no trouble in assuring the public that it was cheaper, cooler, cleaner and more healthful than gas, and we put out 50 sets in two weeks. The gas manager asked how much longer we were going to run that offer. I replied "forever," and he went away declaring that we would go into bankruptcy if we continued at such a price. Johnson contended that we were making a good profit on it at two cents, as you see the cooking load runs like Fig. 4. It is an all-day load until people begin to get their supper; the load at five o'clock is not worth considering, and it gradually gets heavier until after six. After we put in our new 500-kilowatt generator, we cannot get enough residences to fill our load curve out from five to six, so the cooking load will fill in there very nicely and only increase our expenses a little for coal.

You asked me how to organize and conduct a commercial department, and, after my experience, I can safely say: Hire the best commercial man in the country, and let him do the rest. Electrical engineers and mechanical engineers are absolutely necessary in building and operating your plant, but don't expect them to be commercial men any more than you would expect your architect to manage your factory, office, bank or department store if he should build it. So far the electric lighting industry has paid the high salaries to the engineers and has employed young inexperienced solicitors at salaries from $40 to $100 a month, to market the product from an investment of, sometimes, millions. For that reason good salesmen have never cared to go into the central-station business, and consequently to-day, when there is millions of business to be sold, there are very few men capable of selling it.

Electric Heating and Cooking Appliances Popular In New York.

Electric heating and cooking-appliances are becoming increasingly popular in New York, says the October bulletin of the New York Edison Company. During the month of August 152 kilowats of these appliances were connected with the mains of the New York Edison Company. The amount may not seem large compared with the Edison company's general growth, but it is most suggestive when taken in connection with this particular departent of electric service.

Electric irons are in demand in the neckwear and embroidery trade. As the electric motor is the ideal means of obtaining power, so the electric

iron seems to be correspondingly ideal in work of this nature.

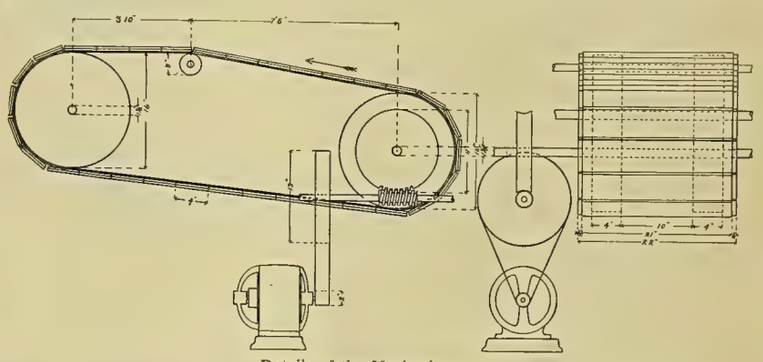
During the month of August no less than 45 inquiries from industrial concerns were received by the New York Edison Company regarding the application of electric current for heating purposes.

The bulletin says: "Manufacturers of electric heating and cooking appliances have every reason to feel well assured concerning the future of this branch of the industry. It is a branch also in which the supplying companies are taking a great deal of interest. The use of any single appliance costs but little, and the returns to the supplying company are small. But this is one of the many advantages the central stations place at the disposal of the public, which increase greatly the convenience of modern living."

A Moving Window Display.

An ingenious and enterprising Cleveland merchant dealing in aluminum wares has multiplied his available window-display space by four by arranging a moving display on the endless-belt principle.

The Window from the Outside.



Details of the Mechanism.

A MOVING WINDOW DISPLAY IN CLEVELAND.

The window floor was arranged so that it revolved like an endless chain over two drums at either end; the window floor extending back into the store the depth of the window and being separated from it by a black velvet cloth.

Some 200 different aluminum articles were fastened securely to the moving window floor, and thus passed in procession before the observer. The effect is striking and attracts great attention from passers-by. Not only is the advertising very effective, but 200 pieces are shown, whereas by the old stationary plan but 50 objects could be displayed.

This enterprising merchant has "blazed a new trail" in the window-display line which merchants in many other lines of business may find it to their advantage to employ. Central-station solicitors may also do well to take notice.

Home-made and simple in design, the device is inexpensive, being driven by a small electric motor concealed below the floor. The accompanying reproduction of a photograph and sketch show clearly the appearance of the "traveling window" and the details of the mechanism.

Placing Small Motors on Trial.

The trial method of selling flatirons, now in use by many large central stations, might well be more generally applied to small and large power motors. It is noticeable that this plan is gaining in favor; many central-station men say that it is very seldom that trial motors are ordered removed after their convenience and reliability have been demonstrated. Many contractors could undoubtedly adopt the same plan with good results if local conditions permit. There is a certain amount of motor business to be secured in every day-circuit city, and one method may succeed where another fails.

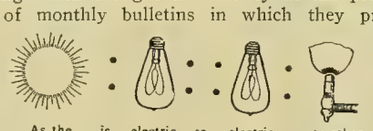
Small power motors are in very active demand by the electrical trade as well as by the many manufacturers of machines who are now using large numbers of small motors. Central-station men everywhere are awakening to the possibilities of small motors, and are setting out after business with a determination to retain as large a percentage as possible of the vanishing fan-motor load. Electric flatirons, heating and cooking appliances, all help to compensate for the lost fan motors, but small power units will be found quite as easy to install and more profitable in the long run. Electric chafing dishes, hair curlers, etc., will at most be used only a few minutes at a time. Many a small motor runs eight hours a day. Even the family sewing-machine motor will be used for considerable periods, and the aggregate current consumed will be much greater than that used by other much-exploited current-consuming devices.—Emerson Monthly.

Attractive Advertising.

In many localities central-station managers fail properly to lay before the merchants and manufacturers the advantages to be derived from the use of electricity for light and power purposes. Well-equipped plants can be found in large numbers, no doubt, operating at half their capacity in the very community where stores and factories are using antiquated light and power methods. Many of these establishments could be induced to try electricity if the central-station man would persistenly employ the arts of modern business promotion.

There is scarcely a mercantile or manufacturing business which cannot in some way advantageously use an application of electricity, and with the many electric current-consuming devices now on the market, not to mention lighting and electric signs, it is up to the central-station man to make his product popular. Good literature attractively presented, whether in the local paper, in bulletins or in circulars, should be kept constantly before the prospective consumer.

Some of the larger central stations are expending much thought and money in the preparation of monthly bulletins in which they present



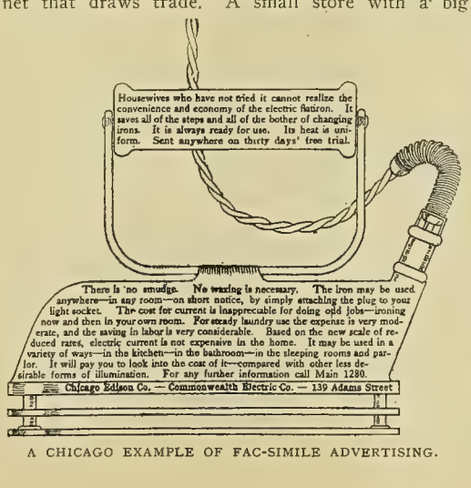
A SUM IN PROPORTION FROM BOSTON.

their arguments and show by word and picture how their customers are profiting by the use of electricity.

It is to be borne in mind always that even a good argument needs to be clearly, brightly and attractively presented. Here are a few short specimen items from the Public Service Monthly:

"A dark store isn't like a 'dark horse.' A 'dark horse' stands a pretty fair show, but a dark store has no show at all. Electric light is a magnet that draws trade. A small store with a big electric sign gets more custom than a big, poorly lighted store with no sign."

"Scarcely any progressive grocer or butcher endeavors to do his grinding by man-power, yet a few there are who still hold to the old-fashioned hand mills, in spite of the fact that both motors and the current to run them are to-day so very cheap."



A CHICAGO EXAMPLE OF FAC-SIMILE ADVERTISING.

"Catchy" illustrations are not to be overlooked in successful advertising. They often are the means of interesting a prospective customer where no amount of argument would succeed. The accompanying cut representing the sun, electric and gas light as a sum in proportion is from the October bulletin of the Edison Electric Illuminating Company of Boston. The electric flatiron cut is a reduced reproduction of a three-column daily newspaper ad of the Chicago Edison Company and Commonwealth Electric Company.

When your trade is on the blink,
And at customers you wink
In surprise,
It is time to get a "hunch"
That you must—to catch the bunch—
Advertise.

When that fact you have digested,
You will be quite interested
In our rate,
For our signs from sun to sun
Bring you custom on the run.
They are great.

Patent Report for 1905.

F. I. Allen, commissioner of patents, has made his report for the year ended December 31, 1905. This report, recently issued, contains a number of facts that are interesting and which seem to indicate that there is a healthy activity among the inventors.

During the year the Patent Office received 54,034 applications for mechanical patents, 781 applications for design patents and 156 applications for reissues. This shows an increase of 2,828 applications over the year 1904. There were 30,270 patents issued, including reissues.

In proportion to population more patents were issued to the citizens of the District of Columbia than to those of any of the states or territories—one to every 1,201. Next in order is Connecticut with one to every 1,225 inhabitants. The fewest patents, in proportion to the number of inhabitants, were granted in Alaska—one to every 63,441, South Carolina coming next with one to every 19,147.

Of the foreign patents granted, Germany received 987, England 770, Canada 413, while France received 303. Of the total number of foreign patents granted from the earliest period to December 31, 1905, France ranks the highest with 368,678, Great Britain next with 351,818 and Germany third with 182,166.

It is interesting to note the entire elimination in 1904 and 1905 of expenditures of the Patent Office, caused by office errors in the preparation of patents for publication.

The most important business event of the Patent Office during 1905 was the new trademark law, reducing the fee upon filing an application for trademark from $25 to $10. This caused a great increase in the number of trademark applications, as shown by the totals, 16,224 for 1905 and 2,524 for 1904.

The report concludes with the statement that the work of the Patent Office has increased about 40 per cent. from 1899 to 1905, while the increase in the number of employes is 12.8 per cent., and that more space is needed for the economical and satisfactory transaction of the business.

"Evenings are getting chilly now; it gets dark early, too. Does your store look gloomy and chilly, after six o'clock, or does it look warm and bright and comfortable? If you were buying goods for yourself, what sort of store would you choose—the cheerful or the gloomy?" asks Brains.

THE SMALL CENTRAL STATION.

Practical Hints on Its Construction and Operation.

Chapter XV. (*Concluded.*)

COST OF PLANTS.

Arc Plants.—An arc dynamo "complete" includes sliding base-frame, belt-tightener, ammeter, switchboard for one circuit and two lightning arresters. A station voltmeter, to indicate the number of arc lamps burning, also a portable voltmeter for adjusting lamps, are extras. Carbons are not included in the dynamo price.

Arc lamps include opal, opalescent, clear, ground, one-half ground or one-quarter ground globes, as desired. Colored globes are extra. Weather protectors or japanned-tin hoods, conical painted galvanized street hoods and inside or outside hanger boards are not included in the price of lamps. Cored carbons for enclosed lamps cost from $30 to $40 per thousand, depending on size. Solid carbons cost from $32 to $38 per thousand.

A hard carbon burns longer than a soft one, but gives less light, as its greater resistance consumes more current in burning. The same is true in carbons of different diameters, the smaller giving more light with the same amount of current.

Arc-line circuits average in cost, per single line of wire, $325 a mile.

AVERAGE COST OF CONSTRUCTION OF 20-LIGHT ARC PLANT.

Twenty-light arc generator	$575
Twenty arc lamps, at $16	320
Three miles No. 6 wire, delivered to poles	285
Two miles poles set	300
Labor on line	150
Suspending lamps across streets	300
Stockroom supplies	50
Incidental expense	50
Total	$2,030

AVERAGE COST OF CONSTRUCTION OF 30-LIGHT ARC PLANT.

Thirty-light arc generator	$750
Thirty arc lamps, at $16	480
Five and one-half miles No. 6 wire, delivered at the poles	523
Three miles poles set	450
Labor on line	250
Suspending arc lamps	450
Stockroom supplies	75
Incidental expense	75
Total	$3,053

AVERAGE COST OF CONSTRUCTION OF 45-LIGHT ARC PLANT.

Forty-five-light arc generator	$1,050
Forty-five arc lamps, at $16	720
Eight miles No. 6 wire, delivered to poles	760
Five and one-half miles of poles set	825
Labor on line	400
Hanging 20 inside lamps, at $7	140
Suspending 20 outside lamps across streets	300
Stockroom supplies	90
Incidental expense	100
Total	$4,385

AVERAGE COST OF CONSTRUCTION OF 65-LIGHT ARC PLANT.

Sixty-five-light arc generator	$1,300
Sixty-five arc lamps, at $16	1,040
Ten miles No. 6 wire, delivered at the poles	950
Six miles poles set	900
Labor on line	500
Hanging 30 inside lamps, at $7	210
Suspending 35 outside lamps across streets	525
Stockroom supplies	125
Incidental expense	150
Total	$5,700

AVERAGE COST OF CONSTRUCTION OF 85-LIGHT ARC PLANT.

Eighty-five-light arc generator	$1,700
Eighty-five arc lamps, at $16	1,360
Twelve miles No. 6 wire, delivered at the poles	1,140
Seven miles poles set	1,050
Labor on line	600
Hanging 35 inside lamps, at $7	245
Suspending 50 outside lamps across streets	750
Stockroom supplies	150
Incidental expense	175
Total	$7,170

An arc-lamp trimmer re-carbons from 50 to 70 lamps per day, and, when provided with a horse, from 90 to 110 per day. Facilities for repairing and readjusting lamps should always be provided and the trimmer instructed to bring in all lamps not burning properly, exchanging them for those already repaired and tested. An equal adjustment of all the arc lamps burning on a circuit is necessary for good service, as a few lamps out of adjustment and absorbing intermittingly an excessive amount of current will cause bad service in the entire circuit.

Labor.—The labor account is approximately 30 per cent. of the total maintenance cost of a plant.

In the practical operation of a station there should be but one man in authority, who has the entire management as well as the entire responsibility of its successful operation, as there are too many details of too varied a character to divide either the authority or the responsibility.

If an employe, in no matter what capacity, proves by results, or lack of results, to be incompetent, no question of sentiment nor expediency should prevent his immediate discharge, because a careless or unskilled man is in a position to injure and disable thousands of dollars' worth of machinery.

The wages paid to the different employes required to operate a plant vary with local conditions, services performed, etc. The following table gives the usual limits for each employe as shown by reports received:

	Per Month.
Superintendents and managers	$90.00 to $175.00
Foremen	75.00 to 105.00
Inspectors	60.00 to 82.50
Engineers	50.00 to 97.50
Firemen	45.00 to 75.00
Dynamo tenders and switchboard men	45.00 to 75.00
Linemen	45.00 to 82.50
Trimmers	37.50 to 67.50

The labor accounts vary less than the fuel accounts in the stations of different capacities. The plant that is sufficiently large to economize in the station labor requires additional help in the office force, and to a considerable extent in the line-construction account.

Reports showing a small labor account almost invariably have a correspondingly large fuel, repair or rebate account, and they clearly demonstrate that wellpaid labor increases the profits of a lighting station.

Stockroom.—A factor of economical operation is the stockroom, that is kept under lock and key, and having all the material ordered therefor or taken therefrom properly accounted for, either by a system of numbered check blanks or some efficient means of tracing every item from date of purchase to its final disposition.

A system of daily reports showing the amount and kind of fuel used, weight of ashes and clinker removed, time run of boilers, engines and dynamos, daily circuit test and daily lamp record, covering interruptions from any cause, will prove at least a great advantage if not a necessity.

CHAPTER XVI.

GENERAL DATA.

Contract Blanks.—The following forms of contract for electric light and power are in use by the Chicago Edison Company. They are the result of 20 years experience, and, used as a basis, can easily be varied to suit local conditions:

APPLICATION FOR ELECTRIC LIGHTING.

(*Maximum Demand System.*)

The subscriber, hereinafter called the consumer, requests the Chicago Edison Company, hereinafter called the company, to furnish electricity for ..... incandescent lamps and ..... arc lamps at the premises, No. ....., Chicago, Ill., for the period of ..... year .., commencing ....., 190.., and ending ....., 190.., and thereafter until this agreement is cancelled by 30 days' written notice being given from one party to the other.

The consumer agrees to pay monthly, within ten days from date of bills, on the following basis and at the following rates, for all electricity to be furnished as measured by a meter or meters to be installed by the company, namely:

Fifteen cents (15c.) per kilowatt-hour for all electricity consumed in each month which shall not be in excess of thirty (30) hours' use of the maximum number of kilowatts taken at any one time during the month, according to the reading of a maximum-demand meter or the combined readings of maximum-demand meters to be installed by the company. (This portion of the monthly consumption of electricity, figured at fifteen cents (15c.) per kilowatt-hour, shall be herein called the primary or full-rate portion of consumer's monthly bills.)

Also ten cents (10c.) per kilowatt-hour for all electricity consumed in each month which shall be in excess of thirty (30) hours' use of the maximum number of kilowatts taken at any one time during the month, according to the reading of a maximum-demand meter or the combined readings of maximum-demand meters to be installed by the company. (This last-mentioned portion of the monthly consumption of electricity, figured at ten cents (10c.) per kilowatt-hour, shall be herein called the secondary or low-rate portion of consumer's monthly bills.)

Wholesale discounts, as follows, will be allowed by the company from the secondary or low-rate portion of the bill figured as above described, whenever said secondary or low-rate portion of the bill amounts to one hundred ($100.00) dollars or more in any month.

Under $100.00 no discount.

100.00	5 per cent. discount
200.00	10 per cent. discount
300.00	15 per cent. discount
400.00	20 per cent. discount
500.00	25 per cent. discount
600.00	30 per cent. discount
700.00	35 per cent. discount
800.00	40 per cent. discount
900.00	45 per cent. discount
1,000.00	50 per cent. discount

Intermediate wholesale discounts to be determined by interpolation.

A discount for prompt payment of one cent (1c.) per kilowatt-hour on consumer's total monthly consumption of electricity will be allowed by the company on all bills paid by the consumer at the proper office or agency of the company on or before ten (10) days after their dates.

The rules and regulations of the company endorsed on the back hereof are hereby made a part of this application.

The company does not guarantee a constant supply of electricity and shall not be liable for any damages to the consumer in consequence of its failure to supply electricity at any time or times.

The consumer guarantees to pay the company not less than ..... dollars ($.....) each month during the continuance of this contract; and in consideration thereof and of the period this contract is to cover, the company expressly agrees as follows:.....

.....

This application shall not be binding on the company until accepted in writing by its general contract agent, and, as accepted, shall constitute a contract which cannot be varied or waived by any representations or promises of any agent, solicitor, or other person, unless incorporated into this agreement in writing before such acceptance.

Dated Chicago, ..., 190..

.....Consumer.

Accepted....., 190..

CHICAGO EDISON COMPANY.

By .....

General Contract Agent.

RULES AND REGULATIONS.

Referred to in, and made a part of, the above application.

Standard incandescent lamps for original installation will be furnished by the company. Renewals of same will also be furnished by the company upon the return by the consumer of the worn-out lamps. Such renewals will be furnished free, except when the conditions or manner of use are such as to materially shorten the normal life of such lamps, in which case the consumer shall reimburse the company in the extra expense occasioned by excess renewals.

Standard arc lamps will also be furnished and put in place by the company, and the company will trim same whenever necessary. All incandescent or arc lamps, or renewals, furnished by the company, and not returned to the company, are to be paid for by the consumer at the company's regular prices.

All wiring and other electrical equipment in said premises (except lamps and meters) shall be furnished by the consumer and shall be maintained by the consumer at all times in conformity with the requirements of the Department of Electricity of the city of Chicago and with the reasonable rules and regulations of the company's inspection department, in force from time to time. The consumer shall protect and indemnify the company in respect to injury to the company, to the consumer and to others, resulting in any way from defective electrical equipment in said premises or from any negligence on the part of the consumer.

All lamps, meters and other appliances installed in said premises at the company's expense shall be and remain the property of the company.

The properly authorized agents of the company shall at all reasonable hours have free access to said premises for the purpose of examining, repairing or removing its meters and other property, and no one who is not an agent of the company shall be permitted to remove or tamper with the same.

If the consumer shall fail to afford suitable space for the company's maximum-demand meter, or if the number of lamps connected in consumer's premises is five (5) or less, the company will not install a maximum-demand meter, but the total number of lamps connected shall, for the purpose of determining consumer's maximum demand for each month, be deemed to have been lighted simultaneously for 30 hours during each month.

No other electric light or power service shall be used by the consumer in conjunction with the company's service, either by means of a "throw-over" switch or by any other connection, without the express written consent of the company specially obtained for the purpose, and any violation of this rule shall authorize the company to discontinue its service entirely and to take out its service connections.

The party making application for electricity will be held responsible for all electricity consumed on the premises until written notice is received by the company as provided in this application.

The company is hereby authorized and empowered to cut off the supply of electricity and remove its meters and other property whenever any bill is in arrears, or upon violation by the consumer of any of the terms or conditions of this contract or of any other contract with the consumer or to protect itself from fraud or abuse; and in case of such cutting off by the company, in addition to the amount then due, there shall immediately become due and be payable to the company, as liquidated damages, not as a penalty, a further sum equal to the amount guaranteed under this contract for the remainder of the term of this contract.

In case of defective service the consumer must immediately give notice of the fact to the company's office.

The company shall have the right, at any time, to require a deposit in advance to secure prompt payment of bills.

CONTRACT FOR ARC LIGHTING.

(*Flat Rate.*)

Agreement entered into this .... day of ....., 190.., between the Chicago Edison Company, hereinafter called the company, and ....., hereinafter called the consumer, both of Chicago, Cook County, Illinois.

The company agrees to equip the premises of the consumer at No. ..... with a system of electric wiring for the use of ..... 300-watt arc lamps to burn upon the company's constant-potential circuit. Fees for city inspection to be paid by consumer. Said arc lamps to be installed as herein described:

.....

The consumer agrees to keep and use said arc lamps ..... continuous months, beginning ....., 190.., and ending ....., 190.., and thereafter until this agrement is cancelled by thirty (30) days' written notice being given by one party to the other. The consumer further agrees to pay the company for said service weekly at the prices hereunder written, subject to a discount of 15 cents per lamp per week if payment is made to the company on or before three days from date of bill rendered.

LAMPS AND HOURS OF SERVICE.

.... Lamps to burn from .... M. to .... M. .... days per week, at $.... per week each.
.... Lamps to burn from .... M. to .... M. .... days per week, at $.... per week each.
.... Lamps to burn from .... M. to .... M. .... days per week, at $.... per week each.
.... Lamps to burn from .... M. to .... M. .... days per week, at $.... per week each.

The consumer agrees to burn said arc lamps only during the hours specified, and will pay additional for any extra use thereof. The consumer also agrees to pay the company extra, at its regular prices therefor, for all additions to or changes in his installation.

Said arc lamps, with the necessary switches, wires and other appliances, are to be and remain the property of the company, and the consumer agrees to protect them from all injury, interference or tampering. The consumer also agrees that the company's employes shall, at all reasonable hours, have free access to the premises for the purpose of examining, repairing or removing its property.

The company does not guarantee a continuous or uninterrupted service, and if said lamps fail to burn, or do not burn properly, or if for any reason the company is unable to supply electricity, the consumer agrees that the only liability of the company shall be to abate the rent for the actual time of no service.

The consumer hereby expressly authorizes and empowers the company to remove the lamps, switches and all its other property, and to cut off the supply of electricity whenever any bills for said service are in arrears, or upon violation by the consumer of any of the terms or conditions of this contract or of any other contract between the parties hereto; and in case of such cutting off the consumer agrees to pay the company, in addition to all other amounts then due, ... dollars, as liquidated damages, not as a penalty, to cover the company's expense of wiring for and installing said lamps in said premises.

In case of defective service, the consumer must immediately give notice of the fact to the company's office. Collectors, solicitors, trimmers, emergency men and other like employes are not authorized to receive complaints, and the company will not be held responsible unless complaints are made direct to the company's office.

The consumer agrees that no arc lamps other than those furnished by the company shall be used in said premises during the continuance of this contract.

This contract, although signed, is subject to the approval

of the second vice-president of the company, and shall not be binding on the company until endorsed with his approval.

It is finally agreed that all the terms and stipulations heretofore made or agreed to by the parties in relation to the use of said arc lamps and the installation thereof are merged in this contract, and that no previous representations or agreements made by the company's officers or agents shall be binding upon the company except as and to the extent contained herein.

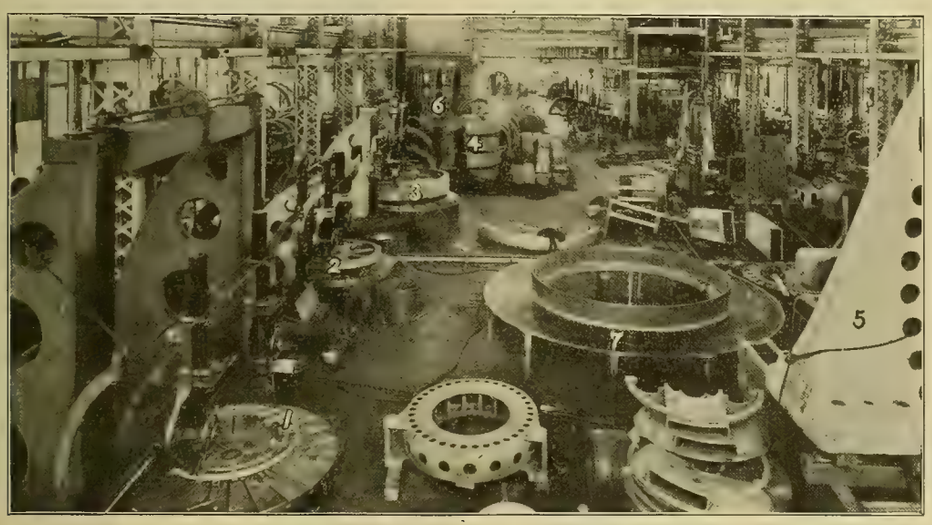
CHICAGO EDISON COMPANY,
By .....
.....Consumer.
By .....

Approved ....., 190..
Chicago Edison Company.
By ..... Second Vice-President.

[To be continued]

Electrical Machinery in the Making.

The view of the main aisle and extensions of the Allis-Chalmers Company's Bullock works, Shop No. 3, Cincinnati, reproduced herewith, will serve to indicate to some degree the large amount of work of all kinds which this branch of the big



ELECTRICAL MACHINERY IN THE MAKING.

Milwaukee concern is rushing to completion, although the photograph does not do full justice to the subject. The works have been greatly enlarged and extended within the last year in order to facilitate the rapid increase in demand for space to manufacture electrical generating, transforming and driving apparatus of every type. They cover at the present time a floor space of approximately 7½ acres. Shop No. 3, the interior of which is shown above, is 462 feet long, the front portion being one story high and 176 feet wide, while the rear portion is 107 feet wide and two stories in height.

On the floor are shown generating units from the small standard sizes up to those of 2,000-kilowatt, designed for direct-coupling to gas engines. The stator frames (marked 6 in the picture) are for gas-engine alternators being built for the Illinois Steel Company and the Carnegie Steel Company. The large machine at the right (5), only partially shown, is the 3,500-kilowatt alternator which was exhibited at St. Louis, driven by the "Big Reliable" engine at the Louisiana Purchase Exposition, and which has been rewound for installation in the Pittsburg Plate Glass Company's plant at Crystal City, Mo. Brush holder and rotor spiders, respectively mounted on machine tools, are shown at (1), (2) and (3), while (4) shows a number of rotor spiders for 2,000-kilowatt gas-engine alternators stored, waiting for finishing. The commutator of a 2,500-kilowatt direct-current engine-type generator undergoing the process of assembling is seen at (7).

Foreign Corporations in Illinois.

"The Illinois Supreme Court has just handed down a decision which will very widely affect the business interests in the state and will involve many an eastern manufacturer maintaining branch houses within this state," says Frederic P. Vose, attorney for the Electrical Trades Association of Chicago. "The case is that of the United Lead Company v. Elevator Manufacturing Company, 222 Ill., 199, and relates to the restrictions placed upon foreign corporations under the laws of 1899. The court now holds that all attempts of a foreign corporation, which has not first complied with this law, to transact business of whatsoever kind and nature in this state are absolutely without effect, and any contracts entered into within this state, without having first complied with the law, is in violation of the plain provisions of the statute, and therefore null and void, and no action can be maintained thereon at any time, even if the corporation should at some time after the making of the contract qualify itself to transact business in Illinois by compliance with the laws in reference to foreign corporations that desire to engage in business within this state."

Institute Meeting in New York.

President Sheldon was in the chair at the regular meeting of the American Institute of Electrical Engineers held at the Edison Auditorium, New York city, on October 26th.

Secretary R. W. Pope announced that at a meeting of the board of directors held in the afternoon, 41 associates were elected and the following-named associates were transferred to the grade of member: Armin Henry Pikler, Ampere, N. J.; Otto Martin Rau, Milwaukee, Wis.; Warren Ray Thompson, Manchester, England; Arthur Bowers Stitzer, Philadelphia, Pa.; Arthur Thomas Cooper, Bombay, India; Thomas Hesketh, Folkstone, England; Allen Harwood Babcock, Oakland, Cal.; Herbert C. Work, Schenectady, N. Y.; Harry Guthrie Spain, British Guiana, South America; Theodore Hanamann Schoepf, London, England; Sebastian Ziana De Ferranti, London, England; John Francis Cleverton Snell, Sunderland, England; Alois John Joseph Pfeiffer, Calcutta, India; Harry Lepper Kirker, Pittsburg, Pa.; Robert Hammond, London, England; Arthur William Beresford, Milwaukee, Wis.

The secretary also announced that the new Engineering Building would be ready for occupancy on the first of December and it would be in operation by December 15th, to be occupied by the officers and staff of the three societies. There will be no meetings held there, however, and no opening of an official character, until April next, as it is the intention to make the opening rather an important event in the engineering history of the country with invited guests from foreign parts. It is also the purpose that the building shall be occupied, fully completed and every department in full and actual operation before what may be termed the official housewarming takes place in the spring.

The paper of the evening was by Lee De Forest and was entitled "The Audion—A New Receiver for Wireless Telegraphy." It was read by the author. Dr. M. I. Pupin, Percy H. Thomas, Sewall Cabot, E. P. Thompson and others discussed it.

Chicago Street Railway Companies Present a Proposed Settlement Ordinance.

The Chicago traction companies have presented to the local transportation committee of the Council the draft of an ordinance purporting to meet the general principles which Mayor Dunne recently declared fundamental to any settlement of the street-railway controversy. The ordinance is drawn in the name of the Chicago City Railway Company, but is understood to be practically the same as one to be submitted by the Chicago Railways Company, when that corporation is in shape to take over the Union Traction properties.

This ordinance is to form the basis of renewed negotiations between the city and the traction representatives for a final settlement of the franchise question.

Some of the features of the proposed settlement plan are:

Both companies will put into first-class condition all their property and agree to sell it to the city on the first of any year within 20 years. The city must buy, however, for its own use and operation and pay cash; the companies will not agree to allow another company to take over the property as the licensee of the city within that time.

Supervision of the reconstruction and operation of the lines is to be by a board of supervising engineers, one appointed by the city, one by the companies and a third by these two.

Net receipts from the operation of the property are to be divided between the companies and the city.

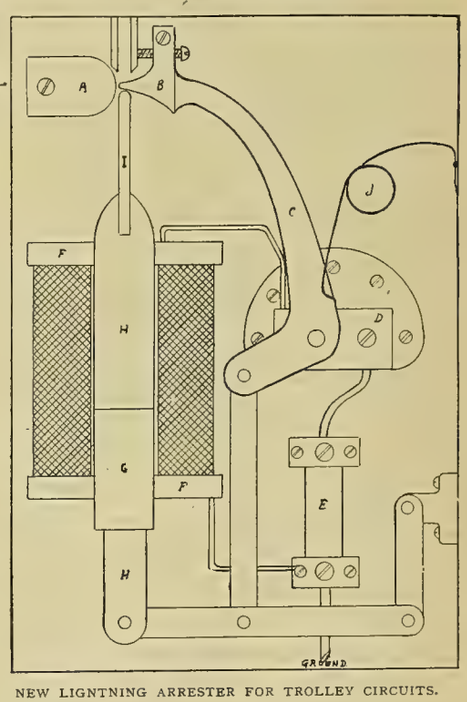
A subway system will be built by the companies in partnership with the city, the companies' investment to be limited to 5,000,000 for the first five years.

How much money the companies are willing to put into their properties to put them in first-class condition has not been stated, but the amount, including the proposed $5,000,000 subway, probably would not be less than $50,000,000.

Last week marked the end of cable service in Chicago, when the North Side trunk lines were converted to trolley operation. Some congestion and confusion was experienced at first but the new electric service is now working smoothly and is a great improvement.

New Lightning Arrester for Trolley Circuits.

A new lightning arrester of the circuit-breaker type was exhibited at the Columbus convention of the American Street and Interurban Railway Association by the Oleson-Williams Company of Toledo, Ohio. Referring to the accompanying diagram, the block (A) is connected with the trolley circuit. Between this block and the block (B), which is mounted on the movable arm (C), is an air-gap, the length of which may be regulated. The lightning discharge is offered a ready path through these parts and the graphite resistance plug (E) to earth. If the lightning discharge is greater than the carrying capacity of the graphite resistance plug, the excess is shunted across points approaching each other immediately under the graphite from the brass blocks holding the same. When the graphite is taxed to its carrying capacity, it becomes an easier path for the lightning discharge to jump across the points, thus preventing the graphite from becoming burned or charred and putting a splendid insulator in the place where only a certain ohmic resistance was intended. In this manner the efficiency of the graphite resistance plug is preserved.



NEW LIGNTNING ARRESTER FOR TROLLEY CIRCUITS.

The graphite used is of sufficiently low ohmic resistance as to shunt just enough of the dynamo current through the solenoid (F) to magnetize it and pull up the core (G) which is mounted on the wooden pin (H). By means of proper leverage this action throws back the pivoted arm (C), stretching out the arc. At the same time a slide (I) of incombustible, insulating material, mounted on the upper end of the pin (H) and just uncovering the block (A), moves up in grooves cut in a frame of the same material and takes its place in front of the block (A), thus cutting the arc as nearly instantaneously as possible. A spring (J) is so placed that its tension will become greater as the arm is thrown back, thus insuring a positive resetting of the air-gap after the arc is broken.

The advantages urged for this device are the free path to earth offered to the static charge; the quick break of the dynamic arc outside of any inclosure which may become clogged by the confined heat; the method of preserving the efficiency of the graphite resistance plug and the automatic action requiring no attention. Full patent protection has been applied for and the owner is preparing to manufacture types to meet varied requirements.

A 30,000-volt Transmission Plant in Northern Italy.

In the north of Italy a hydro-electric plant of considerable importance has been erected for transmitting power over a long-distance line to the city of Turin. The plant belongs to the Société des Forces Motrices du Mont Cenis, and the contract for the work was awarded to the Compagnie Thomson-Houston de la Mediterranee. The purpose is to utilize a waterfall situated in the Alps, at the foot of Mont Cenis. The plant, which is now in regular operation, is remarkable not only for the amount of power used at present and the probable extension, but also for the high tension which is used in the transmission line. According to the information supplied the writer by Mr. A. S. Garfield, one of the engineers of the Paris Thomson-Houston Company, the hydraulic plant, which is situated on the Italian slope of the Alps, receives its power from one of the falls of the Cenischia torrent, fed by water coming from the different glaciers of the Alps. The fall has a net height of about 2,600 feet, and its volume is rated at 300 gallons per second, representing about 12,000 horsepower gross. This capacity will be increased to 16,000 horsepower when the new hydraulic work is carried out, so as to utilize by means of a dam the Mont Cenis Lake, which is crossed by the torrent, thus using the lake as a regulating reservoir. The utilization of the total head of water in a single plant has some serious drawbacks which are mainly due to high pressure, so that in the present case it was preferred to erect two hydraulic plants, one above the other, taking half the power from the fall in each of the plants, and running the two in parallel on the transmission line.

The present hydraulic plant is erected at the lower part of the fall. Later on it is proposed to erect the second plant at the middle point when the increased demand for power at Turin will have made this necessary. At present the current is produced by three main groups of 1,600 horsepower, of which one acts as a reserve. Two other groups will be added when the hydraulic work on the Cenischia is completed. Space has been left for the new groups. Each of the main units includes a turbine of 1600 horsepower direct-coupled to a 1,400-kilowatt alternator. The turbines, constructed by Piccard & Pictet of Geneva, operate at 500 revolutions per minute. They are connected to the alternators by an elastic insulating coupling of the Zodel type. The alternators are of the 12-pole Thomson-Houston type, with fixed armature and revolving field. At normal load they deliver 200 amperes at 3,000 volts and a speed of 300 revolutions per minute, working at 50 cycles. Such a high speed made it necessary to use a special design for the revolving part of the machines, and which is of very solid construction. Should the turbine run at a much higher speed than the standard, on account of racing, the machines will withstand up to double the rated speed. The weight of the alternators is 36 tons.

For furnishing the exciting current, the station has two smaller sets, one of which is used as a reserve. These groups are formed of 110-horsepower turbines constructed on the same lines as the larger wheels, coupled to direct-current machines, each of which delivers 75 kilowatts at 125 volts, operating at 600 revolutions per minute. As the distance between the generating plant and the point of utilizing the current at the city of Turin is considerable, being about 38 miles, it was indispensable, in order to avoid a great expense in the overhead line, to adopt a very high tension, and this was fixed at 30,000 volts, which is one of the highest voltages used on the Continent. Step-up transformers of the water-cooled type in large upright cylindrical tanks of sheet iron some ten feet high are used in the station. Motor-driven pumps send a water circulation through a coil of pipe in the upper part of the tank, which is filled with oil. The transformers are connected in series of three on the star system, using a fourth unit as a reserve.

Between the main dynamo room and the transformer room is placed the switchboard, which is one of the interesting features of the station on account of the high tension which it is required to handle. A series of marble panels mounted in front contains the measuring instruments and operating handles. All the high tension apparatus is mounted clear of the front panels on a framework placed in the rear, and connection is made by insulated levers, etc., with the handles on the panels. Ammeters and voltmeters are connected to the secondaries of reducing transformers. Oil-switches of the company's design are used for the high-tension current. The bus-bars and oil-switches are located in a basement floor under the switchboard.

Schenectady Branch of the Institute.

The third meeting of the season of the Schenectady branch of the American Institute of Electrical Engineers was held on Saturday evening, October 20th. Dr. Rossiter W. Raymond was the speaker of the evening and presented an address on "Professional Ethics," a subject of great interest at present to all electrical engineers on account of President Wheeler's address at the Milwaukee convention of the Institute and the present activity on the part of the Institute's special committee recently appointed to formulate a code applicable to the electrical profession.

Dr. Raymond was greeted by an enthusiastic audience of some 700, and the value of his remarks amply justified the large attendance.

As president of the American Institute of Mining Engineers for several years, as the efficient secretary of that body for some 20 years and as editor for years of the Engineering and Mining Journal, which he founded, Dr. Raymond is particularly well equipped to speak with authority on the subject. He addressed his remarks to the young engineers and students, speaking for loyalty to one's employer and to one's self, with a fund of anecdote and wit that seemed inexhaustible, and kept the room in laughter between the serious portions of his talk. He gave much good advice and summed up with the following general rule of engineering ethics:

"Do not do what you cannot tell, or if there be a good reason for not telling the details, do not do what you cannot tell without shame."

The speakers were introduced by Chairman Rushmore, and among the others were Dr. George R. Lunn of the First Reformed Church, Dr. W. R. Whitney of the Research Laboratory, General Electric Company, and Professor Hoffman of Union University.

The branch meetings are held in the auditorium of the Schenectady High School, and the officers of the branch are greatly gratified by the continual increase in the size of the audience. Although the admission was by ticket only at this meeting, the attendance was the largest in the history of the branch.

An interesting feature of the meeting was the large number of men who came prepared to join the branch. The membership committee has succeeded in building up a branch membership which already is more than three times the number of regular members and associates of the national body residing in Schenectady. At the same time, however, the local membership of the parent organization has been greatly increased on account of the activity of Institute work at Schenectady.

Weekly meetings are being held through the winter. On Friday, October 5th, the branch was addressed by Mr. T. Commerford Martin on "Technical Journalism," and on October 12th by Mr. E. G. Acheson on "Inventions and Discoveries." The list of addresses for future meetings is sufficient to carry the branch well into next year with the same high class of lecturers.

Muscle Shoals Power Project for the Tennessee River.

The Muscle Shoals Hydro-electric Power Company of Montgomery, Ala., has just been incorporated, the purpose of the company being to span the Tennessee River by two masonry dams of a maximum height of 60 feet, the lower one being located at the foot of the Little Muscle Shoals and the other near Florence, Ala. These dams, by backing up the water of the Tennessee River, will make available the entire fall of the Big and Little Muscle Shoals, making practicable a development of 100,000 horsepower, it is said. Each dam includes as an integral part of itself a boat lock for facilitating navigation on the Tennessee River.

A substantial power house with a full complement of waterwheels, generators and transformers will be built below each dam. Power-transmission lines will be built radiating from the generating stations to such places within a 100-mile radius as will be benefited by the introduction of the service, including Nashville, Huntsville, Decatur, Birmingham and other places, as well as isolated cotton mills and other large industries.

The company has a capital stock of $1,000,000, and the incorporators are Frank S. Washburn of Nashville, Tenn., Charles H. Baker of New York city, William H. Lindsey of Nashville, J. W. Worthington of Sheffield, Ala., and Massey Wilson of Montgomery, Ala.

Messrs. Washburn and Baker are the persons chiefly interested in the enterprise. Mr. Washburn has been connected for years with important canal, water-supply and power enterprises in various countries. Mr. Baker, with his father, the late William H. Baker of Chicago, projected and built and is now the principal owner of the Snoqualmie Falls and White River power developments, which supply electrical energy to Seattle, Tacoma, Everett and other places in the Puget Sound country for lighting, traction and general power purposes.

Indiana Telephone Items.

The Central Union Telephone Company has passed its 10,000 mark in Indianapolis. This makes this city the largest exchange, either Bell or Independent, in Central Union territory. Several causes have combined to produce the large increase, but the principal one has been good service. Within a few weeks the conduit system of the company will be completed. The company has also made notable improvements in other parts of the state, notably at Culver, Anderson, Kendallville, Lafayette and New Castle. In Indianapolis the company has established a cable system for the State Life Building. This is the largest office structure in the city, and the new system has a capacity to serve every room in the building with individual circuit.

Work has been begun on a new fireproof building for the Indianapolis Telephone Company, in which will be placed the new switchboard that will be bought in a few weeks. The estimated cost of the new building is $50,000. The building will be four stories high, and the switchboard will be placed on the fourth floor, which will have no windows at all, but will be lighted and ventilated by double skylight and other modern appliances.

The molding and planting of cement telegraph and telephone poles in the vicinity of Naples, Ind., is attracting considerable attention. These poles are being made by H. W. Tapp, and are from 25 to 35 feet long, nine inches square at the base for a distance of 17 feet, and tapered to six inches at the top, being octagon in shape from the base portion. They have niches on two sides at convenient distances to accommodate the spurs of a lineman who may wish to climb them, and two holes in the top for the reception of iron rods to hold the crossarms.

The Central Union Telephone Company showed considerable enterprise in the establishment of a telephone exchange on a lot purchased in the new Beech Grove incorporation where the New York Central Railroad Company is building immense shops, some seven miles south of Indianapolis. The lot was purchased at auction, and within one hour thereafter the company had the exchange established. S.

Pacific Slope Telephone Items.

Farmers at Oakesdale, south of Spokane, rejected a proposition to join the rural lines with the Pacific States Telephone and Telegraph Company a few days ago, and agree that they will not enter into any contract with any long-distance telephone company.

The Interstate Co-operative Telephone Company of Palouse, Wash., has been handicapped by lack of facilities, but expects a new switchboard early in November and will then establish a 24-hour service and make a fight for city business. Connection with Spokane is promised within a few months.

An increase in capital stock from $20,000 to $100,000 has been made by the Interstate Telephone Company, which is organized to transact a general telephone business in Washington, Oregon, Idaho and Montana. It has a system in operation in Northern Idaho. M. A. Phelps is president.

The Rocky Mountain Bell Telephone Company is extending two direct lines from Spokane to Coeur d'Alene, Idaho, and another to Sandpoint, Idaho, also numerous small toll lines. The work is being retarded by the scarcity of electricians and wiremen.

J. E. Lawrence, manager of contracts for the Home Telephone Company, is in Spokane, Wash., looking after contracts. He announced that the system will be in working order early next spring. W.

Telephone News from the Northwest.

J. S. Cain has taken charge of the local telephone system at Barnum, Minn.

The Tri-State Telephone Company has arranged to furnish a fire-alarm service in Minneapolis hereafter, and a police service also, without cost to the city.

The Mesaba Telephone Company will install a central station at Aurora, Minn. A switchboard to accommodate 100 lines has been forwarded.

The Citizens' Telephone Company of Mankato, Minn., has secured connection with the Nicollet County Telephone Company at St. Peter, Minn., over the toll lines of the Tri-State Telephone Company.

M. H. Driftmeyer of Clarinda has been appointed superintendent of the Mutual Telephone Company's system at Shenandoah, Iowa.

The Farmers' Mutual Telephone Company of Umatilla, Neb., has filed articles of incorporation with a capitalization of $5,000. R.

The following-named telephone companies are among those recently incorporated: Montgomery County Telephone Company, Coffeyville, Kan.; Farmers' Mutual Telephone Company, Unadilla, Neb.; Mount Pisgah Telephone Company, Okarche, Okla.; Prairie Grove Telephone Company, Prairie Grove, Ark; Livingston Home Telephone Company, Livingston, Mont.

The Transmitophone.

There have been numerous changes and many improvements of late years in telephone apparatus for ordinary exchange use, but a novel development and one which promises to open a large new field for equipment is the recent production of an instrument that can be used for transmitting speech communication or vocal and instrumental music to a large audience at a distant point. One of the best demonstrations of the possibilities of this instrument for entertainment purposes was made this season at Riverview Park,

FIG. 1. "SINGING TREE" AT RIVERVIEW PARK.

Chicago. The test was particularly exacting, as the park is one of the largest pleasure gardens in the country, having many amusements.

The instrument used at the park was the transmitophone recently evolved by the International Telephone Manufacturing Company of Chicago. The outfit consisted of a sending station, located in one of the offices in the Casino at one end of the park, connected by wire with three reproducing instruments, located in different parts of the garden about 30 feet up in the trees. There was also used an accompanist's circuit arranged to enable the soloists to hear the orchestra in the garden.

Fig. 1 is a view in the garden showing one of the reproducing instruments suspended in a tree to the right of the center of the picture. The reproducing instrument consists of a powerful bipolar horseshoe-magnet telephone receiver specially adjusted for throwing a heavy volume of sound through a megaphone over a large area

FIG. 2. ORCHESTRA TRANSMITTER.

of space. A large brass megaphone is centered into the receiver-shell cap. Rubber-covered wire is used for connecting the reproducers with the sending station. The wire is run directly into the shell of the receiver and taped with rubber tape to prevent moisture entering the working parts during heavy rainstorms.

Suspended in the orchestra stand is the accompanist's transmitter, and it is shown in Fig. 2 at the left of the piano. This transmitter is made highly sensitive and is connected by a separate circuit to the sending station with the soloist's head receiver.

Figs. 3 and 4 show the sending stations, which consist of a local battery portable desk telephone with necessary switching device and batteries. For cornet and vocal music rendered directly into the mouthpiece, 18 volts or 12 cells of "1900" dry batteries are connected directly in the circuit, going through the one-ohm primary side of the induction coil, through the transmitter and back to the battery, which completes the primary circuit.

The reproducing receivers are connected on what is known as a closed secondary circuit; that is to say, both terminals of the secondary winding are connected to the receiver or receivers.

The switching box in this installation is provided for three reproducing circuits consisting of three cam-lever keys and arranged so that the transmitting circuit can be switched to any one of the three receivers or to any two or to all three at one time. The switching box is also provided with binding posts and terminals so that the various circuits may readily be connected.

Two sets of 18 cells of "1900" batteries are arranged in the battery box. Each set is connected in series and arranged so it can be connected in the circuit with 12, 18 or 24 volts to meet the necessary requirements, depending on the nature of the work desired to be accomplished. The batteries are connected to a spring jack so that connection with the telephone circuit can readily be made with a cord provided with connecting plug.

At the sending station the accompanist's transmitter circuit is also provided with a spring jack so that the head receiver can readily be connected with a cord and connecting plug and so that the transmitter may be promptly disconnected when the instrument is not in use.

With 12 cells of dry battery in the primary circuit, the transmitter is so constructed that it transmits vocal or instrumental music to the receiver with megaphone attachment vibrating the receiver diaphragm, so that the music can be heard from the instrument as loud and clear as

FIG. 3. TRANSMITOPHONE SENDING STATION.

if the soloist were singing or playing at the location of the receiver.

Though one transmitter was in use the entire summer season, and at each evening's entertainment, when continually used for 15 or 20 minutes it would become so heated from the heavy battery current that one could not bear to touch the shell of the transmitter, it has shown no signs of deterioration whatever, thus apparently demonstrating the practicability of the instrument for work of this kind or for any service where it is desired to communicate with a large number of people at one time.

One of the most attractive features of the evening musical programmes was provided by this entertainment. The megaphones were painted black and suspended up in the trees above the

FIG. 4. MUSIC TRANSMITTED TO TREE.

lights so they were not easily seen. Many visitors believed that soloists were concealed in the trees, and some ascribed it to ventriloquism. What was most mystifying was that the music came from different trees at intervals during the same selection and kept in perfect time and tune with the orchestra. No one who had not seen the operation of the apparatus believed that the entertainment was given over a telephone.

This instrument has not only developed a new form of entertainment but has demonstrated the efficiency and durability of the telephone transmitter as manufactured for ordinary commercial purpose for the Independent telephone field. It shows the practicability of the telephone for transmitting speech communication to a large audience at a distant point.

Detroit Home Telephone Building.

The accompanying picture is a view of the central exchange building of the Home Telephone Company of Detroit, which was described in the Western Electrician of October 6th, and which is now in course of erection.

This new building will house one of the largest

CENTRAL EXCHANGE OF DETROIT HOME TELEPHONE COMPANY.

switchboards ever constructed in this country, the ultimate capacity of which will be 15,000 lines with an immediate installation of 9,600 lines. The immediate and ultimate capacity of the several branch exchanges will bring the total number of switchboard lines in the entire system to nearly 40,000 lines.

Telephone Franchise Developments in Chicago.

The gas, oil and electric-light committee of the Chicago Council has resumed negotiations in the telephone franchise controversy. Until last week the Chicago Telephone Company and a company launched by the Illinois Manufacturers' Association were the only serious contenders for the Chicago field after the expiration of the Chicago Telephone Company's franchise in 1909. Last week the Council committee received a bid from new interests represented by Arnold Kalman of Kansas City, Mo. He is largely interested in Independent telephone properties, and the proposition made by the interests which he represents is almost identical to that of the Manufacturers' Association.

The Council committee has now asked the Chicago Telephone Company to submit an extension ordinance which shall embody its best offer in the way of rates, service, compensation, etc.

GENERAL TELEPHONE NEWS.

W. B. Broom and others have organized a local telephone company at Bono, Ark.

The Farmers' Telephone Company of Randall, Kan., has been incorporated with a capital stock of $10,000.

The D. A. Kusel Telephone and Electrical Manufacturing Company of St. Louis has suffered a loss by fire.

The Cannon Valley Telephone Company of Waterville, Minn., has increased its capital stock from $50,000 to $100,000.

The Illinois Central Railroad will install an independent telephone system connecting its offices and depots in Omaha, South Omaha and Council Bluffs.

The Mount Pulaski Telephone Company will erect a building in Mount Pulaski, Ill., in the near future to be equipped with all modern apparatus for telephone purposes.

The various farmers' mutual telephone lines in Valley County, Neb., have come together and have incorporated a county company under the name of the Farmers' Mutual Telephone Company, with headquarters at Ord, Neb.

A telephone in a stove and connecting wires through a bed spring were found a few days ago by the Chicago police in the apartments of a suspected hand-book maker in Ashland Avenue. The police searched the room for evidence and did not find it till they opened the stove and examined the bed.

A meeting of the business men of Roseau, Badger, Greenbush and other near-by Minnesota towns has been called to discuss ways and means to raise money to finance an electric railway which it is proposed to build from Roseau to Karlstad, a station on the Winnipeg line.

The Production of Rubber.

In the course of his address on "Some Imperial Aspects of Applied Chemistry" to the Chemical Section of the British Association at York, Prof. Wyndham Dunstan said, according to the Electrical Engineer of London:

There is no more important group of questions demanding attention from the chemist at the present time than those connected with the production of india rubber or caoutchouc. An enormous increase in the demand for india rubber has taken place in the last few years, and last year the production was not less than 60,000 tons. Until recently the supply of rubber came chiefly from two sources—the forests of Brazil, which contain the tree known as Hevea brasiliensis, furnishing the Para rubber of commerce, which commands the higher price, and the forests of Africa, where climbing plants, generally of the Landolphia class, also furnish rubber.

The increased demand for caoutchouc has led to the extensive planting of the Para rubber tree, especially in Ceylon and in the Federated Malay States. Systematic cultivation and improved methods of preparation are responsible for the fact that the product of the cultivated tree, which begins to furnish satisfactory rubber when six or seven years old, is now commanding a higher price than the product of the wild tree in Brazil. It is estimated that, within the next seven years, the exports of cultivated India rubber from Ceylon and the Federated Malay States will reach between 10 and 15 million pounds annually and that after 15 years they may exceed the exports of the so-called wild rubber from Brazil.

The services which chemistry can render to the elucidation of the problems of rubber production and utilization are very numerous. Methods of treatment, depending on a knowledge of the other constituents of the latex, have led to the production of rubber in a purer condition. Much still remains to be elucidated by chemical means as to the nature of the remarkable coagulation of the latex. As is well known, the latex is a watery fluid, resembling milk in appearance, which contains the rubber, or, as I think more probable, the immediate precursor of rubber, together with proteids and other minor constituents. The constituent furnishing rubber is in suspension, and rises like cream when the latex is at rest. On the addition of an acid, or sometimes of alkali, or even on mere exposure, coagulation takes place and the rubber separates as a solid, the other constituents for the most part remaining dissolved in the aqueous liquid or "serum."

The chemical nature of caoutchouc is a subject which has attracted the attention of distinguished chemists from the middle of the eighteenth century, among them being Faraday, Liebig and Dalton. Faraday was the first to examine the constituents of the latex of Hevea brasiliensis. It is only in recent years that our knowledge of the constitution of organic compounds, and especially of the terpene group, has rendered it possible to make any great advance. It is interesting to record that Greville Williams, in 1860, made most important contributions to this subject. He identified a new hydrocarbon, isoprene, as a decomposition product of caoutchouc, and recognized its polymeric relation to caoutchouc. Harries' Work has brought us much nearer the goal, and has led to the discovery of a new method of investigation through the ozonides, which is obviously of wide application. But it cannot yet be said that the constitution of caoutchouc has been settled or its relation to the parent substance of the latex definitely established.

I have very briefly drawn attention to the present position of our knowledge of the chemistry of caoutchouc in illustration of the interest which attaches to the examination of vegetable products, and also because of the immense importance of the problem from the practical and commercial standpoint. Chemistry in this case holds the premier position in reference to this subject, and to a large extent may be said to hold the key to the future of the rubber industry in all its phases. The discovery of better methods of coagulation, preparation and purification will be effected through chemical investigation, as will also the determination of the manner of utilizing the various other plants which furnish rubber-like latexes. That the physical properties of raw rubber, on which its technical value depends, are to be correlated with the chemical composition of the material there can be no doubt. The chemical analysis of raw rubber, as at present conducted, is, however, not always to be taken by itself as a trustworthy criterion of quality, and more refined processes of analysis are now needed. Although the finest caoutchouc for technical purposes is only yielded by half a dozen plants, under whose names these varieties of caoutchouc pass, there can scarcely be a doubt that the elastic substance in each case possesses a very similar, if not identical, chemical structure. Nearly all the latexes and similar fluids furnished by plants contain more or less caoutchouc. Even opium, which is the dried juice of the capsule of the poppy, contains caoutchouc, while the opium yielded by certain Indian species contains a notable proportion. Chemistry must determine the means by which caoutchouc can best be separated from these relatively poor latexes. In view of the increasing production of the nearly pure caoutchouc which is furnished by Hevea brasiliensis, Funtumia elastica, Castilloa elastica, Ficus elastica, and a few other plants which occur or can be cultivated in several of our tropical possessions, the question is not a pressing one at the moment.

Moreover it cannot be doubted that chemical science will sooner or later be able to take a definite step toward the production of rubber by artificial means.

The production of caoutchouc by chemical means has, indeed, virtually been accomplished in its formation from isoprene. The exact nature of this change has still to be determined. When this has been done it will only remain to cheapen the cost of production to make the manufacture of synthetic rubber a purely practical problem. I should be the last to discourage the great extension of rubber planting which is now taking place. It is warranted by the present demand for the material. It has also to be remembered that the actual cost of producing raw rubber, which is at present about one shilling (24 cents) a pound, will probably be reduced, and the market price of rubber may eventually be so considerably lowered that, as with quinine, the synthetic production could not be profitably carried on. That is a question which involves many factors at present unknown, and only time can decide. Chemists may, however, confidently predict that before the British Association again meets at York the synthetic production of rubber will be a fully accomplished fact.

As I have said, our science is concerned with nearly every problem connected with the great rubber industry, and in concluding these few remarks I may allude to the production of vulcanized rubber, depending on the formation of additive compounds of the hydrocarbon with sulphur. In this connection I should mention the recent experiments of Mr. Bamber in Ceylon, which appear to show that vulcanization may be accomplished by acting on the uncoagulated latex with chloride of sulphur. If this proves to be practicable, it may mean the transference to the tropics of the subsidiary industry of vulcanization.

BOOK TABLE.

MANUAL OF WIRELESS TELEGRAPHY. By A. Frederick Collins. New York: John Wiley & Sons. 1906. Pages (4¾ by 7¾ in.), 232, with 90 illustrations and a communication chart. Price, $1.50.

The appearance of this book signalizes the advent of practical wireless telegraphy. This is the fourth American book to be published on the subject of wireless telegraphy and the first that can in any sense be termed a "manual" or "hand-book."

The thorough treatment of the subject of "wireless" in Mr. Collins' former work, "Wireless Telegraphy: Its History, Theory and Practice," indicates that he is well qualified to instruct regarding the satisfactory operation of wireless telegraph apparatus, and the present book gives lucid and concise instructions for the setting up and adjustment of the various devices used in practical wireless telegraphy.

In the first two chapters the theory of the art is considered in simple language, and in the seven following chapters appear diagrams and descriptions of the various devices and instruments used in practical operation, which have survived the test of practical service, and no space is taken up in the description of inventions which have been discarded, or which have been found wanting. Chapter X gives general information regarding the rates charged for aerograms, and in regard to the location of present ship and shore stations installed by the different telegraph companies and the various governments.

Copies of the three telegraph codes are given, as well as instructions in regard to the method of sending and receiving messages. A very commendable feature of the work is the glossary of wireless telegraph words, terms and phrases given in the back of the book, and which will be of considerable help to students in gaining an understanding of more advanced works. In the back of the book also appears a printed copy of the Marconi company's Atlantic communication chart, which resembles very much an ordinary "train sheet" as used on American railroads. This chart shows the location of the various vessels carrying Marconi apparatus at all times during the passage of the Atlantic, and serves as a guide to ship and shore operators in determining with what ships they can communicate at any given times. The diagrams of station wiring indicate that wireless telegraph engineers have still something to learn regarding the convenient arrangement of apparatus used by the operator, and that they have not yet mastered the many tricks of the trade practiced by Morse line operators and wire chiefs, but, of course, these refinements will be developed with experience.

Mr. Collins has written a book that will be found of great value to the operator at present employed in wireless telegraph practice and to the student who is seeking a knowledge of the fundamentals of the new telegraphy.

Electrical Copper Consumption.

The General Electric Company, one of the largest consumers of copper in the world, has covered its copper requirements for the next six months, the most of it on a basis of 18 cents a pound. Consequently it will be a long time before the corporation will have to pay prevailing prices. If the company entered the market at present as a purchaser of copper for future delivery it would have to pay 21 or 22 cents a pound for the metal. It is understood that other electrical companies have also covered their wants far ahead on a much lower price basis than now prevails.

The copper consumption of the General Electric Company this year will be from 40 to 50 per cent. greater than in the preceding year, while the increase in the copper production of the country will not, according to expert miners, be in excess of five per cent. This is one of the explanations for the sharp upward movement in the price of the metal over the last 12 months.

The consumption of copper next year is expected to be even larger than in the current year. For example, the General Electric Company will endeavor to bring its plant up to a degree of efficiency that will enable it to take care of $70,000,000 of gross business. This compares with an expected gross business of approximately $55,000,000 in the current fiscal year and $43,146,902 in the preceding fiscal year.

This expansion in business will not result from the extensions that will be made possible by the recent stock issue, as they will hardly be completed by the close of the next fiscal year. For example, the gross business in the current year will be based, practically, upon the floor space of 4,350,000 square feet given in the last annual report of the company.

At the close of the fiscal year ended January 31st last the General Electric Company had a working capital of $39,952,000. Since then an increase of $6,236,734 is reported, making a total of $46,188,734 on a capital stock and bonded indebtedness of less than $58,500,000 par value.—Chicago Inter Ocean, October 23d.

Weights of Cars.

[From the Question Box of the American Street and Interurban Railway Engineering Association, presented at the Columbus convention, October 17, 1906.]

What are the average weights of cars? Give lengths over corner posts and over bumpers.

First Answer.—Forty thousand pounds, including trucks and electrical equipment. Lengths over corner posts 29 feet; over bumpers 41 feet.

Second Answer.—Semi-convertible car, 30 feet eight inches over corner posts and 42 feet over bumpers, four-motor equipment; weight 45,000 pounds.

Closed car, 28 feet over corner posts, 40 feet over bumpers, two motors, double truck; weight 29,230 pounds.

Convertible car, 30 feet five inches over corner posts, 41 feet over bumpers, two motors, double trucks; weight 31,700 pounds.

Closed car, 23 feet over corner posts, 34 feet over bumpers, two motors, single truck; weight 22,286 pounds.

Open cars, 12-bench, 31 feet nine inches over corner posts, 40 feet over bumpers, two motors, double trucks; weight 30,744 pounds.

Bloomington Gets Cheaper Street Lighting.

The City Council of Bloomington, Ill., has decided to grant to the Bloomington and Normal Railway and Light Company a franchise for 20 years for all lines in the city. In return the company agrees to furnish the city current for 300 electric street lights during the life of the ordinance, and as many more as are needed, at a rate of $25 a year. The city furnishes all lights, wires and supplies and trims and keeps them in repair. This makes a saving to the city of Bloomington of $9,000 per year, it is said. It is also understood that the new arrangement carries with it waiver of claims of perpetual franchise on some of the lines. The railway is owned by the McKinley syndicate.

Lower Lighting Rates in New Jersey.

Announcement is made that beginning January 1, 1908, the Public Service Corporation of Newark, N. J., will reduce the rate on public lighting contracts on a five-year basis to all municipalities. The rate to first-class cities will be $75 per light; all other cities, $80 per light; muncipalities, other than cities, $85. On and after January 1, 1908, the rate for commercial light and power will be reduced to 10 cents per kilowatt-hour throughout all the Public Service territory. The present rate ranges from 12 cents to 14 cents. The price of gas is to be lowered to $1 after January 1, 1909, except in Bergen County. The rate for cash in New Brunswick is now $1.25.

CORRESPONDENCE.

Continental Europe.

Paris, October 16.—In France a number of projects for electric lighting in the larger towns are under consideration at present. Among the most important of these I may mention the arrangements which are being made at Evreux between the municipality and the Continental Gas Company. It is proposed that the latter company shall supply the town with all the electric light which is needed and also current for private lighting. The streets will be lighted partly by incandescent gas burners and the rest by arc lamps. To carry this out it is thought that the gas company will proceed to put up a large electric station on a piece of ground which lies next the gas works. The question will soon be submitted to the Municipal Council.

At Argenton the town is to use current from a hydro-electric plant which will be erected on the Creuse River. The plans for this work are already drawn up, and the construction will be commenced soon. The North and East Gas Company is to undertake the lighting of the town of Chaumont, according to the project which was drawn up by a special commission. It is expected that the new plant will be in running order by the coming winter. A public and private lighting project has been decided upon by the municipality of St. Didier, in the Rhone district. Malzieu is another town which is to have an electric-light station before long.

Regarding the new projects in Algeria I may state that a central station is to be erected at Sidi-bel-Abbès, under the control of French capital. It is to be installed by De La Salle & Co. After examining and modifving the project, the Municipal Council approved it, and the work will soon be begun. Current is to be used in the town for public and private lighting as well as for a tramway system.

The Allgemeine Elektrizitäts Gesellschaft has brought out a new insulating material composed of asbestos, resin and alkaline earths. It is very hard and will resist a heavy pressure, having also an unusually high breaking strain. A sheet of it 0.16 inch thick requires over 40,000 volts to perforate it. Owing to the character of this material it can be molded in a press to any desired form. It is known as "tenacite."

Another new insulating material is made by an Italian firm. It is of a high quality and is intended to replace mica for many purposes. Sheets of it and even an insulating paper can be made, and it is said to stand a voltage of 18,000 for a thickness of 0.024 inch on the perforation test. It is prepared of animal matter pressed together at a high temperature.

The Iron and Steel Company of Santander, Spain, is installing an electric railroad of short length for handling the iron ore between the mines belonging to the company in the Camargo Valley and the mills located at Nueva Montaña, over a distance of five miles. An overhead-trolley system working at 550 volts is used, with a number of electric locomotives of 80 horsepower. Each of the locomotives carries two motors which allow a speed of 10 miles an hour. Gas engines and generators are now being set up in the station. These engines are to work on the low-carbon gas coming from the blast furnaces.

Motor cars which run upon an ordinary road and take current from an overhead line—"trackless trolleys"—are now used in France and Germany. The Schiemann system is employed at present upon four different lines in Germany. One of these connects the railroad station of Grevenbrück with the neighboring stone quarries, and it is said to run upon one-third the expense of horse traction. The car is designed to run either way, and has a specially-designed trolley pole, so that it can run over 10 feet on either side of the line, so as to allow other vehicles to pass. Two motors are used, one upon the middle of each axle.

Large gas engines are used to drive the dynamos in the municipal electric plant of Schwerin, Germany. This is one of the most recent plants of the kind. At present there are installed two groups which use Körting gas engines of 300 horsepower running at 125 revolutions per minute coupled to 200-kilowatt generators. Two producers furnish the gas, using anthracite fuel.

Turbo-generators are to be used in the proposed enlargement of the Frankfort electric plant. Two Brown-Boveri steam-turbine sets of 5,000 horsepower each are soon to be installed. This will bring the total power furnished by the turbine groups of the station to 20,000 horsepower. The city of Berlin is using a number of 7,400-horsepower steam-turbine sets of the same make, and also two turbine groups built by the Allgemeine Gesellschaft. The latter have a capacity of 1,000 kilowatts each. A. de C.

Great Britain.

London, October 17.—In a few notes on the position of electric-railway traction in London, which I sent a short time ago to the Western Electrician, some reference was made to experiments with compartment coaches as opposed to the corridor type which has been universally adopted so far. There were several reasons for at least one of the companies going into this matter. To speak of two, mention may be made of observations by some officials of the Metropolitan Railway Company which have led them to the belief that loading and unloading is not carried out so quickly by the corridor coach, while in the second place the company happened to have some nearly new compartment rolling stock intended for steam traction and which, quite naturally, it did not wish to scrap. Consequently it was determined to adapt it for electric traction. The company possesses nine such compartment trains, each consisting now of two motor coaches and five trailers. The total weight of the seven-coach train is 172 tons, the seating capacity being for 189 third-class passengers and 120 first-class. The Sprague-Thomson-Houston control system is adapted to these new trains, the driver's cab being the converted guard's compartment of the original steam train. The contents of this differ from those of the driver's cab of the ordinary electric train, in that the whole of the control equipment, including motor resistances, main circuit-breaker, reverser and contactors, are now placed therein. With the ordinary electric train the resistances and contactors are under the train. This is the first electric train of such a type in service on any electric railway in England.

The electric-tramway question has been exercising the minds of the Oxford town councillors for some little time, and a decision has just been arrived at, which in some quarters is regarded as a ruse to shelve the matter. Two points render the controversy worth comment, one being the strong feeling that an ancient and ill-conditioned horse-tramway service was more in keeping with such an old-world town as Oxford, with its colleges, and the other that the choice of the corporation has fallen upon the Dolter surface-contact system. Oxford further affords an object lesson in so-called municipal "progressiveness." In 1902 the old horse company offered to electrify the lines upon the conduit system in the center and trolley on the outskirts, but it was refused. After allowing matters to remain dormant for three years, an agreement was entered into for the purchase of the horse tramways. A poll was subsequently taken as to whether the corporation should work the undertaking, and the vote was overwhelmingly against this course. Now an agreement has been entered into with a new company for the adoption of the Dolter system, which is only to be installed after it has been commercially working in England for six months. Now the Torquay tramways are the only Dolter installation in Great Britain, and these have not yet started operations. It will therefore be seen that electric traction in Oxford has not been expedited by reason of the intervention of the corporation.

An instance of how rapidly electrical plant becomes obsolete nowadays is afforded by a report presented to the Manchester Corporation Electricity Committee by the chief engineer. In Manchester there are three generating stations which have been built partly owing to increased demand and partly owing to the previous station being somewhat inefficient owing to the comparative obsolescence of the plant. The latest station, Stuart Street, is now, under a scheme prepared by the engineer, to be utilized to its fullest possible extent, and the oldest is to be shut down as far as possible altogether in the summer months. As evidence of the development of electric supply in Manchester, it may be pointed out that within the last 12 months contracts have been entered into with manufacturing firms which will effect the sale of 10,000,000 kilowatt-hours annually, and it is to meet this extra demand that more economical working is being aimed at, coupled with some extensions to the plant.

The tramway programme which the London County Council has planned for the coming parliamentary session is now under discussion. The proposals are for 32½ miles of new lines, which involve an invasion of some of London's most select residential squares in the western central districts, and considerable opposition will be forthcoming. By April, 1907, it is anticipated that there will be 58½ miles of electric tramways worked by the council, while a year later this will be increased to 150 miles.

Good progress is shown by the Clyde Valley Electric Power Company, for the connections now number 10,000 horsepower. Included in the firm's new customers are Messrs. Yarrow, the shipbuilders, who are removing from London on account of the burden of taxation and the absence of cheap electric power.

Gas street lamps in Swindon are to be replaced by tantalum lamps. G.

Dominion of Canada.

Ottawa, October 27.—The Electrical Development Company's transmission line from Niagara Falls to Toronto is now completed and power is expected to be turned on at an early date.

The Bell Telephone Company of Canada has let a contract for 2,500 miles of poles for lines to be built next year in Western Canada. The contract calls for 83,000 poles.

C. D. Warren, president of the Lake Superior Corporation, says a contract for improving the power plant in the Michigan Soo will be let shortly. The plans are now in the hands of contractors. The cost of improvement will be in the neighborhood of $1,000,000, and it will take five months to complete the work.

It is reported the Ontario government is making arrangements with the Ontario Power Company for the supply of power for municipal and manufacturing purposes. The price mentioned is $10 per horsepower a year up to 160,000 horsepower, and $8 over that amount. This rate is, of course, for delivery at Niagara Falls, and the cost of transmission must be added for other places. The demand from municipalities for power has now reached the aggregate of 90,000 horsepower, and a very large portion of this aggregate comes from municipalities geographically within the supply radius of Niagara Falls power.

Peter Verigin, the leader of the Doukhobors in the Canadian Northwest, passing through this city, said: "We have at present telephone connection with Swan River, and the work of connecting all our villages with the telephone system is now in progress. We also intend installing electric-light plants in many of our villages. We had intended using kerosene, but we think electricity less expensive and far more convenient."

A judgment has just been rendered in the Ontario courts which is, in effect, that the power in all navigable rivers belongs to the crown. The action was brought to restrain the town of Kenora from prosecuting expropriation proceedings in a branch of the East Winnipeg River with a view to the establishment of a municipal power plant. The eastern bank is owned by the Hudson Bay Company, the western bank by the Keewatin Power Company. The town of Kenora leased the bed of the river and proceeded to construct a dam for power purposes and to expropriate land on either side for this purpose. The owners of the two banks claimed their title was to mid-stream. The court held that the original grant gave title to the water's edge. W.

New England.

Boston, October 27.—The Massachusetts Supreme Court has handed down a decision which declares that an electric-railway company is not responsible for passengers' injuries from missiles entering the cars from outside the company's property on the Fourth of July.

The Boston and New York Electric Railroad Company has filed a petition for the Massachusetts Railroad Commission's approval of its proposed electric interurban railway between Forest Hills in Boston and Providence, R. I., a distance of 35 miles. This is to be part of a Boston and New York electric line.

The Lynn (Mass.) City Council has passed an ordinance adopting the National Electrical Code of the National Board of Fire Underwriters, to govern the city electrician's work.

The Derby Gas Company, which supplies gas and electricity in Ansonia, Derby and Shelton, Conn., will change from the direct to the alternating current, and is installing a 500-kilowatt Curtis steam-turbine unit.

The Salmon River Power Company has acquired the Rhode Island Contract Engineering Company's property and rights along the Salmon River at Leesville, Conn., and will install a large power plant from which it will furnish electricity for lighting, power and traction plants in Middlesex County. The company has a capital of $500,000.

In the United States Circuit Court, October 22d, attorneys for the American Bell Telephone Company made a motion for the appointment of an auditor in the suit of the National Telephone Manufacturing Company, which sued the American company to recover $1,000,000 for an alleged false and malicious prosecution. This suit was based on the American company's patent-infringement suit against the National Telephone Manufacturing Company, which was brought in August, 1895. Decision on the motion for an auditor was reserved.

Tucker, Anthony & Co. of Boston have formally transferred their interest in the Ohio electric railways recently sold to the Everett-Moore syndicate of Cleveland, Ohio. These railways are now part of the Northern Ohio Traction and Light Company's system. The sale involved about $3,000,000 in cash and bonds. B.

New York.

New York City, October 27.—It is said that W. H. Lamprecht of Cleveland will be made chairman of the board of directors of the Longacre Heat, Light and Power Company of this city at the next meeting of the board, and that Edward Van Eten, now vice-president and general manager of the Boston and Albany Railroad Company, will be chosen president. This company has purchased the business of a company that was formed to furnish current to the theaters on Broadway, and has also secured a franchise that was granted some years ago to another company. The lower courts have decided that the company may lay its wires

in the tunnel used by the New York Gas and Electric Light, Heat and Power Company. This suit has been appealed to the higher courts.

Inaudible cab calls by the use of electric-lighted numbers being thrown on a screen have been quite successful at hotels and theatres, but one objection has been met and that is the coachman is not always awake and is not roused by the inaudible call. At the Hotel Astor in this city an experiment has been tried, in connection with the screen method, of flashing an electric searchlight down the line of vehicles and into the drivers' faces. It is said the glaring light never fails to awaken the drowsy men.

Five private plants on Manhattan Island were abandoned during the month of August, says the New York Edison Company, and full Edison service substituted. During the last five years more than 250 plants have been abandoned in like manner.

The next meeting of the New York Electrical Society will be held at the Edison Auditorium on October 31st. Prof. V. Karapetoff of Cornell University will deliver an address on "The Human Side of the Engineering Profession." Professor Karapetoff has given considerable attention to the influences affecting an engineer's professional success, the principal factors being knowledge, personality, and the views of life held.

The Appellate Division of the Supreme Court has handed down an order confirming the report in the matter of the two rapid transit routes planned by the Rapid Transit Commission. One of these is the Jerome Avenue four-track subway from One Hundred and Sixty-sixth Street to Woodlawn Cemetery. The other is the route from Bronx Park to the White Plains Road.

The electric vehicle service of the New York Transportation Company was at a standstill on Thursday. The company's chauffeurs went on strike at six o'clock in the morning, and the concern was able to get only one vehicle out of the garage at Forty-ninth Street and Eighth Avenue all day. The union demands a uniform wage of $2 a day for the men who run public machines and $2.50 a day for the men who operate machines hired by the month. They also demand 20 cents an hour for overtime work. There are between 300 and 350 men employed by the company.

The fifth National Business Show opened tonight in Madison Square Garden. Devices of every sort for saving time and labor and for promoting speed and accuracy are on exhibition in the 200 booths. Every kind of "graph" and "meter" and "phone" is represented by the show. The United States Department of Commerce and Labor has an exhibit in which the export trade figures of this country are shown. One of the features of the show will be the world's championship typewriting contest. The show will continue all next week. C. I. C.

Southeastern States.

Charlotte, N. C., October 27.—A deal of some importance in this state has just been consummated at Hickory where Col. M. E. Thornton has sold to Pennsylvania capitalists the Thornton Light and Power Company and the lighting franchise in the town and at Thornton Shoals, two miles distant on Catawba River, also the Odell holdings in the Horseford Shoals and the required lands necessary for developing the two waterpowers. The Horseford Shoals development now contemplated will call for $225,000 outlay, and it is finally purposed to generate enough power to supply all of the surrounding towns and manufacturing plants.

The town of Clover, S. C., has begun to use the street-lighting system, current for which is secured from the Southern Power Company of Charlotte. The latter company has closed the reported contract with the Cannon Cotton Mills of Concord, N. C., for 5,000 horsepower for operating the big cotton mills. A contract has been made with the Odell mills in the same town for 1,800 horsepower, and it is expected that 1,000 additional horsepower will be placed in the same town by the first of the year for smaller plants. The Great Falls (S. C.) development of the Southern Power Company will transmit electricity to Charlotte, Concord and Gastonia, where large contracts have been secured. The company is revolutionizing manufacturing in the western portions of the two Carolinas, and the end is by no means in sight. The company owns the water rights for a distance of 110 miles along the Catawba, and when the developments now purposed for immediate use are finished, it will have about 110,000 horsepower daily. The only plant now in operation is that near Rock Hill, S. C., supplying 10,000 daily, lighting the town of Charlotte, and furnishing power for numerous manufactories and cotton mills. Dr. W. Gil Wylie of New York is the man who planned and worked out this immense undertaking for the South.

The Atlantic Electric Company of Norfolk, Va., has been chartered, with Walter Hitt president and H. N. Brown secretary and treasurer. The capital is $50,000 and the purposes to conduct an electrical construction and supply business in Norfolk.

Wrightsville, Ga., has voted for an issue of $35,000 bonds for owning its electric-light plant, and for water.

Union, S. C., has contracted for an electric-light plant to cost about $11,000, under the terms of a proposition from the Stanley-G. I. Electric Manufacturing Company. The town will have a modern plant in every way. L.

Ohio.

Cleveland, October 27.—The trouble between the Cleveland Electric Railway Company on one side and the Forest City Railway Company, the Municipal Traction Company and the city of Cleveland on the other, has resolved itself into a fight with injunctions as weapons. So many actions of the kind have been commenced the last week that it is almost impossible to keep track of them. The Forest City Railway Company has been barred from what it claimed as free territory on the West Side. An application for an injunction to cover the Central and Quincy Avenue lines was made by the Cleveland Electric Railway Company Thursday. Friday Mayor Johnson instructed the police department to stop the operation of cars on East Ninth Street from Prospect to Central Avenue. This not only compelled the company to reroute the cars that had been using that section of line, but cut the interurban cars off from their depot and compelled the Electric Package Company to load and unload its cars on St. Clair Street. Depositions in the blanket injunction case were taken early in the week. Mayor Johnson admitted that he had agreed to stand good for something like $400,000 for the new companies. He also admitted that he had signed a bond or agreement to make good to the Cleveland Press, when it offered to guarantee the securities of the new company. The object of bringing out this testimony was to show that the mayor is financially interested in the company. President Horace Andrews and Secretary Davies of the Cleveland Electric Railway Company were also examined.

The Stark Electric Railroad Company operates an up-to-date line between Canton and Salem, giving an outlet toward the eastern portion of the state. When the Youngstown and Southern and Youngstown and Ohio River lines are completed a through route to the Ohio River from Cleveland will be formed. The road does a freight business also, and operates its own express cars. An extension from Alliance to Cleveland, 55 miles, is contemplated. C. R. Morley is the president of the company.

George T. Bishop has resigned as receiver of the Eastern Ohio Traction Company, owing to pressure of business in looking after the affairs of the Washington, Baltimore and Annapolis. Robert D. Beatty, general manager, has been appointed to succeed him.

Albert Shaw of Cleveland, an applicant for a lighting franchise at Marion, says that he is organizing the United Light and Gas Company of Cleveland to build the proposed plant.

The Portsmouth Street Railway and Light Company is offering for sale $250,000 five-per cent. first-mortage bonds. The company is laying a lot of new track and making other improvements. The earnings are about $63,000 a year.

Fire destroyed the repair shops of the Lake Shore Electric at Fremont a few days ago. The blaze probably started from a stove in a car run into the shops. Four passenger cars, six new Westinghouse motors, the armature room, machine shop and carpenter shop were destroyed. The loss will be about $100,000, fully covered by insurance.

An entertainment and card social was held a few evenings ago by the Cleveland Electric Railway Beneficial Association. A literary and musical program was also enjoyed.

The People's Light, Heat and Power Company of Toledo has been incorporated by Homer T. Yaryan and others, with a capital stock of $400,000. The Yaryan Light and Power Company of Toledo was incorporated at the same time by Mr. Yaryan, with a capital of $100,000.

Work on the Ely lines at Wellsburg is being rushed, and it is expected that they will be completed by the first of the year. Ties have been distributed and most of the grading is completed. The line connects Wellsburg with Steubenville, Bellaire, Bridgeport and with Wheeling and other West Virginia towns.

The Xenia, Cedarville and Jamestown Traction Company has been incorporated with a capital stock of $1,000 by J. O. McCormick, George Little and others. O. M. C.

Michigan.

Grand Rapids, October 27.—Grand Rapids men who have purchased the Manistee Gas and Electric Company of Manistee have organized the Northwestern Michigan Light and Power Company of Manistee. The officers are: President, Edward M. Deane; vice-president, Dwight Smith; secretary-treasurer, Frank G. Deane; general manager, Harry B. Wales. New apparatus is being installed and the system extended. The concern has also taken over the management of the Manistee Traction Company with an option to buy.

The Northern Michigan Traction Company has commenced surveying for an electric railway from Manistee to Cheboygan, which, with branches, it is said will be 225 miles in length. It will touch Traverse City, Charlevoix and Petoskey. From Traverse City a branch 18 miles in length is to run to Old Mission, and from Petoskey a branch to Waloon Lake, East Jordan and Bellaire, connecting with the main line at Elk Rapids. F. O. Oleson announces that there is ample capital behind the scheme, though the estimated expenditure will be $7,000,000. The third-rail system with the overhead trolley in towns is to be used, and local systems installed wherever they are warranted. It is thought that Cleveland capitalists are back of the project.

At the forced sale of the Marquette County Gas Light and Traction Company at Ishpeming, conducted by Master in Chancery Lawrence of Grand Rapids, the property was disposed of to Granger Farwell of Chicago, holder of bonds. for $289,000. The property includes a gas and electric-light system and street railway serving the cities of Ishpeming and Negaunee.

Greenville citizens have voted not to bond the city for $28,250 for a municipal lighting plant. The proposition received a majority vote, but a two-thirds vote is required.

Parma has voted to contract with the Commonwealth Power Company of Jackson to provide the village with electric lights.

Experts are to be called in to advise as to the uniting of the two electric plants in Bay City, and the erection of a new plant.

Zero Marx of Chicago, a maker of electric signs, has asked the Common Council of St. Joseph to amend the ordinance regulating electric signs. He objects to the requirement that signs be made of all metal.

Sufficient capital has been subscribed for the extension of a telephone system from Daggett, Menominee County, to Nathan and other points on the Wisconsin and Michigan Railway. Work will be commenced at once.

The Marquette County Telephone Company of Marquette has increased its capital from $60,000 to $100,000. Extensive improvements are to be made. The new board of directors is headed by J. E. Sherman and D. W. Powell of Marquette. L. W. B.

Illinois.

Peoria, October 27.—The Illinois Traction Company is planning to put two more limited cars on the run between Springfield and St. Louis, making four in all. The company is planning for an increase in traffic, as it is now having 60 new cars built in St. Louis. Three of these will be limited cars, 15 express cars and 42 local passenger cars. The company is pushing work on the Danville-Springfield line and as soon as completed will put into service a train to be known as the "Capital City Limited." The Corn Belt Limited will be the train running through to St. Louis. General Manager Fisher, speaking of the Peoria-Bloomington line, said that with no delays the line will be in operation by January 1st.

Work on rebuilding the smokestack at the power house here has been commenced, also on the stack being built by the Peoria Gas and Electric Company.

The machinery for the new municipal lighting plant at Mason City has arrived and is being installed.

A. M. Searles of Chicago has been granted a franchise for lighting the town of Washburn. He is looking for a site now. The plant is to be in operation in six months.

At a meeting of the board at Stonington it was voted to issue $15,000 in bonds to build a waterworks and light plant. The contract is to be let at once.

There is a plan on foot to establish a wireless-telegraph station in Springfield.

The Chicago-New York Electric Air Line has opened offices here for the sale of stock.

John Finley, formerly general manager of the Central Railway Company, has gone on a trip of several months' duration. He will visit the Atlantic Coast and later will go to Panama. Mr. Finley had given his undivided attention for years to the railway company.

The Farmers' and Merchants' Telephone Company of Highland has been incorporated with a capital of $15,000 to maintain and operate a telephone system. Incorporators are Leo. R. Brand, M. Cummings and John S. Koerner.

The Central Illinois Long-distance Telephone and Telegraph Company of Effingham has been granted incorporation papers to operate telephone and telegraph lines. Incorporators are B. W. Kerr, C. E. Munday and T. C. Dore. V. N.

Northwestern States.

Minneapolis, October 27.—The St. Anthony Falls Water Power Company, which is developing power at St. Anthony Falls, Minneapolis, is planning to utilize the power for the operation of a mineral fertilizer plant operating under a new process never before tried in the United States. The base of the fertilizer will be pulverized limestone, which is combined with the atmospheric nitrogen by an electrical treatment. About 6,000 horsepower is being developed.

The General Electric Company will place its new power plant at Taylors Falls, Minn., in operation about November 15th. The opening has been delayed about six weeks by high water.

It is proposed to issue $35,000 worth of bonds for the purpose of making extensive improvements to the electric light and waterworks plant at Marshfield, Wis.

It is reported that the Western Union Telegraph Company will erect a new office building at Ripon, Wis.

The American Electric Railroad Company has filed articles of incorporation at Des Moines, Iowa, with C. W. Baker as president and Chas. F. Castleman as secretary. It is proposed to build a trolley line from Winterset to Greenfield, to form a link in the projected line from Omaha to Chicago.

An election was held October 30th at Neillsville, Wis., to vote $40,000 worth of bonds for the construction of a municipal hydro-electric lighting and power plant.

The Milwaukee Northern Electric Interurban Company has asked for the withdrawal of its application for a franchise at Sheboygan, Wis. This is taken to mean that the company plans to build to Elkhart Lake from Port Washington instead of to Sheboygan.

A new 100-kilowatt dynamo has been purchased for the electric-light plant at Le Sueur, Minn., at a cost of $1,300.

The Owatonna (Minn.) Gas, Electric and Heating Company has been sold to H. G. Wagner.

The new electric-light plant at Eureka, S. D., has been placed in operation.

Robt. C. Ives has been appointed general superintendent of all lines of the Frost interests along the western shore of Lake Michigan.

The City Electric Company of Stillwater, Minn., has incorporated with a capital of $10,000. George Mayer of Chicago is at the head of the enterprise.

On November 17th an election will be held at Atlantic, Iowa, to vote on a proposition submitted by Ross & Judd to purchase the city's electric lighting system for $30,000, if granted a 25-year franchise.

The business men of Roseau, Badger and Greenbush, Minn., are discussing means for financing an electric railway from those towns to Karlstad, Minn.

A 3,000-horsepower engine in the Milwaukee Electric Railway and Light Company's plant at Racine, Wis., was completely wrecked recently by the cylinder head blowing out. The engine cost $6,000.

The contract has been let to Fairbanks, Morse & Co. for a new engine and dynamo for the state insane asylum at St. Peter, Minn., at $8,000.

Articles of incorporation have been filed for the Madison (Wis.) and Fond du Lac Electric Railway Company by eastern capitalists. The projected system will be a third-rail line and will take an air line from Madison to Fond du Lac. The company is capitalized at $150,000, which will be increased to $3,000,000.

The contract has been let for the construction of an electric-light plant at Staples, Minn., which will cost $4,215.

The contract for a new engine and dynamo for the electric-light plant at Hibbing, Minn., has been let to the Burgess Electric Company of Duluth at $4,166 and $3,143.

The electric-light company at Richville, Iowa, is planning on completely remodeling its plant.

The contract for a 100-kilowatt alternator and exciter for the electric-light plant at LeSueur, Minn., has been let to the Electric Machinery Company of Minneapolis.

J. A. Reuling and C. P. Philbrick have applied for a franchise for an electric-light system at Wymore, Neb.

The Duluth (Minn.) Electric and Construction Company has filed a petition in voluntary bankruptcy. Its liabilities are $25,914 and its assets nominally $35,714, but much of the latter is said to be uncollectable.

The Gowrie (Iowa) Lighting and Heating Company has filed articles of incorporation with a capital stock of $10,000 and will apply for a franchise. N. A. Lindquist heads the list of stockholders.

Andrew Morrissey is talking of putting in an electric-light plant at Deer River, Minn.

The City Council at Superior, Wis., has voted to purchase the electric-light plant from the Superior Water, Light and Power Company or to construct a new plant. A previous ordinance was passed which provided for building a plant only and was vetoed by the mayor. R.

Texas.

Austin, Texas, October 25.—Carroll & Co. of New York have under consideration the proposition to build an interurban electric railway between Austin and Lockhart, Texas, a distance of about 30 miles.

It is reported that the Temple-Belton Traction Company will extend its line east from Temple to Marlin, a distance of about 30 miles. This road was built by Pennsylvania men more than a year ago and has proved a satisfactory investment.

A survey is being made for an interurban electric railway between Dallas and Waxahachie, a distance of about 30 miles. The work is in charge of J. W. Martin, an engineer formerly employed by the North Texas Traction Company. It is stated that Waxahachie is to be made the diverging point for other lines of the proposed system, one of which is to run to Ennis and Corsicana and the other to Hillsboro and Waco.

James D. McKeever of Philadelphia and associates are interested in the project of building an interurban electric railway between San Antonio and Pleasanton. Liberal bonuses have been offered for the proposed road by the people of Pleasanton and those living along the route.

The proposition of Owen Ford of St. Louis, Mo., to install an electric-light plant and complete waterworks system in Brownsville, Tex., at a cost of $100,000 if the people of the town will subscribe to $25,000 of the stock of the company, has been accepted. Practically all of the stock was subscribed in a few hours. H.

Mexico.

Mexico City, Mex., October 25.—The federal government has granted a concession to Schoendube & Neugebauer to install a large hydro-electric plant on the Concho River in the Iturbide district, state of Chihuahua. The electric power will be transmitted to a number of towns and industrial concerns in the state of Chihuahua.

One of the largest electric power and transmission plants in Mexico is to be installed on the Aros River at a point about 150 miles from Cananea by Colonel W. C. Greene of New York, president of the Greene Consolidated Copper Company. Engineers are now making a survey for the proposed plant. It is stated that there is practically no limit to the electrical energy which can be generated on the Aros River, and a series of plants may be installed by Colonel Greene in order to furnish power for mines and other industries throughout a large region of Northwestern Mexico. The primary object of the project is to afford electric power for operating the mines, smelter and other industrial concerns of the Greene Consolidated Copper Company at Cananea, and its large lumber mills and paper factory in the Sierra Madre region of the state of Chihuahua. The Cananea transmission line will be about 150 miles long while the transmission line which is to be built to Dedrick and other places where the lumber mills are located will be more than 200 miles long. It is also planned to build transmission lines to Hermosillo, the capital of the state, and to a number of towns where there are large mines and smelters in operation.

Otway Norwood, an American, is preparing to install an electric power plant and transmission system on the Nazas River near El Oro, state of Durango. The transmission lines will run to several towns and industrial centers of this section where the power will be used in operating machinery and for lighting purposes.

The deal for the purchase of the extensive holdings of La Electra, S. A., and the Company Industrial de Guadalajara, in Guadalajara, by the Mexican Light and Power Company, the Canadian concern which owns the big electric power transmission plant at Necaxa and the street-railway systems of Mexico City and Puebla, has practically been completed. The consideration is said to be upwards of $5,000,000. The property includes the electric-lighting plants and street-railway systems of the two companies. The Mexican Light and Power Company was represented in the transaction by Frank Thomason and W. F. Tye of Montreal, Canada, and R. F. Hayward, manager for the company in Mexico City. It is announced that extensive improvements will be made to the existing systems. W. D. H.

Pacific Slope.

San Francisco, October 25.—The San Francisco Department of Electricity, at the head of which is W. B. Hewitt, is rehabilitating the fire-alarm telegraph system of the city in the burned district as rapidly as the limited funds at its disposal will permit. The sum of $1,716 has just been granted by the supervisors for additional alarm gongs and wire connections for the local engine houses. This amounts to duplicating the present gong circuits, so that in the case of a failure of the main system alarms would still be sounded. It remains to be seen whether or not the present complicated fire-alarm system, with instruments of local manufacture, will be perpetuated when the city is rebuilt. The installation of a modern high-class non-interfering system is favored by many local electricians, instead of duplicating the old plant that was destroyed.

The Ocean Shore Railway Company, which has completed about 20 miles of trackage on its double-track electric line between San Francisco and Santa Cruz, has levied an assessment of $5 per share on the issued capital stock of the company for construction purposes. Arrangements have been made to sell bonds in the East, but the management recognizes the necessity of rushing the completion of the 83 miles of track through to Santa Cruz, via Half Moon Bay, in order to keep up the interest in real-estate sales in the adjacent territory, and wishes to secure money at once. Twelve miles of the road extending northward from Santa Cruz are already in operation as a steam road, handling freight for the big cement mills approaching completion at San Vicente. The company's main power house is being erected at Half Moon Bay, and it is hoped to have rail connection between San Francisco and the plant early next year. A contract has been let for the completion of the tunnel through Pedro Mountain. Terminal tracks have been laid adjoining the company's office at Twelfth and Mission streets, San Francisco, and a large passenger station will be erected there.

H. S. Crocker & Co., printers and stationers, are to occupy a new three-story brick building in this city with one of the largest printing plants west of Chicago. A direct-current isolated electric plant will be installed to furnish light and power for the entire establishment.

The Novelty Electric Sign Company's shop at 837 Ellis Street, San Francisco, was destroyed October 23d by fire.

The Electric Appliance Company of this city suffered considerable loss by a fire this week, which is supposed to have started in that company's stock of goods on the fifth floor of the Haslett Warehouse Company's building at 115 Townsend Street. The total loss will not exceed $50,000, and the Appliance company's damage was largely covered by insurance.

George Hanscom, master electrician at the Mare Island Navy Yard, has sailed for Eureka, Cal., with a full crew of workmen and two complete sets of equipment for two wireless-telegraph stations that have been erected. One of the plants will be installed at the Table Bay station near Eureka and the other at Council Bluff, 100 miles further north. When a few more of these stations are in working order, it should be possible to keep up a complete interchange of wireless communication from Puget Sound to San Diego. Very few merchant vessels plying on the Pacific Coast have as yet been equipped with wireless-telegraph instruments, although good records have been made by the existing stations with government vessels so equipped.

The Marysville and Nevada Water and Power Company, according to its latest prospectus, has expended about $100,000 on its properties in Yuba and Nevada counties and is preparing to develop electric power. Land and water rights along the Yuba and Bear rivers have been acquired.

The Electric Heating and Manufacturing Company has awarded the contract for the construction of its factory building at Dolgeville, Cal., to Earl F. Low for $9,550. The equipment will cost considerably more.

The Key Route (San Francisco, Okland and San Jose Railway Company) of Oakland, Cal., will proceed with the construction of its extensive system of piers and docks on the northern waterfront of Oakland. Cement-covered piling will be used, as the government engineers have reported that the construction of the proposed mole two miles long would interfere with the tidal currents in the bay.

The Northern Electric Company, which is operating from Chico to Oroville, has completed the tracks on its 26-mile extension from Marysville nearly to Live Oak, about 12 miles from Yuba City.

The San Bernardino Valley Traction Company has purchased a franchise for double-tracking its electric-railway lines through the town of San Bernardino, Cal. On securing a franchise at Colton, Cal., the company will begin the immediate extension of its system to Riverside and Rialto. Connection will be made with a projected Huntington electric line from Los Angeles.

The United Railroads of San Francisco has commenced the work of putting in a large loop that will occupy nearly a block in front of the Union Ferry Building at the foot of Market Street. This will replace the old Cable turntable and the crossover switches that have been used to transfer the cars from the down to the up tracks at the end of the run. The loop will be somewhat similar in arrangement to the one at the New York end of the Brooklyn Bridge.

The American Biscuit Company, which is building a large cracker factory of reinforced concrete covering a half block on Battery Street, at a cost of $400,000, will install a steam-driven electric-generating plant for the purpose of generating light and power for the entire plant.

The Pacific Coast Steamship Company has been granted permission to install a steam-driven electric-lighting plant at the Broadway wharf, San Francisco, for the purpose of lighting the docks and approaches while handling cargoes.

The board of trustees of Wilmington, Cal., are considering the project of issuing bonds to the amount of about $300,000 for the construction of a city light and water plant.

The Consolidated Gas and Electric Company of San Diego, Cal., is said to be planning the installation of a new turbo-generator with a capacity of 1,000 kilowatts. With the necessary boilers, the cost of the plant is estimated at $100,000.

The United States cruiser Charleston, which has just returned from a cruise in southern waters, established a Pacific Coast record for wireless

telegraphy when it signaled the Mare Island Navy Yard on San Francisco Bay, announcing arrival at Magdalena Bay in Lower California, over a distance of 990 miles. The ship is equipped with a Schumaker wireless plant. A.

PERSONAL.

Norman G. Kenan has resigned as president of the Cincinnati Gas and Electric Company and Charles P. Taft has been chosen in his place. Mr. Kenan is president of the Union Gas and Electric Company, which holds the property of the old company under lease.

Harry S. New has resigned as president of the Indianapolis Telephone Company, and as first vice-president of the New Long-distance Telephone Company of Indianapolis, both of which concerns are controlled by the same interests. James S. Brailey, Jr., of Toledo succeeded Mr. New in both positions. As president of both companies Mr. Brailey will spend most of his time in Indianapolis.

Preston C. Nason died in Westboro, Mass., on October 19th, after a long illness. He was the originator of a transmitter, an automatic shunt, corrugated vibrator, and other telephonic devices. He was employed by the American Bell Telephone Company during the earlier years of its existence. He built and equipped a telephone system in San Domingo in 1884. Of recent years he had not been engaged in telephone work.

Henry Clay Sherman, an old-time telegrapher, died at the Boston City Hospital, October 24th. He was born in Essex, Vt., 61 years ago. He was chief operator of General Butler's staff during the Civil War. Later he was manager of the Vermont and Boston Telegraph Company's office at Northampton, Mass., going to White River Junction, Vt., when that company was absorbed by the Western Union Telegraph Company. In 1883 he was transferred from White River Junction to the superintendent's office in Boston where he remained until 1902 when he became president of the International Mining Company. He resigned the latter position on account of illness three months ago. He left a wife and one son.

Mr. C. A. S. Howlett, who was formerly a contracting engineer for the Western Electric Company, Chicago, has been appointed manager of the power-apparatus sales department of the Chicago office to succeed Mr. Alfred McEwen, who has resigned. Mr. Howlett is well known in the electrical-engineering field in the Middle West. He obtained his technical training at the Lawrence Scientific School, Harvard University. After obtaining a practical experience in the shops of the General Electric Company at Lynn, he entered actively the commercial engineering field. He is a member of the American Institute of Electrical Engineers, the Western Society of Engineers, the Illuminating Engineering Society and the Chicago division of the Business Science Club. Mr. Howlett is chairman of the general advancement committee of the Electrical Salesmen's Association and secretary of the Chicago division of the Rejuvenated Sons of Jove.

Several prominent men identified with business industries of the country were in Milwaukee, Wis., a few days ago, the guests of President W. H. Whiteside of the Allis-Chalmers Company. The party inspected the new plant at West Allis, now nearing completion at a cost of several million dollars. In the party were Judge E. H. Gary, chairman of the board of directors of the United States Steel Corporation and chairman of the executive committee of the Allis-Chalmers Company; Cornelius Vanderbilt III., W. N. Read, a member of the board of directors of the Allis-Chalmers Company, all of New York, and James H. Eckels, president of the Commercial National Bank, Chicago. Mr. Whiteside is quoted as saying that the company is operating in all the new shops as well as the old. The number of employes at the Milwaukee works is 2,900. By spring this number will be doubled. The complete electric department will be moved to West Allis from Cincinnati the first of January.

At the recent dedication of the new engineering building of the University of Pennsylvania the degree of doctor of science was conferred upon the following-named gentlemen: Marie Michel Henri Vetillart, a harbor engineer of distinction, who represented France at the dedication; Alexander Mackenzie, brigadier-general and chief of engineers of the United States Army, representing the Army; Charles Whiteside Rae, rear admiral and engineer-chief of the United States Navy, representing the Navy; John Fritz, the well-known Nestor of the Bessemer process in America; Mansfield Merriman, instructor in civil engineering at Yale; Samuel Matthews Vauclain, conspicuous in the development of the steam locomotive; Frederick Winslow Taylor, president American Society of Mechanical Engineers; Frederick Pike Stearns, president American Society of Civil Engineers; Samuel Sheldon, president American Institute of Electrical Engineers; Henry Wilson Spangler, professor of mechanical and electrical engineering at the University of Pennsylvania; Edgar Marburg, C. E., professor of civil engineering at the University of Pennsylvania, and Ramon Ivarrola, representative of the Mexican Government at the dedication.

ELECTRIC LIGHTING.

The Citizens' Electric Company of Gary, S. D., has been granted an electric-light franchise.

At a special election held recently Wellington, Kan., voted bonds for an electric-light plant.

The City Council of Valley City, N. D., is considering the construction of an electric-light plant.

The Morgan City (La.) Electric Company has been incorporated with a capital stock of $25,000.

W. C. Blackman has purchased the burned South Boardman (Mich.) electric-light plant and will rebuild it at once.

A new plant is being erected by the Merchants' Electric Light, Heat and Power Company in York, Pa., to develop 2,200 horsepower. A sub-station will be constructed in the central portion of the city.

The Citizens' Electric Light and Power Company of Wichita Falls, Tex., has been incorporated by T. J. Taylor, E. P. Walsh, J. D. Avis and others. An electric and power plant will be established.

The Board of Public Works of South Haven, Mich., will expend $17,000 in extending and repairing the electric-light plant, $7,000 in extending and repairing water plant and $20,000 in the construction of a new intake.

The Ogden (Utah) Gas, Light and Fuel Company has been incorporated with a capital stock of $500,000 for the purpose of manufacturing and supplying gas, electricity and steam to municipalities, corporations and individuals for light, heat and power purposes. A. T. Wright is president of the concern and F. B. Stevens is secretary and treasurer.

Michael Hose of Dallastown, Horace Welty of Red Lion, George A. Kohler of Yoe and George S. Bilmeyer of York, Pa., have purchased the controlling interest in the York and Windsor Electric Light Company. It is rumored that the York Traction Company has a hand in the new enterprise. It is the intention of the new managers to connect their lines with those of the York Haven Power Company.

Robert W. Hunt & Co., engineers, The Rookery, Chicago, have been appointed consulting, designing and constructing engineers for the new municipal electric-light plant for the city of Milwaukee, by Chas. J. Poetsch, city engineer. This appointment has been unanimously confirmed by the City Council. The site for the plant has been purchased, and work will immediately start upon plans and specifications. The estimated cost of the plant is $700,000.

ELECTRIC RAILWAYS

A. G. Hubbard of Redlands, Cal., will build an electric street railway in Riverside, Cal.

Melville Dozier of San Francisco has been granted a franchise to build an electric railway in Vacaville, Cal.

The Southwestern Traction Company will build an electric railway from Fort Scott, Kan., to Independence, Kan.

The Oskaloosa and Buxton Railway Company has been granted an electric-light and street-railway franchise in Beacon, Iowa.

The Nebraska Central Electric Railway Company proposes to build an interurban electric railway from Omaha to Hastings, Neb.

A franchise has been granted by the county commissioners of Salt Lake to H. P. Clark and W. G. Pursell to build an interurban electric road from Salt Lake City to Garfield.

The Pittsburg Railways Company will build an interurban road from Carnegie, Pa., to Wheeling Junction, W. Va. From Wheeling Junction the road will be extended to Follansbee.

The Southern Wisconsin Railroad Company will build an electric railway from Beaver Dam, Wis., to Mayville, by way of Minnesota Junction, and to Horicon, with another branch to Juneau.

The Huntsville and Birmingham (Ala.) Electric Railway Company has been incorporated for the purpose of constructing and operating an electric railway from Huntsville to Birmingham through Marshall, Cullman and Blount counties. C. S. Briggs is president and F. T. Perry of Huntsville treasurer.

The Chicago and Oak Park Elevated Railway Company made a deficit of $92,778 in the fiscal year ended June 30th. This compared with a deficit of $110,847 in the preceding year. Traffic earnings increased about $42,000, and the net earnings about $48,000. The operating expenses were 56.77 per cent. of the gross earnings. Passenger earnings for the fiscal year ended June 30, 1906, were $863,637, against $821,196 the previous year.

One of the questions asked at the recent street-railway convention in Columbus was: "Would the use of metal tie plates tend to lessen the electrolysis between rail base and spike head?" This was the answer: "Where this electrolysis exists I believe a tie plate would only serve to accentuate it. Proper bonding is the best remedy."

The Buffalo and Lake Erie Traction Company of Buffalo, N. Y., a consolidation of the Buffalo, Dunkirk and Western and the Lake Erie Traction companies, was incorporated a few days ago, with a capital of $3,900,000. The directors are L. B. Grant and W. J. Bagnell of Brooklyn, M. J. Dodge and C. H. Wener of New York.

Upon petition of a firm of Boston bankers the Peoria and Pekin Terminal Railway Company has been placed in the hands of W. T. Irwin of Peoria as receiver. A statement given out by the receiver is to the effect that receivership proceedings were necessary for the purpose of reorganizing and refinancing the company.

The Common Council of West Minster, Md., has granted a street-railway franchise to the Washington, La Gore and Gettysburg Railroad and Power Company for the construction of the company's main line across the town. The purpose of the company is the construction of an electric passenger and freight line from Washington to Gettysburg, with lateral branches.

This was asked in a Question Box at the Columbus street-railway convention: "Would it be best on an interurban car to have each motor separately fused in addition to the main circuit-breaker?" The answer was: "Yes; the individual fuse on each motor makes the best arrangement in addition to the circuit-breaker, particularly with four-motor equipments."

PUBLICATIONS.

The National Carbon Company of Cleveland, Ohio, is sending out an advertising card entitled "A Pair of Crooks," the object of which is to call attention to the Columbia carbons, which have no crooks.

The Chicago Pneumatic Tool Company has issued a booklet showing some of the users of its Franklin air compressors throughout the world. It has given an alphabetical arrangement under geographical heads for the convenience of those desiring to investigate installations in their own locality.

The paper on "The Electrical Plant of the Ontario Power Company" at Niagara Falls, Ont., by V. G. Converse, electrical engineer of the company, presented at the convention of the Canadian Electrical Association at Niagara Falls on June 20, 1906, has been reprinted by the company in the shape of a handsomely illustrated pamphlet of 24 pages, with cover.

Bulletin No. 2, from the A. D. Granger Company, 95-97 Liberty Street, New York, describes the Star safety water tube boilers for power, steam heating and hot-water heating. In addition to the usual complete tables of dimensions and sizes it gives a practical technical discussion of the points to be considered, not only in Star boilers but in all other boilers.

Bulletin No. 101 of the series entitled "The Application of Storage Batteries to Railway and Lighting Stations" has just been issued by the Electric Storage Battery Company of Philadelphia. The bulletin contains a description, accompanied by several illustrations, of the installations of chloride accumulators for the Columbus Railway and Light Company of Columbus, Ohio.

The Fort Wayne Electric Works has issued Bulletins Nos. 1082, 1083, 1084 and 1085. These contain, respectively, descriptions of their multiple alternating-current street arc-lighting system, types MA and M induction motors, standard switchboard panels for multiphase generators and integrating switchboard wattmeters, type K, form SAC. These bulletins are well illustrated and contain several diagrams.

The Hawthorne Works of the Western Electric Company, Chicago, form the subject of an artistic publication from this company. These works, previously described in the Western Electrician, are for the manufacture of power apparatus and consist of a large group of fine buildings devoted to the making of direct-current and alternating-current motors and generators, besides the cable and rubber plants. Some good halftones showing buildings and equipment are given in the brochure.

The tenth edition of "Graphite as a Lubricant" has just been printed and is now being distributed by the Joseph Dixon Crucible Company. The subject of lubrication in general, and graphite lubrication in particular, is exhaustively treated. All the good features of the previous edition are retained, but the very latest information—both scientific and practical—that has to do with the

subject is added, making it valuable to the student of theory and the man of practice. The publication is arranged and indexed so as readily to enable the reader to find the information he is most interested in. Those who desire to post themselves on better lubrication should secure a copy of the publication by writing the Joseph Dixon Crucible Company, Jersey City, N. J.

SPACE TELEGRAPHY.

A newspaper dispatch from Washington, D. C., says: President Roosevelt during his trip to Panama this month will be kept in touch with Washington by wireless telegraphy. The battleship Louisiana, on which he will make the trip, is, of course, fitted out with the necessary apparatus and will keep in communication with wireless stations going to and coming from the isthmus.

A new system of wireless telegraphy is said to have been submitted to the international wireless telegraph conference at Berlin, and to have proved a success. It is the invention of Vladimir Poulsen of Copenhagen. Its chief feature is described as the substitution of a continuous flow of energy to the receiver for the old method of intermittent sparks. It is asserted this new device solves immediately the much-vexed question of interference between stations working simultaneously. Under the new system wireless stations can receive many messages simultaneously over separate lines of communication.

MISCELLANEOUS.

The Erie Railroad Company will commence the construction of a large new electric power plant at its ore docks in Cleveland, Ohio, to operate its extensive ore-unloading machinery. The estimated cost is $500,000.

Eels have been so plentiful in the Connecticut River during the last week or two that they have caused serious inconvenience to hydro-electric plants. A few days ago, at Bellows Falls, Vt., they passed through the racks of the electric-light flume in such quantities that they clogged the wheels and finally stopped the plant, it is said.

It is said that Secretary of Agriculture James Wilson may send an exhibition to the Chicago electrical show to demonstrate the efficiency of electricity as a valuable adjunct to farm equipment. Among the devices which may be exhibited by Secretary Wilson for the government will be electrically operated harvesters and reapers and electrical apparatus for milking cows.

Henry H. Clough of Elyria, Ohio, has received a United States patent (No. 833,202) on a concrete base for poles. It comprises a concrete cylinder molded about a cylindric openwork metallic cage, and provided about midway between its ends with a concrete cross wall forming the base of the pole socket. The cylindric cage is provided with annular strengthening bands heavier than the cage and surrounding the socket portion of the base.

The Trans-Alaska Siberian Railway Company, incorporated a few days ago at Trenton, N. J., with a capital of $6,000,000, and having for its purpose to connect the Western Hemisphere and the continent by an all-rail route, tunneling under Behring Strait, proposes also, it is said, to install a telephone and telegraph system. The incorporators are Loicq Le Lobel of Paris, France; J. A. L. Waddell of Kansas City, John Healey of Washington, William H. Black of Jersey City, and John R. Tanner of New York. The main line is to start from Kansk Station, in Siberia. The main road will be about 3,750 miles long, and the branch roads 2,250 miles.

The Helderberg Cement Company, whose plant is situated at Howe's Cave, N. Y., about 30 miles south of Albany, has begun active preparations to enlarge its output of Portland cement and to add extensively to the present properties. The additional power required will be produced by means of a 1,500-kilowatt Allis-Chalmers steam-turbine generator unit, the order for which was recently placed through Thos. E. Murray, consulting engineer, New York city. The new alternator is wound for 440 volts, 60 cycles, three-phase and to operate at a speed of 1,800 revolutions per minute under a steam pressure of 150 pounds at 28-inch vacuum. This turbine unit comprises the eighth Allis-Chalmers outfit which has been ordered through Mr. Murray, six of which have a capacity of 1,500 kilowatts and two of 5,500 kilowatts.

TRADE NEWS.

The Societa Veneta di Costruzioni, Padua, Italy, wishes to purchase electric-railway equipment.

The municipality of Cologne, Germany, will spend about $125,000 for 46 motor trolley cars and 40 trailers.

Consul-general George Horton of Athens writes that trolley cars are about to be purchased for the new electric railway in the Greek capital.

The Chicago Mica Company of Valparaiso, Ind., is having plans prepared for a fireproof building, to be constructed entirely out of steel and concrete, to be used for the manufacture of insulating varnish, oil cloth and papers. The estimated cost of the building is $25,000, and while the site has not yet been definitely decided, it will be erected either at Philadelphia or Newark, N. J.

BUSINESS.

W. F. Bruer of Kansas City, Mo., recently received orders for electric-light poles to be used by the Independence Electric Company at Independence, Kan., and the Consolidated Light, Power and Ice Company at Joplin, Mo.

The Artistic Porcelain Company of Trenton, N. J., manufacturer of electric specialties in high-grade porcelain, calls attention to the quality of its white, thoroughly vitrified, tough porcelain as being especially adapted to electrical purposes.

The demand for the single-phase, self-starting vertical motors for direct connection to centrifugal pumps, etc., manufactured by the Century Electric Company of St. Louis, and which have been on the market for a year, has far surpassed the company's most sanguine expectations. It seems that this vertical type is becoming more popular all the time. The company is making them not only for supporting by feet, as is usual of this type of motor, but also so that they may be bolted to any vertical support.

The Central Electric Company of Chicago has been circularizing the trade on its Universal portable fixture. This portable is universal in the true sense of the word, combining the desirable features of any adjustable portable, and in addition is at once light in weight, strong, durable and ornamental. It throws the light just where it is wanted and can be folded into a small space when not in use. The Universal portable is sold at a moderate price, and the Central Electric Company will be glad to furnish complete information.

The Chicago Pneumatic Tool Company reports that up to October 25th orders booked had exceeded orders for the first 25 days of October, 1905, 47 per cent. and an increase over September of 37 per cent. The amount of business done for the first nine months of the current year has shown an increase of 27 per cent. over the corresponding period of 1905. Notwithstanding the fact the company had on its books at the close of the year 1905 in excess of 8,000 active customers it has added to this large list during the first nine months of the current year over 1,500 more, which indicates the rapidly increasing popularity of the Chicago company's tools and appliances generally.

The Crocker-Wheeler Company of Ampere, N. J., has shipped within the last few days nine carloads of electrical machinery, exclusive of other smaller shipments, as follows: Four carloads to the National Tube Company, including motors of various sizes; two carloads to the Lehigh Portland Cement Company, one direct-current generator and a number of motors of various sizes; two carloads of alternating-current generators to the Snow Steam Pump Company; one carload of form L motors to the Crocker-Wheeler Company of San Francisco, which are to fill part of the company's orders taken since the fire. This latter is the sixth carload of these small motors which has been rushed to the Pacific Coast, besides numerous other larger apparatus which has been sent direct to customers.

ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued (United States Patent Office) October 23, 1906.

833,733. Telephone System. William W. Dean, Chicago, Ill., assignor to Kellogg Switchboard and Supply Company, Chicago. Application filed December 23, 1902.

There is a consequent-pole electromagnetic device for each line; also means for operating the same to establish contiguous poles of the same polarity, whereby a consequent pole is formed thereon to cause a signal at the central office, and means to prevent the formation of such pole when a connection is established with a line to render the signal inoperative.

833,741. Electromagnet. Hans H. Hansen, Chicago. Application filed May 1, 1905.

There are two core portions and two circuits, one for each core. One of the circuits carries wave-form current dephased with respect to wave-form current carried by the other circuit to prevent the operation of the armature.

833,745. Telephone Transmitter Arm. John A. Loff, Chicago, assignor to Kellogg Switchboard and Supply Company, Chicago. Application filed December 6, 1901.

Various methods for forming a yielding connection between the pivoted arm and the pedestal are described.

833,760. Regulating Apparatus. Elmer A. Sperry, Cleveland, Ohio, assignor to the Safety Car Heating and Lighting Company. Application filed June 6, 1905.

One feature of this invention which relates to the regulation of dynamos is the provision of a pair of brushes adapted to contact the commutating means upon the same side thereof and complete a circuit through the armature with means adapted to equalize the pressures of the brushes upon the commutating means. (See cut, next page.)

833,765. Signal System for Railways. Maximillian G. Voigtlander, Harrison, Ohio, assignor of one-third to Owen W. Grubbs, Harrison, Ohio, and one-third to Abraham L. Weeks, Harrison, Ohio. Application filed November 14, 1904.

An electrically continuous rail and a mating block-rail are features. The respective blocks have an electric conductor at each end, respectively, at opposite sides thereof, projected into other blocks of the block-rail.

833,805. Electrical Selecting Appliance. Charles E. Scribner, Jericho, Vt., assignor to Western Electric Company, Chicago. Application filed December 18, 1905.

There is a contact member and a contact anvil, mechanism for giving the member two movements away from and into engagement with its anvil, respectively, and a shunt about the member and anvil closed during one of the movements of the member.

833,816. Telephone-circuit Signaling Apparatus. James G. Wray, Chicago, Herbert T. Gardner, Maywood, and William G. Kinton, Chicago, Ill., assignors to American Telephone and Telegraph Company, Boston. Application filed July 3, 1905.

This is a telephone system for selectively signaling the sub-stations on a four-party line and consists of a generator for signaling currents, an electromagnetic pole-changing device, a key for operating and controlling the movement of the device and an electromagnetic switch for reversing the circuit connections of the generator with the line conductors.

833,817. Telephone Switching and Signaling Apparatus. James G. Wray, Chicago, Herbert T. Gardner, Maywood, and William G. Kinton, Chicago, Ill., assignors to American Telephone and Telegraph Company, Boston. Original application filed July 3, 1905. Divided and this application filed March 12, 1906.

A four-party selective ringing system is described. An electromagnetic pole-changing switch connects one terminal of the ringing generator to either side of the line, grounding the other. The pole-changing switch is controlled by a separate circuit for each station, relays of sufficient resistance being introduced into two of these circuits to prevent the operation of the switch through them.

833,866. Telephone System. Charles V. Beaver, Anita, Iowa. Application filed August 19, 1904.

Means are provided for connecting one side of each of one or more double-wire lines and include a method of connecting together the better side of one line (where one side is superior to the other) and the better side of each of one or more other kinds of lines; thus completing the principal side of the line formed when any two or more of the lines are connected together.

833,870. Underground Conduit. Horace B. Camp, Akron, Ohio. Application filed October 3, 1905.

An underground conduit has a number of ducts enclosed by cement. Longitudinally extending strengthening rods are embedded in the conduit block.

833,877. Insulator. Francis J. Grant, Chicago, Ill. Application filed August 12, 1905.

This is an insulator having arms presented at an angle to each other. Each of these arms has a circumferential groove, and one of them has a longitudinal opening to receive a support for the insulator, with a recess at the corner where the arms join communicating with the opening, the recess being open at the bottom or under side, so that water cannot collect in it.

833,906. Telephone Switching and Busy-test Apparatus. James G. Wray, Chicago, Herbert T. Gardner, Maywood, and William G. Kinton, Chicago, assignors to American Telephone and Telegraph Company, Boston. Application filed July 3, 1905.

A relay is controlled by the plug and jack at the calling central station. Another relay is controlled by the plug and jack at the called central station. A third relay controls the main connecting circuit from one central station to the other. Shunt circuits are placed around the third relay controlled respectively by the other two relays.

833,907. Signaling Apparatus for Telephone Toll Lines. James G. Wray, Chicago, Herbert T. Gardner, Maywood, and William G. Kinton, Chicago, assignors to American Telephone and Telegraph Company, Boston. Application filed July 3, 1905.

The features are a supervisory signal at the calling central station; a relay controlling the operation of the signal; a circuit controller for the relay located at the called central station; a relay for the circuit controller; a circuit for the relay including the sub-station line-circuit; a supervisory signal at the called central station; a circuit-controlling relay therefor; a circuit for the circuit-controlling relay including the calling central-station line-circuit, and a branch circuit thereof for the supervisory signal at the called station. The energization of the circuit-controlling relay is maintained until the plug and jack at the calling station have been separated and means are provided for retiring the last-named signal upon the insertion of the plug in the jack of the called subscriber's line.

833,929. Hoisting Apparatus. Charles W. Hunt, New York, N. Y. Application filed February 7, 1906.

This apparatus is electrically operated and comprises two independent hoisting drums and an automatic shovel. Connections are made from one of the drums to the

frame of the shovel, the other drum being connected to the moving parts of the shovel to open and close it. The drums have independent motors, each having independent brake and controller.

833,968. Alternating-current Controller. David Larson, Yonkers, N. Y. Application filed September 28, 1905.

An electromagnetic actuator is in series with an alternating circuit with which a second electromagnetic actuator is in shunt. These actuators have rotatable members mechanically connected so as to oppose each other.

833,985. Automatic Changeable Sign. Thomas W. Thomas and George W. Gillette, Cleveland, Ohio, assignors of one-half to Sheridan Risley, Cleveland, Ohio. Application filed November 23, 1905.

This is a combination of a pair of endless chains, display sections or signs suspended between the chains, and means for containing numerous display sections or signs in small space, comprising series of pairs of sprockets over which the endless chains run, partitions being extended between the folds of display sections or signs to prevent them from interfering with each other.

834,010. Electrical Controller. David Larson, Yonkers, N. Y. Application filed November 4, 1905.

The principal feature is a motor with two opposing field windings, one of which is in shunt and the other in series with the circuit to be controlled. The series-connected field winding is of low resistance, while the shunt-connected field winding and the armature are of comparatively high resistance. The windings operate in opposition to each other.

834,054. Spark Gap and Muffler Therefor. Aaron E. Harrison, New York, and Crowell M. Haslett, Jersey City. Application filed September 26, 1905.

There is a hollow member for containing a spark gap with means for admitting air connected to a muffling drum which receives the air heated by the spark and is provided with means for discharging the heated air without permitting the sounds to escape.

834,055. Amusement Device. Olaf Henrichsen, New York, N. Y. Application filed December 22, 1905.

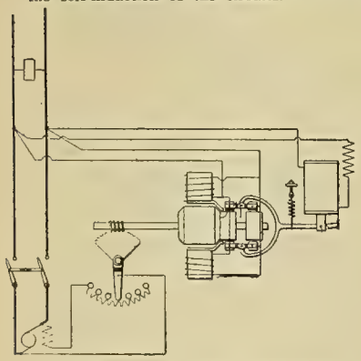
Apparently intended for window display, the mechanism of the apparatus, operating moving figures, is driven by electric motors controlled by pneumatically operated switches.

834,084. High-potential Insulator. Louis Steinberger, New York. Application filed March 24, 1905.

The supporting pin is provided with an enlarged portion and with an annular bead projecting from this portion. A gasket of soft rubber engages the annular bead, and a hood is provided which has means whereby it may be secured to the enlarged portion and with a portion integral therewith for engaging the gasket. (See cut.)

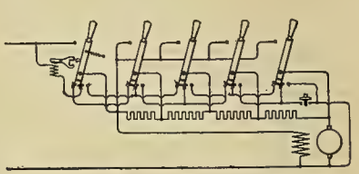
834,098. Alternating-current Motor. Charles A. Ablett, Schenectady, N. Y., assignor to General Electric Company, Schenectady, N. Y. Application filed July 30, 1903.

One claim describes a motor requiring different self-induction in its secondary circuits for starting from that required for running. This motor has a member in inductive relation to the secondary circuits and movable relatively thereto and adapted to vary by its movement the self-induction of the circuits.



NO. 833,760.—REGULATING APPARARUS.

NO. 834,084.—HIGH-POTENTIAL INSULATOR.



NO. 834,128.—CONTROLLING SWITCH.

834,104. Telephone Bracket. Charles H. Borden, Stamford, Conn. Application filed August 29, 1905.

This adjustable bracket for telephones comprises a parallel-ruler-motion device with a counterbalancing-spring means, in combination with friction-cams to compensate for the varying tension of the spring in the varying positions of the bracket. The friction-cams consist of two disks on relatively moving parts of the device having cam-shaped bearing faces and a spring to press them together.

834,107. Power-operated Brake. Frank E. Case, Schenectady, N. Y., assignor to General Electric Company, Schenectady, N. Y. Application filed June 9, 1904.

In combination with the brakes of a vehicle there are a spring for applying the brakes, an electric motor for releasing the brakes and a clutch between the motor and the spring. Mutually controlled means are provided for disengaging the clutch to allow the spring to apply the brakes and for engaging the clutch and energizing the motor to release the brakes.

834,128. Electric Switch. Laurence A. Hawkins, Schenectady, N. Y., assignor to General Electric Company, Schenectady, N. Y. Application filed February 1, 1906.

In a circuit containing a plurality of independently moving switches means are provided for automatically breaking the circuit upon the closing of the switches out of a predetermined order. (See cut.)

834,129. Block-signal System. Laurence A. Hawkins, Schenectady, N. Y., assignor to General Electric Company, Schenectady, N. Y. Application filed April 7, 1906.

This block-signal system is for electrically operated roads having parallel tracks and has connections between track circuits of adjacent parallel blocks adapted to afford a path for the power current. Switches are inserted in the connections, and operating means are provided for the switches which are controlled by train movements.

834,134. Trolley Base. Henry Holland, Cleveland, Ohio. Application filed August 5, 1905.

This comprises a base plate, a trolley-pole socket having double fulcrum rests upon the plate, a coil spring and a sliding yoke upon the socket, a link connected with the yoke and adjustable pivot connections for the link and the base plate.

834,147. Automatic Motor Control. Sam H. Libby, East Orange, N. J., assignor to Sprague Electric Company, New York. Application filed May 21, 1904.

NO. 834,172.—VAPOR ELECTRIC APPARATUS.

An auxiliary motor drives a screw mechanism which cuts resistances into and out of the circuit. A "no-voltage-release" magnet is arranged to open its own and the circuit of the main motor upon failure of current and to connect the auxiliary motor for cutting in the resistance. Means are also provided so that the circuit of the magnet cannot be closed unless the resistance is cut in.

834,148. Transformer. Charles E. Lord, Norwood, Ohio, assignor to the Bullock Electric Manufacturing Company, Cincinnati. Application filed October 19, 1905.

The core, primary and secondary coils have ventilating passageways and means are provided whereby air forced through the passageways in the core and coils will be cooled after it has passed through part of the passageways.

834,160. Transformer. Louis C. Nichols, Norwood, Ohio, assignor to the Bullock Electric Manufacturing Company, Cincinnati. Application filed October 19, 1905.

Air passageways in the core and coils are arranged so that air can be forced through the core and then between the coils in two different directions.

834,162. Electrical Resistance Pyrometry. Edwin F. Northrup, Philadelphia, Pa., assignor to the Leeds & Northrup Company, Philadelphia. Application filed June 16, 1906.

A low-resistance thermometer having potential leads and current leads is provided with a Kelvin bridge in which the leads are connected.

834,172. Vapor Electric Apparatus. Charles P. Steinmetz, Schenectady, N. Y., assignor to General Electric Company, Schenectady, N. Y. Application filed July 1, 1904.

Two electrodes, one of which is vaporizable, are connected by a filament. A polarized magnet makes or breaks the connection between the electrodes. (See cut.)

834,175. Magnetic Ore Separator and Classifier. Guy H. Waring, Webb City, Mo. Application filed November 16, 1905.

This consists of an inclined trough having a smooth non-magnetic surface, a series of magnets arranged so that the planes of magnetic influence overlap longitudinally in the direction of the passing ore. A series of lamps is placed in the circuit to take up the self-induction, and means are provided for reciprocating the trough crosswise relative to the magnets.

834,179. Sparking Plug. Daniel W. Wilson, New Bedford, Mass. Application filed February 16, 1904.

The main feature of this device is that there are three electrodes all arranged in series in the circuit, forming a plurality of jump-sparks.

834,208. Telephone System. Charles Kenney and Robert H. Leather, Philadelphia. Application filed April 25, 1904.

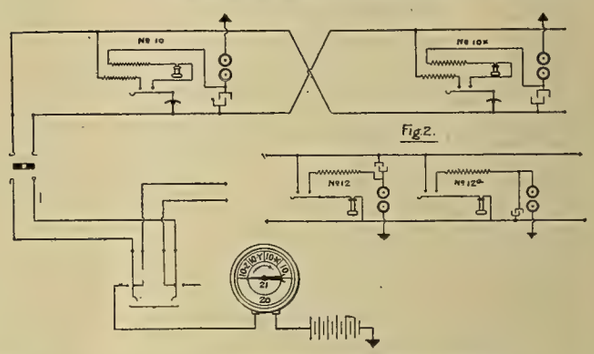
A key is provided for throwing any telephone on a line containing a series of telephones in circuit with an indicator, the telephones in the series containing bell coils of different resistances. (See cut.)

834,209. Therapeutic Apparatus. Ernst Kromayer, Berlin, Germany. Application filed July 15, 1905.

A casing has a broad and substantially flat compressing-lens. The source of light is supported within the casing and means are provided for circulating a cooling medium through the casing.

834,220. Method of Making Coils for Electrical Apparatus. Edward L. Aiken, Schenectady, N. Y., assignor to General Electric Company, Schenectady, N. Y. Original application filed December 5, 1898, patented February 10, 1903, No. 720,092. Divided and application filed January 31, 1901. Again divided and this application filed August 13, 1902.

The method of forming an electromagnet coil consists of giving a bar of metal a substantially trapezoidal section and chamfering the inner corners. The bar is wound about a mandrel so that the innermost parts are compressed longitudinally and radially, and the outermost parts are extended longitudinally and contracted transversely so that the respective turns of the coil may be separated by spaces of uniform width.



NO. 834,208.—TELEPHONE SYSTEM.

834,235. Electric Sign. Anatole C. Heiny, New York, N. Y., assignor to Heiny Electric Company, New York. Application filed December 15, 1904.

In a plurality of circuits a circuit-closing relay is provided for each circuit, and it normally holds the circuit open. A circuit is provided with a circuit closer and the windings of each circuit-closing-relay are connectable with the generator through the circuit closer to actuate it, a selector for it and an operating key for every selector.

REISSUE.

12,543. Electric Motor. Patrick J. Collins, Scranton, Pa., assignor to General Electric Company, Schenectady, N. Y. Application filed April 11, 1906. Original No. 655,852, dated August 14, 1900.

This is an electric motor having a hollow field-frame which has inwardly-projecting polepieces at its opposite sides. A partition extends across the interior of the frame transversely to the polepieces and forms part of the magnetic circuit. The partition has polepieces opposing the polepieces upon the sides, separate field coils for each pair of opposing polepieces and an armature between each pair of opposing polepieces.

PATENTS THAT HAVE EXPIRED.

Following is a list of electrical patents (issued by the United States Patent Office) that expired on October 29, 1906:

413,703. Multiple Thermal Cut-out. A. Wurts, Pittsburg, Pa.
413,708. Electric Safety Lamp for Miners. T. Coad, Forest Gate, County of Essex, England.
413,731. Conduit for Electric Railways. C. P. Poole, Lynchburg, Va.
413,735. Method of Automatically Closing an Interrupted Electric Circuit. L. Schaefer, Boston, Mass.
413,782. Telephone Diaphragm. A. W. Hall, New York, N. Y.
413,810. Transformer or Converter for Alternating Electric Currents. L. Paget, New York, N. Y.
413,818. Device for Suspending Electric Conductors for Electric Railways. T. E. Adams, Cleveland, Ohio.
413,879. Electric Train Signal. W. Winder, Portsmouth, N. H.
413,960. Brake for Electric Cars. L. Pfingst, Boston, Mass.
413,984. Electric Current Regulator. F. Thone, Davenport, Iowa.
413,986. Alternate-current Induction Motor. C. J. Vandepoele, Lynn, Mass.
414,025. Electric Stop Motion for Twisting Machines. V. I. Cumnock, Lowell, Mass.
414,043. Electric Regulator. L. Gutmann, Fort Wayne, Ind.
414,049, 414,050. Electric Railway. R. M. Hunter, Philadelphia, Pa.
414,052. Method of Regulating Electric Motors. M. Immisch, London, Counnty of Middlesex, England.
414,075, Electric Current Indicator. G. Pfannkuche, Cleveland, Ohio.
414,081. Diaphragm for Galvanic Batteries. I. L. Roberts, Brooklyn, N. Y.
414,085. Electric Mechanism for Operating Telephone Call Bells. F. W. A. Schneider, Toronto, Ontario, Canada.
414,130. Arc Lamp. F. W. R. Seifert, Altona, Germany.
414,141. Arc Lamp. F. G. Chapman and F. M. Dearing, London, England.
414,155. Electric Fire Signal. C. B. Head, Allegheny, Pa.
414,170. Mechanical Telephone Exchange. G. F. Shaver, New York, N. Y.
414,172. Electric Railway. F. J. Sprague and P. F. O'Shaughnessy, New York, N. Y.

WESTERN ELECTRICIAN

EVERY SATURDAY

Vol. XXXIX. CHICAGO, NOVEMBER 10, 1906 No. 19

A Unique Swiss Installation for Obtaining an Even Load Line.

By Frank C. Perkins.

One of the most novel and interesting combination hydro-electric equipments in all Europe is that in operation at Olten-Aarburg, in Switzerland, for obtaining an even load line where the current demand at the peak is heavy. A reservoir is available in the mountains and serves as a large hydraulic accumulator.

It is well known that there are many electric generating stations for light and power with fully utilized waterpower for which no reserve is available, and in winter, unless an auxiliary plant operated by steam engines, steam turbines or gas engines has been provided, there is liable to be serious trouble in not being able to supply the demand for current during the morning or evening hours, or at whatever period the peak occurs, while during the day and part of the night, from midnight to morning, a large amount of unused power is available but cannot be stored by batteries without heavy expense as to first cost and great depreciation charges.

In many cities where large reservoirs are available with water-supply plants, undoubtedly satisfactory contracts might be made at low rates to take the excessive current during light-load periods, electric pumps being utilized for absorbing this power; the water being utilized in the city's mains during the day when there is an excess of water demanded over the night hours of usually more than 25 per cent. By operating all of the electric pumps from midnight until morning during light load and stopping a part of them during the heavy-load periods an even load line can be obtained.

The hydraulic accumulator plant and reservoir equipment at the Swiss pumping and hydro-electric station at Ruppoldingen, which is a part of the electric works of Olten-Aarburg, is of great interest, as this problem has been solved in a most satisfactory manner on account of the local conditions being such as to make the application possible at slight expense for first cost, with extremely low maintenance charges.

The accompanying illustration, Fig. 1, and the drawing, Fig. 2, on the next page, show the details of construction and method of operation of this plant at a glance. A combined set was installed, consisting of an impact turbine built by Piccard, Pictect & Co. of Geneva, Switzerland, mounted on the same shaft with a motor-generator constructed at Baden by Brown, Boveri & Co. and a four-stage high-lift centrifugal pump installed by Sulzer Brothers of Winterthur, Switzerland.

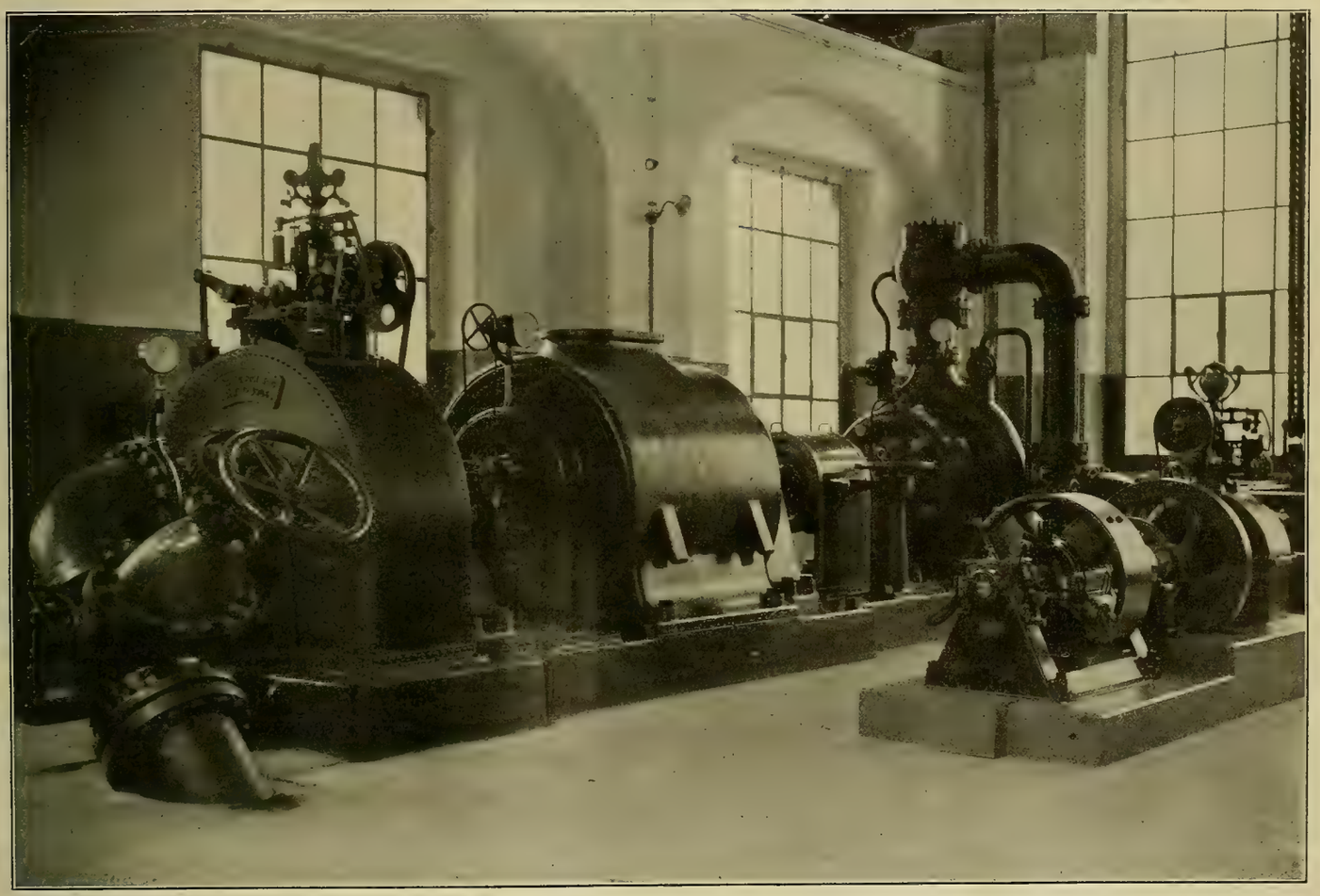


FIG. 1. COMBINATION OF TURBINE, MOTOR-GENERATOR AND PUMP TO MAINTAIN EVEN LOAD ON HYDRO-ELECTRIC STATION.

A brief explanation of the drawing, Fig. 2, will make the arrangement of the plant clear to the reader. (T) is the high-power turbine, (G) the motor-generator and (C) the high-lift centrifugal pump. (S) indicates the suction pipe and (D) the delivery pipe of the high-power centrifugal pump. (V) is the check valve in the delivery pipe, (W) the outlet chamber of the turbine, (HWS) the high-water level, and (TWS) the low-water level.

A reservoir of 12,000 cubic meters' capacity was constructed near the pump house, but at a considerable elevation above the same on the mountain side, the local conditions being particularly favorable, giving a total available head of 325 meters.

The combined pump, turbine and electric motor-generator set has an output of 1,200 horsepower, and during the period of greatest demand on the central station, when the current peak is highest and the main plant cannot supply the required energy to the lighting and power lines in the city, the turbine takes water from the reservoir previously filled by the pump during the light load, and the motor-generator acts as an alternator, being run in parallel with and assisting the alternators of the main central station.

As soon as the load on the station has dropped off and there is a surplus current during light load the turbine is stopped and the gate valve in the delivery pipe of the pump is opened, the excess power at the main station being utilized for pumping water from the river Aare to the reservoir. At this time the motor-generator operates as a synchronous motor.

The pump and its suction pipe are first filled by opening the by-pass valve, when starting the pump, at such a period of the day when the minimum amount of energy is required of the main plant and a surplus is available, and the coupling between the pump and motor generator is engaged. The turbine is started, and, the gate valve in the delivery pipe of the pump being closed, the combined unit increases its speed until synchronism is obtained between the motor-generator and the main alternators in the central station. The normal speed being attained, the current is fed from the main lines to the motor-generator, which acts as a synchronous motor, and the turbine is shut off.

A special Sulzer coupling has been provided between the motor-generator and the pump which is capable of disengagement while running, if desired, even under load. It consists of a number of bolts arranged so that by a lateral motion they are allowed to enter shells, lined with rubber; so that by engaging or disengaging this coupling the pump may be operated or not as required.

The pump has two bearings, one of which is a collar bearing, and is mounted on the same base with the other two machines, the turbine and the motor generator. It draws the water from a pit which is said to contain a special suction chamber, and the delivery pipe is connected with the delivery nozzle by a pipe below, containing a check valve, a gate valve and a by-pass valve. This

four-stage high-lift Sulzer centrifugal pump is said to have an efficiency of 76 per cent. and stands heavy overloads without difficulty. It normally delivers 133 liters of water per second to the reservoir against a head of 325 meters mentioned above.

The Brown-Boveri motor-generator supplies a current of 5,250 volts, the two-phase current having a frequency of 40 periods per second, and it absorbs, when working as an alternator, from 1,000 horsepower to 1,200 horsepower from the impact turbine, which drives the set at a speed of 1,200

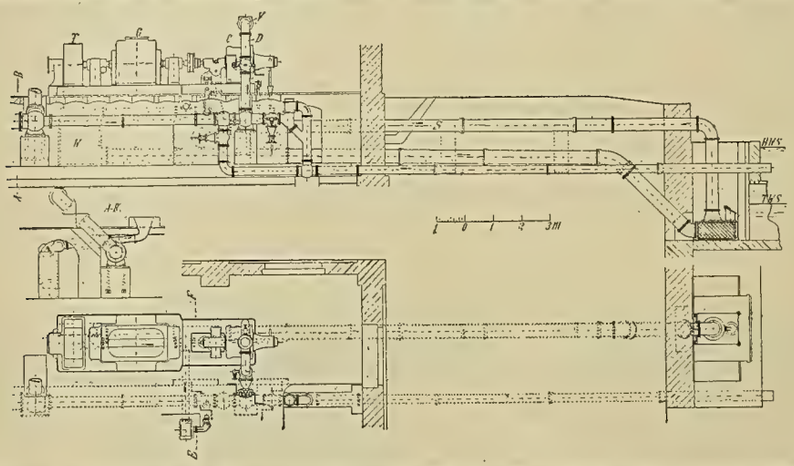


FIG. 2. COMBINATION OF TURBINE, MOTOR-GENERATOR AND PUMP TO MAINTAIN EVEN LOAD ON HYDRO-ELECTRIC PLANT.

revolutions per minute. The exciter set consists of a 65-horsepower turbine taking 21.6 liters of water per second, directly coupled to a four-pole direct-current dynamo, with flywheel between them, as noted at the right in the foreground of Fig. 1.

The arrangement is certainly an ingenious one, and, unless the expense proves prohibitive, may be worthy of imitation in some of the hydro-electric plants of the United States where the topographical conditions are favorable. However, as is particularly the case in all power-transmission propositions, the first cost and maintenance should be carefully figured as an offset to the manifest advantages of the plan.

The West Jersey and Seashore Electric Railroad.

By equipping for electric operation its West Jersey and Seashore branch the Pennsylvania Railroad has accomplished the electrification of a main-line double-track railroad longer from terminal to terminal than any electrified steam road in the country. This undertaking also involved the construction of a power house of original design, built in record time. The site for it was chosen on January 17, 1906; the first pile was driven two days later, and on July 1st the first train to take current from the power house was run on the newly electrified tracks. On September 18th the line was placed in operation.

General Outline.

The line of the electrified system extends from Camden, N. J., via Newfield to Atlantic City, N. J., a distance of 65 miles, and from Newfield to Millville, a distance of 10 miles. In addition to the erection of a power house, this work has called for the building of eight sub-stations, one of which is in the power house, the electrical equipment of approximately 150 miles of single track, the building of 71 miles of duplicate high-tension transmission line and the construction and electrical equipment of 68 cars. In addition, a great deal of other work always incident to extensive undertakings of this nature was done, including the laying of new track, the erection of signal bridges and block and other signals, the building of bridges, trestles, fencing and cattle-guards, changing railroad stations and installing telephone and telegraph lines. There are new terminals at Camden and Atlantic City and from Camden to Atlantic City the road has been equipped with a third rail, with the exception of a stretch of track 4.4 miles in length between Haddon Avenue and South Gloucester, the track passing through the city streets at grade between these points being equipped with the overhead trolley. In addition to this through route, the line from Newfield to Millville, 10 miles, has been electrified. On this portion of the road the overhead trolley has been installed.

From Camden to Atlantic City the road is double-track throughout, and it is a three-track road between Camden and Woodbury. From the Camden terminal to Newfield the road is laid with 100-pound rails of the Pennsylvania Railroad standard cross-section, and from Newfield to Atlantic City it is laid with 85-pound rails of the A. S. C. E. section. The line from Newfield to Millville is a single-track road and is laid with 100-pound rails of standard Pennsylvania Railroad cross-section. The Pennsylvania Railroad Company has two roads connecting Camden with Atlantic City, and it is the longer of these routes that has been electrified. This has been done because there is a large local traffic on the longer route that can be handled more economically and expeditiously by electric traction than is possible with steam haulage.

The importance of the undertaking is further emphasized by the density of the traffic on the electrified section of the road. The power house and sub-station equipment and the line are laid out with a view of supplying sufficient power for the operation of all the cars now provided, operating in an express service to Atlantic City, consisting of three-car trains running on a headway of 15 minutes in each direction at a speed on straight level track of 60 miles an hour, and for a local service of two-car trains between Camden and Millville on half-hour intervals, and single cars between Camden and Woodbury on 10-minute intervals. The initial schedule that has been put into service includes three-car express trains between Camden and Atlantic City on one-hour intervals, the running time being 90 minutes, and a local service of two, three and four-car trains run on a minimum interval of 15 minutes during the rush hours between Camden and Glassboro, every fourth train going on to Millville. The motor baggage and mail cars are attached to the passenger trains as conditions require. It should be mentioned that each car in the electric service is a motor car, no trailers being used.

Contract for the entire electrification work was given to the General Electric Company, which sublet certain portions. The electrical equipment throughout is of standard General Electric design.

Alternating current is generated at a potential of 6,600 volts at the power house, where it is stepped up to 33,000 volts. At this latter pressure it is transmitted over the high-tension transmission lines to the sub-stations, where it is reduced to a potential of 430 volts by means of step-down transformers and then led to the rotaries and converted to direct current at 650 volts, at which pressure it is fed to the third rail for operating the cars.

The Power House.

Fig. 1 shows the power house, which is situated at Big Timber Creek, just to the north of Westville, N. J., at a point 5.6 miles from the Camden Terminal, where there is an abundance of water for boiler feed and condensing purposes. As already intimated, this building, in all probability, was erected at a greater speed than any other power station hitherto built in the United States.

For the sake of brevity, the main portion of the electrical equipment of the power house may be listed as follows:

Three 2,000-kilowatt, 6,600-volt, 25-cycle, three-phase Curtis turbo-generators.
Two 75-kilowatt, 25-cycle, air-blast transformers.
Three blowers, each having capacity of 20,000 cubic feet per minute.
The switchboard consists of:
Three three-phase generator panels.
Two exciter panels.
Three blower motor panels.
One synchronizing equipment.
Three 33,000-volt transformer panels.
Two sets lightning arresters and switches.
Six static potential indicators.
Two 33,000-volt out-going line panels.

It will be seen from the above that the present normal capacity of the generating station is 6,000 kilowatts. Moreover, there is sufficient room provided in the layout of the building for an additional 2,000-kilowatt turbo-generator set, together with the necessary auxiliaries. The foundation for the extra turbine is already built. In addition to this provision for extra power one of the end walls of the station is of a temporary nature in order that increasing demands for power may be met with a minimum of expenditure in the future.

Among the auxiliaries the most important items are as follows:

1. Two exciter sets, consisting of horizontal Curtis steam turbines coupled to 75-kilowatt four-pole General Electric direct-current generators running at 2,400 revolutions per minute, and delivering 600 amperes each at 125 volts pressure. The turbines of these sets work non-condensing, as the exhaust is used for heating the feed water.

2. Three barometric condensers built by Williamson Brothers, in connection with Cramp & Co. of Philadelphia, who were also the sub-contractors for the circulating and air pumps. These condensers are capable of maintaining a vacuum of 28 inches and are designed to condense 60,000 pounds of steam per hour with circulating water at a temperature of 70 degrees F. The approximate ratio of condensing water to steam condensed is 75:1.

3. Three dry-air pumps built by I. P. Morris & Co. of sufficient capacity to fulfill the guarantees given with the condensers.

4. Three centrifugal circulating pumps, built by the I. P. Morris Company and driven by Reeves engines. The piping for these engines is so arranged that the exhaust may be discharged to either the feed-water heater or to the third stage of the turbines, the latter arrangement only being

FIG. 1. POWER HOUSE AT WESTVILLE, N. J., OF WEST JERSEY AND SEASHORE ELECTRIC RAILROAD.

used when the exhaust from the other auxiliaries exceeds that required for the feed-water heater.

5. Two Cochrane feed-water heaters. Each heater has a capacity for heating 135,000 pounds of water per hour from 70 degrees F. to 212 degrees F.

6. Two Worthington boiler-feed pumps.

7. Two Worthington make-up pumps.

8. Two Worthington step-bearing pumps.

9. Three Worthington step-bearing water return pumps.

10. One accumulator for the step bearings with a capacity of 100 gallons of water at 800 pounds pressure per square inch. This accumulator was supplied by R. D. Wood & Co. of Philadelphia, Pa.

The area of the power house is 17,069 square feet, and the cubic contents amount to 829,113 cubic feet, thus giving 2.13 square feet and 103.6 cubic feet per kilowatt as the unit output of the station, based on 8,000 kilowatts as the ultimate capacity of the present structure. The three turbines now erected are shown in Fig. 2.

Steam piping in the power house is laid out after an excellent design and allows ample operating space around all the machinery. W. K. Mitchell & Co. of Philadelphia, Pa., were the sub-contractors for this work together with the steam valves, etc., and Keasbey & Mattison furnished the pipe covering.

Twelve Stirling water-tube boilers are arranged in pairs in the boiler house, forming six batteries. Each boiler is rated at 358 horsepower, and is furnished with a superheater capable of delivering steam at 175 pounds pressure and at a temperature of 125 degrees F. in excess of that of saturated steam. The Stirling Boiler Company of Barberton, Ohio, was the sub-contractor for both the boilers and boiler settings.

Coal is dumped from the railway cars into the receiving hopper, over which the rails are laid. The receiving hopper has a slanting bottom to

feed the coal by gravity through a valve which is only opened when the skip is in the correct position for loading. The loaded skip is raised by means of a hoisting engine till it reaches the level of the deflector, when it is automatically tipped into the crushing hopper, the smaller coal passing through the screen and the larger coal being broken in the crusher in transit. From this hopper the coal is fed into the gravity return car by means of the valve at the bottom, when it is conveyed by the automatic railway over the coal bunkers into which it is tipped. From those bunkers it is again fed to the coal cars on the tracks on the boiler-room floor.

The ashes are taken from the boiler house in cars and dumped into the receiving hopper, from where they are raised in a similar manner to the coal, but the deflector being thrown in the reverse direction from that shown in the illustration. The ashes are conveyed from the ash chute to the ash-storage bin, from whence they are conveyed by means of a chute to cars on the railway track.

Sub-stations.

To reduce in potential the high-tension three-phase current and convert it to direct current at 650 volts eight sub-stations were distributed along the line. One is located in the power house at Westville. There are three terminal sub-stations situated respectively at South Camden, Clayville and Atlantic City, and four intermediate sub-stations, one at Glassboro, one at Newfield, one at Mizpah, and one at Reega.

Equipments in the several different sub-stations vary according to the requirements of the portion of the road they supply. The tables show the number and capacity of rotary converters installed in each sub-station and a list of the switchboard panels.

Table No. 1.—Sub-station Rotaries.

Name of Sub-station.	K. W. Capacity of Rotary Converters Already Installed.	K. W. Capacity of Additional Rotary Converters Provided For.
South Camden	2-750	1-750
Westville (in power house)	2-750	1-750
Glassboro	2-750	1-750
Newfield	2-750	1-750
Clayville	2-500	1-750
Mizpah	2-500	1-750
Reega	2-750	1-750
Atlantic City	2-750	2-1000

Table No. 2.—Sub-station Switchboard Panels.

Panels.	In Power Station.	South Camden.	Glassboro, Mizpah and Reega.	Newfield.	Millville.	Atlantic City.
A. C. rotary converter panels	2	2	2	2	2	2
D. C. rotary converter panels	2	2	2	2	2	2
Starting panels	2	2	2	2	2	2
D. C. feeder panels	6	4	4	5	2	4
Blower motor panels	2	2	2	2	2	2
High-potential incoming-line panels	2	2	2	2	2	2
High-potential outgoing-line panels	2	2	4	..	..	..

The rotary converters are all of standard General Electric design, and are capable of running at 150 per cent. full load for two hours with a temperature rise not exceeding 55 degrees. The transformers are all supplied with taps giving one-third and two-thirds of the working voltage to enable converters to be started from the alternating-current side. This method of starting needs no synchronizing, and should the direct-current polarity of the machine chance to come in the wrong direction it is readily changed by means of the field-reversing switch provided for this purpose. By this method any of the rotary converters can be started, run up to full speed, and be delivering power to the line within a minute.

Three air-cooled transformers are provided for operation in conjunction with each rotary, and these are located in each case with a view to the further extension of the sub-station, and as they are all of standard design it is not necessary to go into details regarding their construction.

The disconnecting switches and lightning arresters in each sub-station are located in a separate room (Fig. 3). The high-tension circuits are of bare copper wires supported on insulators on a pipe framework, and each pole of the oil switches is enclosed in a separate brick compartment. In all cases the instruments and oil switches are of General Electric design. Fig. 4 shows the interior of the Atlantic City sub-station.

Inspection Sheds.

Inspection sheds have been built at the three terminals. The largest one is on the dock at Camden, just back of the new passenger terminal. This is a three-track shed 221 feet long by 56 feet wide, accommodating nine cars, with room for office, storeroom and small machine shop at the end opposite to the entrance. All tracks have pits provided with steam heating, electric lights and receptacles and compressed-air outlets for cleaning. The third rail is not carried into the shed, overhead trolley being used instead. The center track has overhead hand-operated crane, with runway extending into the machine shop. At Atlantic City the shed is of the same general arrangement, but smaller. The shed at Millville has one track and is of sufficient length for one car, with space to work around a truck when run out at one end.

High-tension Transmission Line.

The 33,000-volt high-tension transmission line is in duplicate throughout. It is Y-connected, with the neutral grounded, and consists of six No. 1 B. & S. hard-drawn solid-copper wires mounted on porcelain insulators. The poles are of chestnut, their height being 45 feet, with extra long poles where special conditions require. They are spaced 125 feet, but at street crossings the spacings are reduced to 100 feet. Head guys are used at distances of approximately one-quarter of a mile. There are two cross-arms, the top arm being 12 feet in length, carrying four insulators, while the lower arm, which is eight feet six inches, carries two insulators. The six wires form two inverted

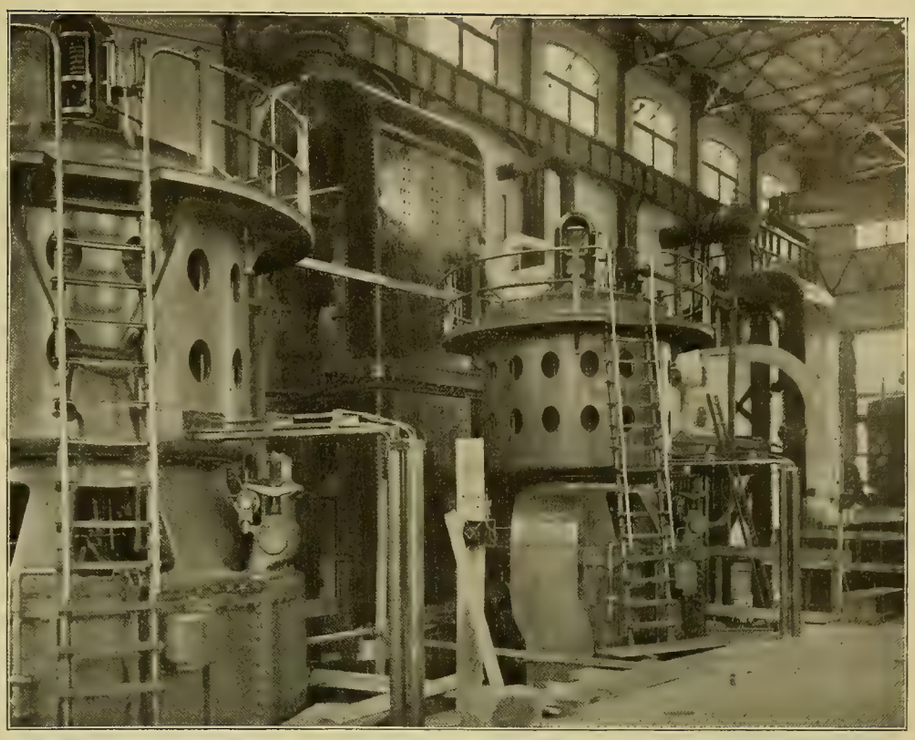


FIG. 2. STEAM TURBINES IN WESTVILLE POWER HOUSE OF WEST JERSEY AND SEASHORE ELECTRIC RAILROAD.

Fig. 3. Lighting-arrester Room at Newfield Sub-station.

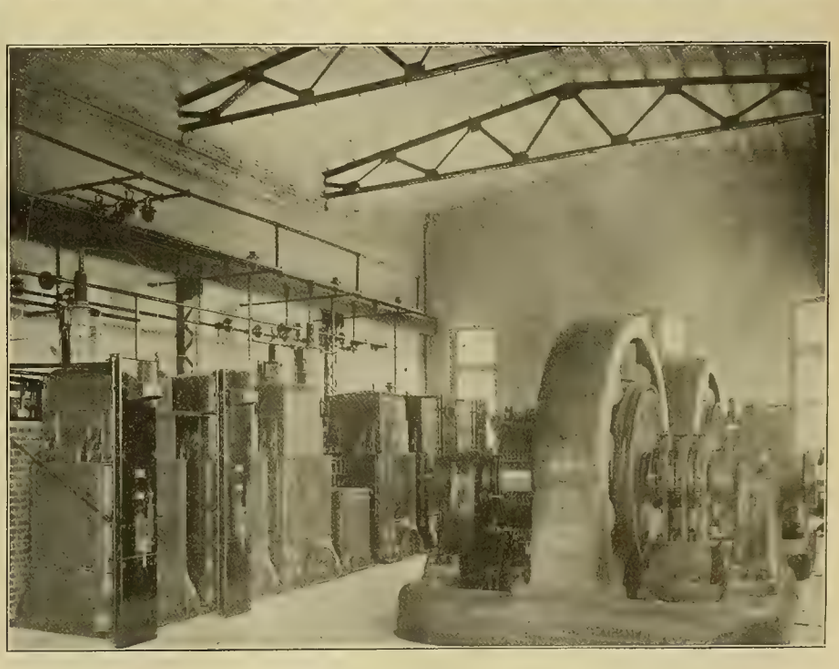


Fig. 4. Interior of Sub-station at Atlantic City.

VIEWS IN SUB-STATIONS OF THE WEST JERSEY AND SEASHORE ELECTRIC RAILROAD.

equilateral triangles, and the insulators on each triangle are 42 inches apart. The wires in each triangle are transposed by one complete spiral between each sub-station.

Cross-arms are bolted to the poles, and as an additional support they are stiffened with galvanized-iron braces. Locke insulators are used, made in three parts and designed to stand double the working pressure. Each petticoat was tested separately, the top section to 45,000 volts. In each case these tests lasted four minutes, and following this the assembled insulator was subjected to 85,000 volts for 10 minutes, and also a precipitation test was made at 52,500 volts. The insulators are mounted on iron pins.

A unique feature of the transmission line is the method of protection from lightning, which consists of a seven-strand galvanized-steel cable 5-16 inch in diameter strung for the entire length of the line on top of the transmission poles, four feet above the nearest active wire, and provided with ground connections at every fifth pole. This form of protection from lightning is believed to be an efficient supplementary adjunct to the arresters.

In all there is 71 miles of transmission line. This was erected at a speed of from one-half to two miles a day; the work including the digging of holes and pole erection, besides the stringing of six wires and tying them in position to their respective insulators.

FIG. 5. CATTLE GUARDS, JUMPER BOXES AND THIRD-RAIL COVERING AT A CROSSING ON WEST JERSEY AND SEASHORE ELECTRIC RAILROAD.

The Third Rail.

To install the third rail for a double-track road of this length in the prescribed time demanded a considerable amount of skill on the part of those organizing the work, and the fact that a large amount of steam traffic and double-tracking was going on at the same time materially added to the difficulties of the undertaking. The rails used for this purpose are of the Pennsylvania Railroad standard cross-section and composition; they are in lengths of 33 feet, weigh 100 pounds to the yard and have a conductivity about equal to that of a copper rod of 1,200,000 circular mils. This type of third rail was used in order that it might be interchangeable with the track rails.

The insulators are of reconstructed granite, and are held in position by a metal-centering cup which is secured to the long ties by means of a lag screw. The insulators are spaced about eight feet apart. The top of the third rail is 3½ inches above the top of the track rails, and its gauge 26 inches distant from the gauge line of the adjacent track rail, these dimensions constituting the standard of the Pennsylvania Railroad and the Long Island Railroad, and also interchangeable with the Interborough Rapid Transit of New York city.

The approaches of the third rail are made of cast iron. The third rail is bonded with concealed ribbon bonds with solid-copper terminals compresed into one-inch drilled holes in the rail. There are two bonds to a joint, and each has an area of 500,000 circular mils, giving a total area of copper per third-rail joint equal to 1,000,000 circular mils. The work of bonding the third rail was accomplished at the rate of 660 bonds a day.

The third-rail jumpers are of especially neat design. They are used at all grade crossings and wherever continuous third rail is impracticable. The cable is drawn into a black bituminized fiber tube, which is laid in a solid concrete protection. Terra-cotta covers are employed to protect the cable terminals. Those for a single-cable jumper are of the round form and those for double cable of an elliptical shape. Fig. 5 shows the jumper boxes and third-rail covering at a crossing at Westville.

For protection, the company's right-of-way is fenced in, and at all crossings (as shown in Fig. 5) the fence turns in from the property line to meet Climax cattle-guards at the edge of the crossings. In this way the public is prevented from reaching the third rail.

At all stations and in the Atlantic City and Camden yards the third rail is protected by a wooden top and side guard. This consists of a two-inch plank carried on castings attached to the top of maple posts, which are secured to the third rail at intervals of about six feet. Opposite all platforms the rail is further protected by a plank fastened to the side of the rail.

At Atlantic City, where the tracks cross the Thoroughfare, a new drawbridge has been built. The third rails on this draw are connected to the third rails on the approaches by sliding contact shoes, so that when the draw is closed the rail is continuously connected. In addition to this two 1,000,000-circular-mil submarine cables are provided connecting the rails so that the opening of the draw does not interrupt the circuit. The submarine cables for the return circuit are bare.

Trolley Line.

Trolley construction between Newfield and Millville and on the stretch of track between Haddon Avenue and South Gloucester is of the span type, with poles spaced at a distance of 100 feet, and where practicable the high-tension transmission poles have been used for supporting the span wires. Through Camden the greater part of the trolley construction is on tubular steel poles. The trolley is suspended 22 feet above the top of the track rails. The length of line between Newfield and Millville is approximately 10 miles. The trolley wire is of No. 0000 grooved section. The span wires are of standard galvanized steel ⅜ inch in diameter. The lightning arresters are installed at approximately 1,000 feet apart.

Cars.

For initial service 62 passenger cars and six combination baggage and mail cars have been provided. All of the cars are motor cars, the motor and central equipment being the same on all. In preparing the design of these cars, the engineers of the railroad followed the general design of the standard Pennsylvania Railroad coaches, except that the height is less than the standard to decrease the weight, the shape of the roof is changed and the interior finish is of mahogany instead of oak. Fig. 6 shows a train of motor cars. Fifty-eight passengers can be seated. Both ends of the cars are provided with vestibules. The cars are 55 feet 5½ inches long over buffers and 46 feet six inches over body. The total weight of car, fully equipped on track, is 89,000 pounds. The combination baggage and mail cars are of the same general dimensions as the passenger cars.

All cars are provided with a 50-candlepower incandescent electric headlight and two electric markers or route lamps on the hood at each end. In the interior of the car there are five five-light clusters and in the saloon there is a single lamp. There are two lights in each vestibule.

Each car has two trolleys, each with a retriever, and on the roof between the trolley bases there is a box containing the lightning arrester, trolley cut-out switch and trolley fuse. The cars are heated by Gold cylindrical heaters, one being under each seat and a total of 28 heaters per car. There are two coils in each heater, thus providing three degrees of heat.

In the vestibule, at the saloon end of the car, on the motorman's side, there is a switchboard on which are mounted the headlight and air-compressor switches and fuses, the switch for cutting out the contact shoes when operating on trolley, the trolley cut-out switch and current limit relay. This switchboard is provided with double steel doors lined with asbestos and is accessible from the vestibule.

Trucks.

The motor and trailer trucks are of the M. C. B. double side-bar equalized type somewhat similar to those used on the cars of the Interborough Rapid Transit Company and the Long Island Railroad, but with greater wheel base. The general dimensions of the trucks are as follows:

Gauge of track	4 ft. 8½ in.
Distance between backs of wheel flanges	4 ft. 5⅜ in.
Wheel base	7 ft. 0 in.
Weight of motor truck complete without motors	14,934 lbs.
Weight of trailer truck complete	9,653 lbs.
Weight on center plate (car body light) motor truck.	25,384 lbs.
Weight on center plate (car body light) trailer truck.	26,065 lbs.

Brakes.

The cars are equipped with hand brakes and with Westinghouse quick-service automatic air brakes, Schedule "AMT." This brake schedule includes the brake valve, brake cylinder, triple valve, feed valve for reducing main reservoir pressure to 70 pounds, the brake pipe for train line, switches, gauges, reservoirs, etc., together with what is known as the control line. This line extends through the train, and besides insuring uniform pump labor on all cars, provides, in connection with other apparatus, for the graduated release. The motorman is able to divide the process of release into as many steps as may be desired, securing the same flexibility as with straight air.

Motor and Control Equipment.

Electrical car equipments were furnished and installed by the General Electric Company. There are two G.E.-69 motors, which are 200-horsepower units, on each car, while the control system is of the Sprague-General Electric automatic multiple unit type. The controllers are so arranged that current is cut off from the motors throughout the train and the brakes are applied automatically should the motorman release his hold of the controller handle.

For the sake of brevity, these equipments will not be described in detail, as they are of standard General Electric design. With the exception that each car is provided with a trolley and third-rail shoe, the control system is similar to that on the 24 equipments supplied to the Boston Elevated road some 18 months ago.

Organization.

The conversion of the lines of the West Jersey and Seashore Railroad from steam to electric traction was carried out by the following organizations:

The construction of the terminals, inspection sheds, double-tracking, changes in existing tracks, grading, new bridges, changes in telegraph lines, and installation of a special telephone system, were carried out by the regular engineering and maintenance-of-way departments of the Pennsylvania Railroad Company.

The installation of the interlocking plants and automatic block signaling was carried out by the Union Switch and Signal Company in accordance with plans of the signal department of the Pennsylvania Railroad Company.

The new cars and trucks required for the electric service were designed by the motive-power department of the Pennsylvania Railroad Company.

The entire contract for the electrical equipment,

including the construction of the power house, substations and the electrical equipment on the cars, was awarded to the General Electric Company, and in accordance with the plans and under the supervision of Mr. George Gibbs, chief engineer of electric traction, in consultation with the officers of the railroad company. Stern & Silverman of Philadelphia were appointed by the General Electric Company as their general sub-contractors, and the Scofield Company, also of Philadelphia, acted as general engineer for the power house and subcontractor for the piling and foundations.

FIG. 6. MOTOR-CAR TRAIN ON WEST JERSEY AND SEASHORE ELECTRIC RAILROAD.

The whole of the electrical work was under the personal supervision of Mr. W. B. Potter, engineer, railway engineering department, General Electric Company, directly assisted by Mr. J. Elliot Hewes, Mr. C. E. Eveleth and Mr. W. H. Clapp.

Electrical Features of the Jamestown Exposition.

The electrical illumination at the Jamestown Ter-Centennial will be one of the great features of the big fair to be held next year on the shores of Hampton Roads, Norfolk, Va. More than 350,000 lights, it is said, will be used in illuminating the exposition grounds, piers and amusement devices, and many projectors from lofty positions will make the harbor and miles of surrounding country bright.

This work is under the direction of Mr. W. M. Dixon, chief of the Department of Electricity. With a corps of skilled electricians he is pushing the installation of electricity as rapidly as the conditions will permit, and the wiring in some of the buildings is already complete.

On the government pier will be strung 30,000 incandescent lights, and 62,000 will dispel the darkness on the main court. Besides the incandescent lights, there will be the searchlight effects. These will be in keeping with the naval features and will keep the warships and other craft at anchor on the waters of Hampton Roads plainly discernible at night. Fifteen 33-inch projectors will be located on the main court, and on the top of a high tower will be placed an 80-inch projector, one of the largest ever built.

On the "Warpath" the lighting will be spectacular. It is contemplated to erect a steel tower, 60 feet high, at the head of one of the streets on the "Warpath" and from this 30-inch projectors will flash. This tower will be provided with automatic color screens, and in revolving the lights will vary from red and green to white and blue.

A complete system of patrol lighting will cover the flower fence that encloses the grounds and numerous arc lights will be placed at suitable intervals throughout. On the canoe trail and "Flirtation Path" will be installed the most unique scheme of lighting. This will be in keeping with the part of the grounds in which the lights will be placed. More than 1,000 winking or "skiddoo" lamps will be hung in the vines and shrubbery that arise on either side of the "Flirtation Path," and they will wink and blink from seven o'clock in the evening until midnight.

In installing the electrical wires, 150,000 feet of underground conduit will be used. This includes the wires for the fire-alarm system, telephone exchanges and telegraph stations which will be under the supervision of the electrical department.

Mr. Dixon has been in charge of electrical illuminations at several expositions. At Buffalo he was assistant to Luther Stringer, and he went to St. Louis as assistant to the late Henry Rustin.

A Reciprocating Electric Motor or Dynamo.

A dynamo-electric machine of startling originality has recently been patented in the United States by Paul Boucherot of Paris. Departing from the general idea of causing induced magnetic poles so to act upon electromagnetic fields as to produce a magnetic torque directly available for the production of rotary motion, the inventor causes these forces rectilinearly to attract and repel each other, as shown in the motor here described.

A cast-iron base plate (H), Fig. 1, carries the U-shaped laminated field core (h), which has mounted on its inwardly projecting arms the coils (k′) (k²) of ordinary insulated copper wire. Midway between these coils the coil (j) is mounted on a similarly laminated core piece (g), forming the middle of the field, and integral with it. These parts, which the inventor describes as the "ondulo-fluxer," correspond to the field structure of ordinarily known machines, and will here be described as such. The coils (j) (k′) and (k²) are connected either in series or in parallel, and all receive alternating currents. That is to say, the alternating current comes from the source of energy when they are in series and from the branches of this circuit when they are in parallel.

Rigidly supported on standards (d), two vertical spring plates (c) (c) carry the reciprocating armatube by means of the solid blocks (b), (Fig. 2),

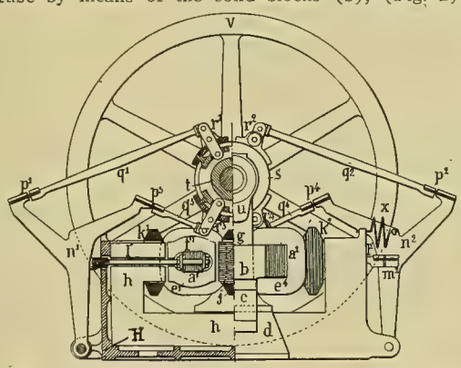


FIG. 1. A RECIPROCATING ELECTRIC MOTOR OR DYNAMO.

which unite the core pieces (a′) (a²), consisting of bundles of magnetic spring-steel blades, which are bound together at their ends, only, by bolts passing through the blocks (b). The springy cores (a′) (a²) are wound with coils (e′) (e²) (e³) (e⁴), which are energized by a continuous current, and are so wound as to produce consequent poles at the middle of their respective core pieces. The pole developed at the middle of (a′) is of the opposite name to that of the pole developed at the middle of (a²).

The two magnetic fluxes thus created then pass into the field. To this end, in the middle of each of the bundles of plates (a′) and (a²) is fixed in anp appropriate manner a laminated pole-piece—that is to say, a pole-piece constituted by thin insulated plates (f′) as regards the bundle (a′) and (f²) as regards the bundle (a²). Upon each side of both of these pole-pieces the lines of force emerge. Those from (f′) are able to join those from (f²) in two ways—either by passing through the part (g) or the part (h) of the field structure.

The portion of this machine here described as the armature is termed the "continuo-fluxer" by the inventor.

The diagram, Fig. 3, shows the connections with the sources of continuous current and of alternating current and the different coils in the case where the series connection is adopted throughout.

The operation of the machine is said to be as follows: Under the influence of these currents the poles (f′) and (f²) are alternately attracted and repelled. The connections being suitably established, (f′) is attracted by (k′) and repelled by (j), while (f²) is attracted by (k²) and repelled by (j). The variable forces acting upon (f′) and (f²) are symmetrical. (f′) and (f²) separate from or approach the center of the machine simultaneously. During these reciprocating movements of the parts (f′) and (f²) the air gaps on each side of these poles vary, thereby producing variations of flux in the two parts (g) and (h) of the field. When the poles are quite brought together, the flux produced by the armature coils passes almost entirely through the part (h) of the field structure. The flux is thus maximum in (g) when it is minimum in (h), and vice versa. These variations of flux in the coils (j) (k′) (k²) induce electromotive forces, whence production of work in this alternating movement, and this work may be utilized in any desired manner.

Returning to the principal arrangement illustrated in Figs. 1 and 2, it remains to examine in

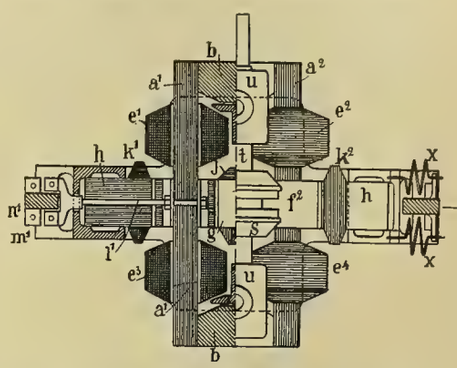


FIG. 2. A RECIPROCATING ELECTRIC MOTOR OR DYNAMO.

what manner the two alternating movements produced are converted into continuous circular movement. With this object, two transmission rods (l′) and (l²) control, by the intermediary of flexible connections (m′) and (m²), two levers (n′) and (n²), which transmit the amplified alternating movement to four connecting rods (q′) (q²) (q³) (q⁴) by the intermediary of four flexible connections (p′) (p²) (p³) (p⁴). The four connecting rods in alternating movement control four connecting lugs (r′) (r²) (r³) (r⁴), and by their thrust communicate a continuous movement to a wheel (s), keyed upon the shaft (t), supported by the bearings (u) (u), and itself carrying the flywheel pulley (v), from which the movement is then transmitted, by means of a belt, to any desired utilization machine or apparatus. The small springs (x), which connect the levers (n′) (n²) to the box containing the lower ondulofiuxer (h), are merely intended to partially or wholly compensate for the efforts of inertia peculiar to the levers (n′) and (n²) and to the connecting rods (q′) (q²) (q³) (q⁴) in order to prevent the transmission of these efforts of inertia by the rods (l′) and (l²). The inertia of the connecting lugs or of any other reciprocating parts may likewise be compensated for by additional springs.

It will be observed that the amplitude of the reciprocation is exceedingly small, being, in fact, limited to the travel allowed by the spring of the plates. The inventor shows a form of his machine in which the poles (f′) (f²) are free to oscillate without restraint from the armature cores (a′) (a²). But as he himself criticizes this amplification, and as it is difficult to see how it will operate successfully, this part has not here been shown.

In view of the exceedingly small extent of longitudinal motion, the device must depend upon

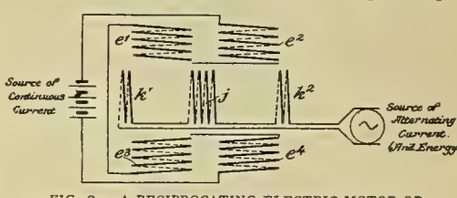


FIG. 3. A RECIPROCATING ELECTRIC MOTOR OR DYNAMO.—DIAGRAM OF CONNECTIONS.

the great velocity of oscillation, and the amplification of these movements by the bell-crank levers and link motions described.

It is further asserted by the inventor that, like every electric machine, this apparatus is reversible and can be employed as a generator of current whether the motion of some rotary motor be converted into reciprocating motion or a reciprocating motor be applied directly. For example, the ends of each of the rods (l′) (l′) may be connected to a piston of a steam, gas or other motor, which, under the action of the fluid employed, will give the necessary reciprocating motion for the production of alternating current.

No less than 156 patents issued by the United States Patent Office were assigned to the General Electric Company last year.

Eichberg's Control of Alternating-current Motors.

Friedrich Eichberg of Berlin has invented an interesting improvement in the control of alternating-current motors of the commutator type, which he has assigned to the General Electric Company of Schenectady. In a former invention Mr. Eichberg and Gabriel Winter disclosed a form of alternating-current motor having three windings, one of which may be termed the "inducing winding," supplied with single-phase alternating current, the second relatively movable to the first and in inductive relation thereto, which may be called the "induced" winding, and the third, which may be called the "magnetizing winding," supplied with current from the secondary of a series transformer, the primary of which is in series with one of the first two windings. The magnetizing winding is arranged to produce a magnetization at an angle to that of the other two windings, which, co-acting with the currents of the other two windings, produces the motor torque. Either the

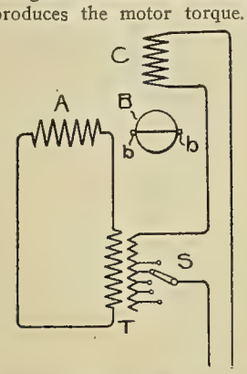


FIG. 1. DIAGRAM OF CONNECTIONS OF EICHBERG'S MOTOR CONTROL.

induced or inducing winding may be stationary, and the magnetizing winding may be placed on the stator or rotor and combined with one of the other windings or independent therefrom.

The present invention consists in connecting the magnetizing winding to the source and supplying the inducing winding from the secondary of a transformer, the primary of which is in series with the magnetizing winding.

Fig. 1 shows a diagram of connections. Fig. 2 shows diagrammatically the invention applied to the control of an alternating-current motor of the commutator type.

In Fig. 1 (C) represents the magnetizing winding, connected to a suitable source of current. (A) represents the inducing winding, displaced 90 degrees from (C) and connected to the secondary of the transformer (T), the primary of which is in series with the magnetizing winding (C). (B) represents the induced winding, which in this case is shown as the rotor provided with the brushes (b b) connected to short circuit the winding on the line of magnetization produced by the inducing winding. (S) represents a switch by means of which the ratio of the transformer (T) may be varied so as to control the

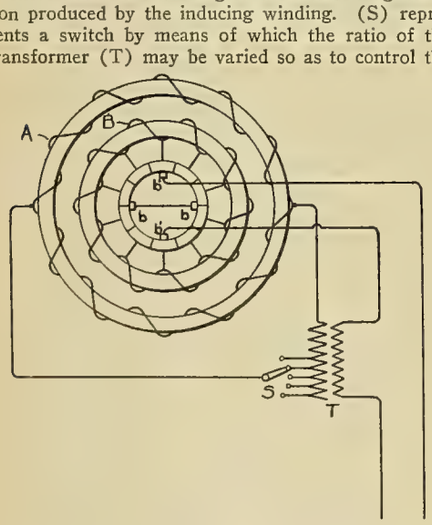


FIG. 2. EICHBERG'S CONTROL OF ALTERNATING-CURRENT MOTORS.

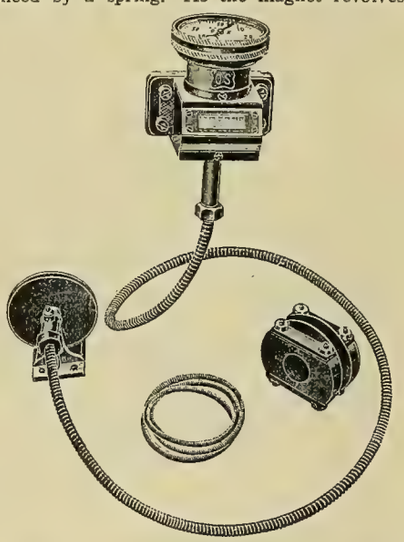
motor torque. The winding (C) may be placed upon either stator or rotor and may be combined with the induced or inducing winding or may be independent therefrom.

In Fig. 2 the magnetizing winding is placed on the rotor and combined with the induced winding, the winding (B) in this drawing performing the functions of both magnetizing winding and induced winding. For this purpose it is provided with two sets of commutator brushes, one set (b' b') being connected to the source of current through the primary of transformer (T), the portions of the rotor winding betwen these brushes acting as the magnetizing winding. The second set of brushes (b b) short circuits the motor on the line of magnetization produced by the stator winding (A), and the portions of the rotor winding between these brushes act as the induced winding. The inducing winding, which is shown as the stator winding, is connected, as before, to the secondary of the series transformer (T). The number of turns of either primary or secondary of transformer (T) may be varied.

Various modifications of the arrangement of the motor windings are also described by the inventor.

Electric Speed Indicator for Automobiles.

A new speed indicator and recorder for automobiles has been brought out at Paris by O. Schultze. It registers the running speed of the car on a dial, and also gives the total mileage on another counter. The latter is of value in order to determine the consumption of gasoline, oil, pneumatic tires, etc., per mile of run. The apparatus allows the owner to check up the running of his car, especially as regards the efficiency of the motor, and to compare the results with those of preceding periods. Besides, he is able to hold the car on the road at the speed which is found to be the best for general use, and thus save the wear of mechanism. The legal speed can be adhered to, which may save him some annoyance as regards the police regulations. An electric method is used in the Schultze indicator, which is solid and not likely to get out of order, owing to the absence of complicated mechanical parts. The construction of the device is simple, consisting of a U-shaped permanent magnet, to which a flexible cable transmits the movement from the car wheel. (See accompanying illustration.) Over the magnet is pivoted a light copper disk, counterbalanced by a spring. As the magnet revolves, it



ELECTRIC SPEED INDICATOR FOR AUTOMOBILES.

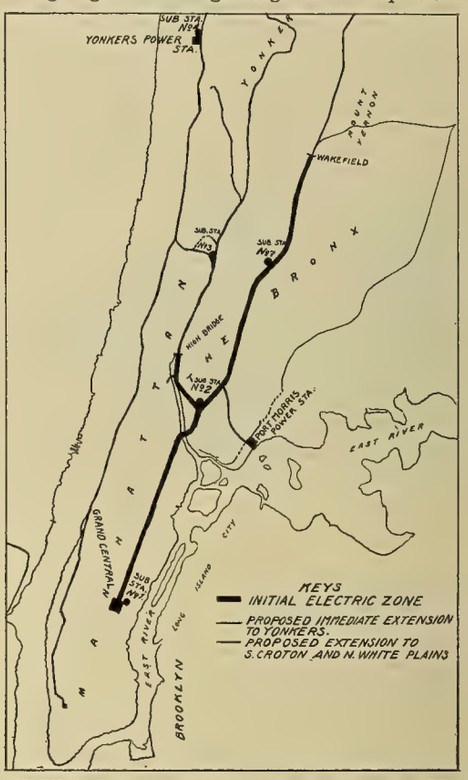
sets up Foucault currents in the copper disk, which is drawn along with it against the action of the spring. There is thus a certain position of the disk corresponding to any given speed. The shaft of the disk carries a pointer which moves over the dial, as shown, and which shows all the speed variations. Contrary to the action of a centrifugal device, the pointer remains very steady and does not oscillate, even under the shocks of the car on the road. The flexible cable is made to work a set of disks mounted below the dial, so as to count the total mileage, on the principle familiar in mechanical speed recorders. Thus two indicators are contained in a very small volume. The counter is fixed on the dashboard, and the flexible cable is connected below to one of the main shafts of the driving mechanism, and the transmission passes through the car body and does not give a bad appearance. A grooved pulley is fixed on the shaft of the car, and connects with the pulley of the flexible cable by spring belting. The diameter of the car pulley is determined by the diameter of the running wheels, that of the shaft, and the gear or chain ratio. The mileage counter runs up to 10,000 miles, after which it falls back to zero, while the speed dial may read up to 100 miles an hour.

Light and Power Rates in Chicago.

The Chicago City Council committee on gas, oil and electric light has re-opened negotiations with the Chicago Edison and Commonwealth Electric companies in the matter of passing an ordinance reducing the electric-light and power rates, a course, however, which the companies had already taken voluntarily. Preliminary to the committee's report an examination of the companies books has been suggested, and this has been agreed to by the central-station people, provided an agreement can be reached as to who shall name the commission to make the investigation.

Electrification of New York Central Railroad Terminals in New York City.

An instructive and interesting address was given before the Chicago branch of the American Institute of Electrical Engineers on the evening of November 2d by Mr. Bion J. Arnold, whose subject was "The Electrification of the Terminals in New York City of the New York Central Railroad." As one of the commission of the consulting engineers having charge of the supervision



OUTLINE MAP OF ELECTRIC ZONE OF NEW YORK CENTRAL IN NEW YORK CITY AND VICINITY.

of this great work, Mr. Arnold is, of course, well qualified to speak on this subject. He talked without notes and illustrated his remarks by lantern-slide pictures.

Commencing with a brief historical recital of the work of equipping the New York terminals of the New York Central for electrical operation, the speaker went on to explain that the current for this work will be generated in two power houses, one at Port Morris and the other at Yonkers. The former is now in service. These power houses are practically in duplicate, each to contain, ultimately, six 5,000-kilowatt General Electric turbo-generators, making the total installation 60,000 kilowatts. These power houses are cross-connected, and either one of them, by running the generator units at 50 per cent. overload, has capacity to carry the entire system. Thus in case of a serious breakdown in one power house the road will not be tied up. In fact, throughout the

STEEL SUBURBAN MOTOR CAR FOR NEW YORK CENTRAL.

whole installation every precaution has been taken, without regard to expense, to insure reliability of operation, as the terminal service is so large and of so much importance that this consideration was a prime necessity.

Each power house has a separate switch-house, following the example of the Fisk Street power house of the Commonwealth Electric Company in Chicago. Alternating current is generated at 11,000 volts, 25 cycles, and is transformed to direct current of 600-650 volts at eight sub-stations of standard construction. This direct current is fed to a third rail, whence the direct-current electric locomotives and motor cars are operated. Transmission from the power houses is accomplished by copper wires supported by steel poles and wooden cross-arms.

The third rail is divided into one-mile sections

with circuit-breakers at the junction points arranged to open the circuit automatically in case of derailment when otherwise there would be a short-circuit between the third rail and the track rails. The third rail is the Wilgus under-contact type. To protect the third rail from accidental contact by men or animals, a covering of fiber is provided.

Large storage-battery auxiliaries are installed in the sub-stations, and these have sufficient capacity to operate the terminal system for one hour if both power houses should be shut down. Thus another insurance against interruption of the service is provided.

All motor cars which will be used in subways or tunnels are constructed entirely of steel and are non-inflammable. Two hundred of these cars have been ordered. Each is equipped with two 200-horsepower direct-current motors, and the Sprague-General Electric multiple-unit system of control is used, so that the cars can be operated singly or in trains of any number of cars.

In addition to the suburban service a large number of through trains are handled, and these will be pulled through the Electric Zone to the Grand Central Station by powerful electric locomotives which will replace the steam locomotives at Yonkers. Twenty-eight of these electric locomotives are now delivered. Each one weighs 100 tons and is equipped with 2,200 horsepower in direct-current motors. These locomotives have made as high as 83 miles an hour, although the normal high speed is 60 miles an hour. There are 37 feet long. The armatures of the motors are mounted directly on the axles of the driving wheels, the fields of the motors being rigidly attached to the frame of the machine. The air gap is about ¾ of an inch. This simple arrangement has been found to work well in practice. An interesting feature of the locomotives is that they are equipped with steam boilers, operated by oil fuel, to generate steam to heat the through trains to which they are connected. The suburban trains have electric heaters.

The terminal yards at and near the Grand Central Station in New York are about 40 acres in extent. Nearly all of this area was excavated in solid rock for a depth of from 30 to 80 feet. This was necessary to provide a double-deck terminal system, the express trains coming in on the upper level and the suburban trains below them. In addition the excavation made it possible to lower the street viaducts over the tracks so that they might be crossed by teams, which was not the case before the electrification.

It is interesting to note that the total terminal electrification and improvements of the New York Central, in and near New York city, including the new Grand Central Station and the excavation, involve an expenditure of between $65,000,000 and $75,000,000.

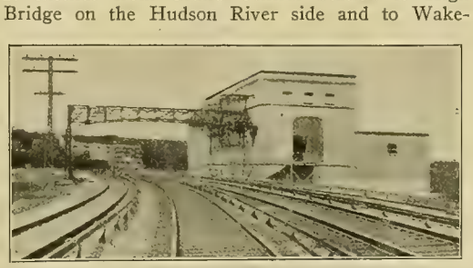
At the conclusion of his extremely interesting address (of which a bare outline is here given) Mr. Arnold answered a number of questions. Several of them related to the alternating current versus the direct current for heavy railroad work. The speaker explained that whereas he believed in alternating current for heavy railroading, nevertheless at the time when the decision was made for the New York Central, two or three years ago, the commission of engineers decided that it would be folly to take any chances or make any experiments. At that time it was known that the direct current could be relied upon absolutely to do the work, but the alternating-current system, that is, a system using alternating-current motors on the cars, had not been developed to such an extent that the engineers in charge felt justified in employing it in such an enormous undertaking. It is also true that with a given weight it is not possible, even at the present time, to get as powerful a locomotive with alternating current as with direct current.

To another question Mr. Arnold said that personally he believed that all conductors for electric cars should be overhead and not on the ground under people's feet. It is quite possible that in the future overhead conductors will be insisted upon. In that case alternating current will be indicated for heavy railroad work.

AERIAL TRANSMISSION LINE, NEW YORK CENTRAL RAILROAD.

Some additional facts and the accompanying illustrations are reproduced by the courtesy of the American Institute of Electrical Engineers, in the Proceedings of which body for October Mr. E. B. Katte, electrical engineer for the New York Central, gives a summary of the terminal electrification.

The engineering staff of the road has prepared complete plans for the electrification from Grand Central Station to South Croton on the Hudson River division and from the Grand Central Station to North White Plains on the Harlem division. This territory is known as the "Entire Electric Zone." The part now installed and in operation is known as the "Initial Electric Zone." It extends from Grand Central Station to High Bridge on the Hudson River side and to Wakefield on the Harlem division side. (See map.) The distance from Grand Central Station to Wakefield is 13 miles and from Mott Haven Junction to High Bridge is four miles, making the total line mileage in the Initial Zone 17 miles. In the Entire Zone, when completed, the length of road electrified will be 52 miles (Grand Central Station to North White Plains, 24 miles; Mott Haven to South Croton, 28 miles). The grand total track mileage to be electrified under present plans is 292.



KING'S BRIDGE SUB-STATION ON NEW YORK CENTRAL RAILROAD.

The two power houses have together a normal ultimate capacity of 60,000 kilowatts and a normal initial capacity (eight 5,000-kilowatt units) of 40,000 kilowatts. Together they have initial capacity for 32 625-horsepower boilers.

For sub-stations Mr. Katte gives these figures:

INITIAL ELECTRIC ZONE.

Number of sub-stations	4
Normal rotary capacity	15,000 kilowatts
Momentary capacity of storage batteries	22,342 kilowatts
Hourly capacity of storage batteries	7,447 kilowatts

ENTIRE ELECTRIC ZONE.

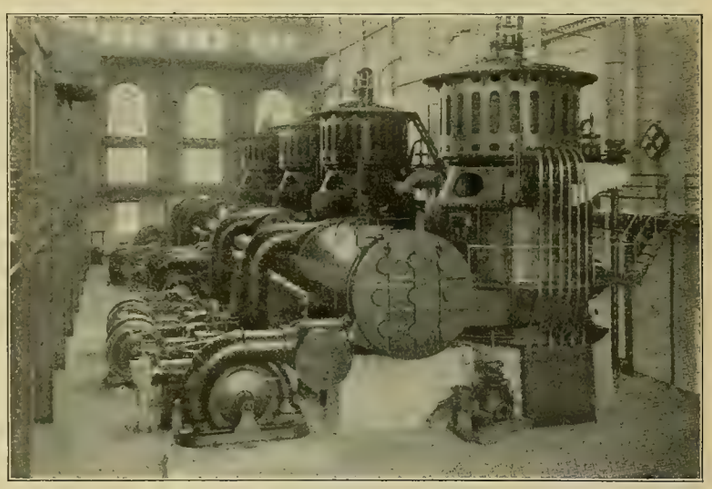
Number of sub-stations	8
Normal rotary capacity	27,000 kilowatts
Momentary capacity of storage batteries	37,786 kilowatts
Hourly capacity of storage batteries	12,595 kilowatts

Approximate weight of transmission-line copper in Initial Zone is 1,500,000 pounds and in Entire Zone 3,000,000 pounds. Third rail is of steel weighing 70 pounds to the yard.

In the Grand Central Station terminal alone there are 25 miles of tracks, while there is capacity for 1,200 cars, handled on 41 platform tracks. In this terminal are 100,000 tons of steel and 260,000 cubic yards of concrete, while 3,000,000 cubic yards of excavation is needed.

Actual work on the Grand Central Station improvement was begun August 17, 1903, the act of the Legislature authorizing the change of motive power having been passed May 7, 1903. The first experimental electric locomotive was run October 27, 1904, and the first electric locomotive was run in New York city on July 20, 1906. The running of the first electric train into the Grand Central Station took place on September 30, 1906, and as the agreed completion of the change of motive power was July 1, 1908, the New York Central has anticipated the date of change, as fixed by law, by nearly two years.

First Electric Train Leaving High Bridge. (Train Contains Eight Cars and Weighs 550 Tons.)



Turbine Room, Port Morris Power Station.

ELECTRIFICATION OF NEW YORK CITY TERMINALS OF NEW YORK CENTRAL RAILROAD.

Formulas for Babbitt Metal.

[From the Question Box of the American Street and Interurban Railway Engineering Association, presented at the Columbus convention, October 17, 1906.]

In case babbitt is used, what is the formula?

First Answer.—In making the babbitt metal for armature bearings for various types of motors the following formula will be found to be quite satisfactory:

	Per Cent.
Tin	82
Antimony	10
Copper	8
	100

The copper should be added after the other mixture is thoroughly melted. As a simple shop test for testing babbitt metals of various makes to insure uniformity in the metal and also to determine approxiately the material of which it is composed, a drop test will be found to be of advantage. This should be arranged with a drop of a known weight falling a certain distance, with a record kept of the number of blows required to break a bar of the metal of various compositions.

Second Answer.—Babbitt formula:

	Per Cent.
Tin	64.5
Antimony	9.5
Copper	2.0
Lead	24.0
	100.0

WESTERN ELECTRICIAN

EVERY SATURDAY.

PUBLICATION OFFICES:

507 Marquette Building, - CHICAGO.

TELEPHONE, MAIN 1746.

Eastern Office, 150 Nassau Street, New York.

Telephone, 5220 Beekman.

Trade Supplied by Western News Co.

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WHATEVER the cause of the recent deplorable accident at Atlantic City on the West Jersey and Seashore branch of the Pennsylvania Railroad, it is evident, from the illustrated description given elsewhere in this issue, that the electrical equipment was practically brand-new and absolutely high-class in every way. This branch of the Pennsylvania connects Philadelphia (or Camden, just across the Delaware River) with Atlantic City, and it was this year equipped for electrical operation on the third-rail principle. On the outskirts of Atlantic City the line crosses a branch of the sea known as the Thoroughfare, there being a drawbridge at this point. It was at this bridge that two cars were derailed on October 28th, plunging into the water with a loss of 55 lives. The only part of the electrical equipment that could have been at fault would be the third rail on the bridge or where connection is made between the movable bridge and the mainland rails. But even if this connection was defective (and we have seen nothing to show that it was), it is difficult to see how this trouble would have derailed the train. Moreover, the drawbridge was new, and the third rails on it were connected to the third rails on the approaches by sliding contact shoes to give a continuous current-path when the draw is closed. These shoes were carefully planned, and it is not likely that there was any flaw in their design. At this writing the coroner's jury is still investigating the disaster, and no announcement of the cause of the accident has been made.

DENATURED ALCOHOL has not as yet entered the lists as a competitor to electricity in artificial lighting, and probably it will not for some time to come, if at all. Those of our central-station friends in semi-rural communities who have had trouble with gasoline competition, and who feared that cheap alcohol might prove as bad or worse, may breathe more freely. Comfort comes from the Department of Agriculture at Washington, which, through Dr. H. W. Wiley, chief of the Bureau of Chemistry, has undertaken to educate the farmers regarding the manufacture of denatured alcohol. Two bulletins were issued last week devoted to the description of the sources from which industrial or denatured alcohol may be obtained, the method of manufacture and to some uses to which it may be put; also giving statistics showing the possibilities in the development of the industry.

From Dr. Wiley's discussion of the subject the conclusion is reached that the manufacture of alcohol on a small scale is not likely to prove profitable. On the subject of sources and manufacture one of the bulletins says: "The principal uses of industrial alcohol are illumination, heating, motive power and the manufacture of lacquers, varnishes, smokeless powder, medicinal and pharmaceutical preparations, vinegar and ether. When industrial alcohol is made at a price at which it can compete with petroleum and gasoline, it doubtless will be preferred for the purposes above mentioned because of its greater safety and more pleasant odor. Under the present conditions it is not probable that industrial alcohol can be offered upon the market at much less than 40 cents a gallon of 95 per cent. strength."

As gasoline is now to be had, even in small quantities, at from 15 to 20 cents a gallon, 40-cent alcohol, it is evident, has little terror for the electric-light man.

WHEN attention is directed toward it, one is struck by the multifarious research activities of the modern technical school of the first class. Thus the Boston correspondent of the Western Electrician, in his news letter of last week, quite casually enumerated some of the recent work of this sort in that city:

Dr. C. J. H. Woodbury recently lectured on "Telephone Line Engineering" before the Massachusetts Institute of Technology Electric Club. A number of awards have been made the Institute's research laboratory. Three hundred dollars has been given Richard C. Tolman to enable him to construct what will probably be the most powerful centrifugal machine ever built for experimental purposes. It will be used in investigating the electromotive force produced in the two ends of a rapidly rotating solution of any ionized substance. Prof. A. A. Noyes, who has charge of the laboratory work, has been given $300 to be used for the construction of a calorimeter adapted to direct thermochemical measurements with solutions up to the temperature of 100 degrees Centigrade. Mr. Tolman gets his money from the C. M. Warren Fund of the American Academy of Arts and Sciences, while Professor Noyes' award comes from the Count Rumford Fund of the American Academy. The Ansonia Brass and Copper Company has given the laboratory a diamond worth $350, which will be used in insulating the electrode within the bomb used in the investigations of conductivity at high temperatures. The diamond will eliminate the error due to contamination which has arisen when quartz insulators have been used.

The above is, of course, merely incidental and fragmentary. But, nevertheless, the statement throws an interesting light on the varied and original character of the work carried on. And the remark is as applicable to other technical schools of equal grade as to the one in Boston. Not only are these institutions training embryo engineers in the elements of their profession (imperfectly, it must be admitted, but still to good purpose), but they are in constantly increasing measure doing research work, and much of this work will have a permanent and lasting value. Manufacturers and others engaged in gainful occupations dependent on the applications of the laws of physics do well to assist the professors and the eager students by donations of money or apparatus or by throwing their establishments open to inspection.

RADIO-TELEGRAPHY is the approved term now, not space telegraphy or wireless telegraphy or aerial telegraphy or Hertzian-wave telegraphy. So, at any rate, has decided the Berlin international "wireless" conference, and it is certainly a very respectable authority. Well, it is a good thing to have an official pronouncement on the subject at any rate, as there has been some confusion in the terminology of the new art. Our own preference has been for "space telegraphy," without prejudice, however, to the popular term "wireless," which is in common use. This choice, too, is that of many of the experts, for more patents were issued by the United States Patent Office in 1905 for "space telegraphy" than for "wireless telegraphy." The term "radio-telegraphy" is evidently thought to be more distinctive than either, as indicating the electric radiation, or the transferrence of electric energy by means of electro-magnetic waves set up in the surrounding ether. But it may be objected that the new term is rather awkward and also that the average layman will find it more obscure than the more familiar terms. However, if all technical men will unite in using it, it may be successfully grafted on everyday speech. Time alone can tell whether the new expression (or, rather, the newly adopted one, for it was proposed years ago) will "take."

The international conference adjourned on November 3d, and brief summaries of the "international radio-telegraph treaty" which it adopted have been cabled to the daily newspapers in this country. We are glad to observe that the principle of free intercommunication between all systems has been adopted, but we should have rejoiced still more if the congress had adopted the proposal of the United States that there be unrestricted exchange of messages between ship and ship and ship and shore, regardless of the system used. That would have simplified matters a great deal. But from the outset Great Britain regarded it as indispensable that strict and efficacious regulations should be made to prevent confusion of systems and for the proper organization of the service, and that each country should be allowed the right to exempt certain stations from the obligation of free international intercommunication. Accordingly it refrained from signing the special article containing the United States proposal as to obligatory exchange of messages, and its course was followed by Italy, Japan, Mexico, Persia and Portugal. All other nations, if we read the dispatches aright, signed the complete treaty, containing the provision for universal interchange.

Of course the treaty has no binding force until adopted by the law-making bodies of the various states. It must first be ratified, and then, no doubt, special legislation will be adopted in each country to make it effective.

So far as one can judge from the Associated Press synopsis of the treaty, the congress has done useful and creditable work. But more detailed comment must be reserved until the full text of the agreement has been received.

Now It Is Radio-telegraphy.

Cable advices state that the delegates to the wireless-telegraph conference at Berlin finished their work on November 1st and signed the international radio-telegraph treaty on November 3d.

The term "radio-telegraphy" was chosen as the one to be used officially in defining the new system of electrical communication by Hertzian waves.

The representatives of all the powers signed the document, but Great Britain, Italy, Japan, Mexico, Persia and Portugal did not join in the special article containing one of the United States' proposals—that intercommunication be obligatory between ship and ship or between ship and shore. The British delegates offered as a compromise to accept compulsory intercommunication between ship and ship upon matters pertaining to navigation alone. The United States delegates declined to agree to the compromise, affirming that they were willing to stand or fall on the principle of free intercommunication. They were supported by the great majority of the delegates, who adhered by signature to the article, only those of the six countries named declining.

Great Britain, Italy, Japan, France, Spain, Denmark, Persia, Portugal and Turkey did not sign the renunciation privilege, thus excepting from the provisions of the treaty such stations as these governments may select. All the other powers agree to free ship-to-shore intercommunication with all nations open to the public, naval and military stations excepted.

The period for the ratification of the treaty will end on July 1, 1908. The next conference will take place in 1911.

Fuller and more exact details of the international agreement will be given in a later issue of the Western Electrician.

Illumination Discussed in Boston.

At the recent Boston meeting of the Illuminating Engineering Society, where the "Indoor Illumination" papers of J. E. Woodwell and E. C. White were discussed, Dr. Louis Bell went into quite a long discussion on these papers. He personally considered the polar diagram with slide rule, etc., as a very convenient combination for measuring illuminating effects at different angles. He also spoke of the relatively small value which could be attached to the law of cosines and made a number of practical demonstrations along those lines, illustrating that the useful light must largely fall on the substance illuminated upon a normal plane.

G. H. Stickney spoke of many experiments along the line of enlarging the light sources and utilizing reflectors of such shapes as to bring down the sources of light from a point of high intrinsic brilliancy to a much lower one spread out over larger surfaces and reflected at suitable angles on to the space illuminated. He favored for the present the determining by experience the number of watts per square foot, having ascertained the value of the particular kind of light to be used as a method of practical application.

Dr. Charles Williams spoke of the injurious effects of the average illumination upon the human eye, and criticized the general tendency of having a strong light and too closely concentrated, especially the locations in the normal range of sight, the effect being to shortly tire the eyes because of the intense light falling on the part of the retina, and coming at the same angle all the time is very fatiguing. He spoke particularly of the necessity that the light should be more diffused and of a lower intrinsic brilliancy. He mentioned several experiments for determining the amount and location of light for certain classes of work.

J. S. Codman mentioned the method of calculating illumination by working a set of curves which he had personally compiled, and which gave a quick way of determining the amount of illumination necessary. The discussion was further entered into by A. J. Farnsworth, C. J. Hatch, Edison Cowles and W. E. Clarke.

Chicago Illuminating Engineers Dine and Talk.

Members of the Chicago section of the Illuminating Engineering Society to the number of about 40 took dinner together at White's restaurant, Clark and Adams streets, on the evening of November 6th, and afterward discussed a number of questions submitted in advance. Mr. George C. Keech was in the chair. The dinner was set for six o'clock, those present going directly from their offices. The arrangement proved to be both pleasant and profitable, and it was voted to meet at dinner at the December meeting in the same manner. Further reference to points brought out in the discussion will be made next week.

Protection of Transformers.

In these days of high-potential transmission of power the question of insulation is occupying the time and attention of a great many thoughtful and practical men. Economy is continually urging the use of higher voltages, and the effort of the inventor is to devise means of safely generating, transmitting and utilizing them.

Even in the highest-class apparatus, however, there are breakdowns of insulation and the results are expensive, annoying and sometimes very dangerous. In many cases the trouble is not due to defective design or workmanship but to the fact that it is difficult thoroughly to inspect the condition of some of the apparatus while it is in use.

The transformer, especially in the larger sizes, is from necessity so designed that it is often both dangerous and difficult to inspect it thoroughly on account of the inaccessibility of the parts and the nature and proximity of the operating currents. Very often the insulation of the high-voltage coils depends partly on a surrounding liquid, as in the case of many oil transformers. If a leak occurs in the joints or fittings of the tank containing the transformer, or if much evaporation takes place, the liquid may become lower than the upper windings of the coils, and, even if the insulation between the exposed parts is sufficient to stand the strain, the lack of the heat-conducting influence around them may cause an undue rise in temperature and seriously damage the apparatus.

John J. Frank of Schenectady, N. Y., has been granted a patent covering a device which he claims will not only give warning of this dangerous condition but will protect the apparatus.

He places electrodes or sparking points inside the tank at the lowest level to which the bath may fall without danger to the apparatus. He then connects these to a source of current which has not sufficient voltage to produce sparking through the oil, but which will cause sparks to pass between the electrodes if they are exposed to air. This sparking would occur, then, if the level of the liquid falls below the electrodes, and the attendant, being provided with means to observe any fluctuations that occur in the current proceeding from the electrode-circuit source, is given warning of the unsatisfactory condition which exists in the tank.

Not stopping with this, however, the inventor plans his source of current in such a manner that the sparking not only will give the warning needed but actually tend to protect the apparatus.

For instance, the sparking points may be connected to one or more of the windings of the transformer. In this case, if the fluid level falls so that the sparking points are exposed the current normally passing through the transformer winding will be shunted through the electrode circuit, including the arc between the electrodes. This will protect the windings, and the attendant will receive warning of the conditions by observing the effects on the external circuit.

Different sets of electrodes in the same apparatus may be used in connection with any winding, and the connection may be made in various ways so that all the windings are protected. In order to limit the current flow through the arc between the electrodes a resistance may be used in series with each protective circuit.

Chicago Meeting of the Institute.

At the first meeting of the Chicago branch of the American Institute of Electrical Engineers, held in the assembly room of the Western Society of Engineers on the evening of November 2d, there was an audience that tested the capacity of the room, and left not a few persons standing, to greet Mr. Bion J. Arnold, who addressed the section on "The Electrification of the Terminals in New York City of the New York Central Railroad." A summary of this interesting lecture is given elsewhere.

Prof. P. B. Woodworth of Lewis Institute presided and spoke briefly on the "forward movement" by which it is proposed to make the Chicago branch more useful than ever before. He urged an increase of membership and outlined the programme for the season, announcing four meetings, one to be devoted to "Steam Turbines," the second to "Alternating-current Railway Work," another to "Direct-current Railway Work" and a fourth to the subject of "Telephony." Mr. J. G. Wray also spoke, indorsing all that Professor Woodworth had said and suggesting the appointment of a committee on membership. By vote the section decided that such a committee should be appointed.

Before the adjournment of the meeting Professor Woodworth read a telegram from Morgan Brooks of the University of Illinois inviting the Chicago branch to meet with the University of Illinois branch at Urbana, Ill., on November 7th. Professor Brooks is the secretary of the branch which sent the invitation, which was much appreciated.

International Conference on Electrical Units.

As announced in the Western Electrician of September 22d the London international conference on electrical units and standards has been postponed until October, 1907. A correspondent of the London Times Engineering Supplement says that the letter of invitation was first sent to the governments of Austria, France, Germany, Italy, United States, Switzerland, Belgium, Spain, Sweden, Norway and Russia, these being the countries known to have already or to contemplate legislation on the subject. In answer, the French government asked for a postponement of the conference, as it was conducting certain technical experiments which it wished to complete before coming to a decision. Subsequently it was arranged that the conference should take place in October, 1907. Refusals to attend the conference have come from Norway and Turkey. Germany has assented conditionally, and the following delegates have already been appointed by their respective governments: Belgium, Messrs. Eric Gerard and Clement, the director and secretary respectively of the Montefiore Electro-technical Institute; United States of America, Dr. S. W. Stratton, director of the Bureau of Standards of the Department of Commerce and Labor, and Professor Henry S. Carhart, professor of physics, University of Michigan; Spain, Don José Madarigia, professor of electro-technics at the Special School of Mining Engineering; Italy, Professor Commendatore Andrea Roiti, professor of the Royal Institute for the Higher Studies, Florence; Switzerland, Professor Conradin Zschokke, state counsellor of Aarau, Dr. Weber, Professor of Zurich and member of the Commission on Electrical Measurements, and Dr. Henry Dufour, professor at Lausanne, member of the Commission for the Regulation of Weights and Measures. Professor Glazebrook, director of the National Physical Laboratory, Bushy Park, is responsible for the arrangements in England.

Electrical Exports for September.

Electrical exports from the United States for the month of September, 1906, amounted to a total value of $1,404,421. This compares with $871,269 for September, 1905. Electrical exports are divided for record in the Bureau of Statistics into two classes—electrical appliances and electrical machinery. Both show a good gain for the month, as made clear by the following comparison: Electrical appliances—September, 1905, $388,887; September, 1906, $677,821. Electrical machinery—September, 1905, $484,382: September, 1906, $726,600.

The following-named countries were the principal buyers of electrical machinery (not appliances) from the United States during September, 1906: British North America, $185,049; Japan, $120,409; Mexico, $04,627; Brazil, $57.784; United Kingdom, $54,527; British Australasia, $42,784; France, $23,312; Argentina, $17,542; British East Indies, $15,307; Philippine Islands, $14,783; Germany, $11,585; Cuba, $10,680: British Africa, $2,919; Central American states and British Honduras, $1,623; Chinese Empire, $1,000; European countries not mentioned above, $41,890; South American countries not mentioned above, $28,484.

Holiday Street Lighting.

The Nashville Railway and Light Company has completed arrangements for the lighting of the shopping district of the city of Nashville, Tenn., during the holidays. The idea originated with the agents and solicitors of the company, and the suggestion to light the shopping district of the city during the holidays at practically no cost to the merchants was made by Mr. S. M. Allen.

The scheme calls for the expenditure of $1,500 by the Nashville Railway and Light Company, which will be given in electricity during the two months that the lights will burn, while the 103 merchants benefited will pay only for the actual cost of the labor in installing the wires. The company gives the current as a token of its appreciation for the increased business of its lighting department during the last two years.

Lights will be strung on Church Street from Sixth Avenue to Fifth Avenue and out Fifth Avenue to Union Street and on Union Street to Third Avenue and out Third Avenue to the Square. The streamers across the streets in this section will contain 25,000 incandescent lights, these streamers to be placed every 25 feet. The lights will burn from dusk to nine o'clock every evening and until 11 o'clock on Saturday nights during the months of November and December.

The Industrial Benefits of Niagara Falls.[1]

By Frank W. Haskell.

The people of the country have the idea fixed in their minds that the falls are gone. Local railroad men tell me that thousands of people are coming here this year to enjoy the mournful satisfaction of gazing on bare rocks and feel defrauded when they find that the falls look as they always did.

Denouncing the spoliation of Niagara became the popular thing, and in order to be original the magazines not only denounced the extent of the evil, but portrayed its peculiar malignity. For instance, so conservative a publication as the World's Work attempted to show that the people of the state, the nation and the world paid tribute not to industry but to a single group of New York capitalists.

The article to which I refer contains three specific statements:

1. The power companies or their officers are financially interested in every power-using concern here.

2. Nearly every concern here, if not here, would be in equally large existence somewhere else.

3. The workmen employed here were all brought from other places, and are here paid lower wages than they received before being transplanted.

Every one of these statements is absolutely false as concerns the company of which I am president. I know them to be equally false of many other concerns here, and I believe them to be false of at least 90 per cent. of all the industries here, measured either by number or magnitude. I believe the third statement to be false as applied to every concern here.

We all know, and you may have seen by observation, that the falls are unimpaired to the eye. One day, some three years ago, the American channel was dry above the falls. It had also been dry two or three times before within the memory of the older inhabitants. On the day that the Burton committee was here last spring, the volume of water was the greatest known for a generation, and the factories were using it. These extremes are the result of strong winds, ice jams and the stage of water in the upper lakes.

But, while the falls still exist in their original glory, it would be sophistry to assert that water can be taken in increasing quantity without limit, and never affect the scenic splendor. If the industrial development goes on indefinitely, Niagara as a spectacle will cease.

Where the line should be drawn, if at all, I will not venture to say. A recent article by Mr. H. W. Buck in the Outlook takes such an advanced, enlightened view of the question that one cannot hope for a sympathetic response from the masses of the people who are still governed by emotion rather than by reason. I agree with Mr. Buck that Niagara as a mighty saver of labor and coal is a vastly greater asset to the people than as a mere show place; but while I have this belief, I realize that it is Utopian; and knowing that the line will be drawn whether wise or not, I will go no further than to say where it should not be drawn.

The Carborundum Company depends entirely on electrical energy for the making of the product. The company started in 1893, producing a substance hitherto unknown to science or commerce. Its original factory used electricity developed from steam and was located in the heart of the soft-coal region of Pennsylvania. The full story of the struggles of the concern and the development of the industry would fill a large volume, but I will merely state to you as a fact that these things were absolutely proven:

1. The manufacture of carborundum is not commercially possible with units of less than 1,000 electrical horsepower.

2. The manufacture of carborundum excepting on a scale as small as to be prohibited by the conditions of (1) is not commercially possible where the electrical power costs more than $20 per horsepower per year, meaning 24 hours per day, 365 days per year.

The experience of the company, which has been corroborated by that of many others, is that under the most favoring conditions power cannot be developed from coal at a sufficiently low cost to permit the industry to exist.

The company came here in the fall of 1895. It had some 20 employes. Its further existence in Pennsylvania was utterly impossible.

The question may now be asked: Are the people of the United States interested in the existence of the Carborundum Company? In 1895 the only ones interested were perhaps half a dozen men, and they only to the extent of the perhaps $150,000 they had invested. It is true that in some cases this meant all the investors had; but no matter; they don't count.

In 1893 carborundum was sold by the carat, and the total sales amounted to a few pounds per year. It is now sold by the carload to the extent of 10,000,000 pounds a year. It has entirely revolutionized the methods of manufacture of hundreds of articles. There are some things of daily use which can be made in no other way than by the means of carborundum. Of course, the world can get along without carborundum, but to cut it out now would call for a radical readjustment in many important hives of industry.

As stockholders of the Carborundum Company, our motives are selfish; but the fact remains that our selfishness cannot be rebuked without injury to many others. The company, as of June 30, 1906, has a total investment of $1,100,950.22. Of this sum $100,000 stands as the value of patents. This is not water, for the patents cost more than that amount. The balance represents the actual cost value of actual tangible property.

The company employs over 450 men, which, by usual ratios, means that some 2,000 people are dependent on the company for their means of living.

No director or officer, nor, so far as can be ascertained, any stockholders of any of the power companies has a direct or indirect interest to any extent whatever in this company, nor are any such persons interested in other affairs with any individuals connected with this company.

The experience with this company has also proven that the business could not be made self-sustaining by using less than 2,000 horsepower nor profitable by using less than 3,000 horsepower.

The company came here to build up a new industry. It expected and received nothing from the present, but looked to the future. Its power contract calls for the delivery of power up to 10,000 horsepower on call. Having had invested from $100,000 to $1,000,000 for over 13 years, it paid its first dividend four years ago, when using 3,000 horsepower. It paid four per cent. on its stock until this year, when it increased its dividend to six per cent. The company is now using 5,000 electric horsepower, and this year's operations have been profitable.

I have given this information at this length as a preface to my contention that the line of limitation should not be and cannot honestly be drawn in such a way as to interfere with the contracted or expected power supply of any concern which has invested funds and developed an industry with the expectation, based on the good faith of the state of New York, that that investment would be protected and not strangled just as it attains maturity.

Thus far I have spoken on this subject with reference solely to those concerns which are interested in knowing whether or not years of working and waiting have been spent in vain, whether or not the United States shall take from a man 10 years of his productive life and throw it away. I shall now mention one more thing and then cease further to bother you.

The Canadian Niagara Power Company has, I understand, the right from the Canadian Government to develop 150,000 horsepower. Acting on that right it proceeds to install its plant. It invests several millions, a large part of which is borrowed on bonds. The ability of the company to pay the interest and principal of these bonds is predicated in the revenue to be derived from the sale of something approaching 150,000 horsepower. The United States says: "We can't prevent your using the water, but we can prevent you selling the product of the power. You may bring 25,000 horsepower into the country, and no more."

It can hardly be expected that the revenue from 25,000 horsepower would pay even the operating expenses of a plant designed for 150,000 horsepower, and the extremely probable result of this restriction of revenue would be an inability to pay the maturing obligations on the bonds.

In the present peculiar state of the popular temperament the shrinkage of the assets of a capitalist would not be regarded as a national calamity; but who holds those bonds? I can't answer that question, but I venture the opinion that any loss in connection with the bonds would fall on the proverbial widows and orphans rather than on the capitalists.

So, as I see it, the first effect of this arbitrary restriction of industry would be to impose suffering on the innocent. The second would be a reorganization of the company with the result that the capitalists would own it free of encumbrances. The third would be that to protect the reorganized company, industrial Canada, with the co-operation of the Canadian Government, will be built up at the expense of industrial United States.

1. This is the greater portion of a letter dated July 27, 1906, and addressed to Capt. Chas. W. Kutz, U. S. A., who reported on the Niagara situation to Mr. W. H. Taft, the secretary of war. Mr. Haskell is president of the Carborundum Company. As the power consumer's side has been somewhat overlooked, perhaps, the Western Electrician gladly avails itself of permission to print the letter, now that Captain Kutz has made his report.

Extensive Plans of Southern Power Company.

The Southern Power Company has announced further developments to cost $3,000,000. These include the falls at Ninety-nine Islands, in the vicinity of Blacksburg, S. C., and at Great Falls on the Catawba River. The former plant will furnish 16,000 and the latter 30,000 horsepower in addition to the power already developed. It is planned that both new power plants shall be completed by the beginning of the year 1908. The company will eventually have developed 150,000 horsepower covering a strip 100 by 150 miles in North and South Carolina, and will light many cities besides supplying scores of cotton mills and manufacturing plants with power for operating.

Maturing Plans for Widespread Electrical Co-operation.

Mr. Arthur Williams, president of the National Electric Light Association, appointed a few weeks ago a committee of five central-station managers to co-operate in the developing and execution of the plans of the Co-operative Electrical Development Association. This committee, which consisted of three members last year, has been enlarged this year to a committee of five, consisting of the following-named representative gentlemen: W. W. Freeman, Brooklyn Edison Company, chairman; John F. Gilchrist, Chicago Edison Company; R. S. Hale, Boston Edison Company; J. E. Montague, Buffalo and Niagara Falls Electric Light and Power Company; F. M. Tait, Dayton Lighting Company. Mr. Paul Spencer, the previous chairman, rendered excellent service in the development of the plans last year, but special attention required on another committee necessitated his withdrawal.

Mr. Freeman called a meeting of this committee in Brooklyn on October 30th, and the entire day was given over to a careful and detailed consideration of the proposed constitution and by-laws, as well as to the detailed commercial plans for 1907, submitted by Mr. J. Robert Crouse. The committee was honored for a good portion of the day by the presence of President Williams.

This conference, which will be followed rapidly by similar conferences with the co-operating committees of the manufacturers, jobbers, contractors and representatives of the technical press and advertising agencies, is all preliminary to a meeting of the joint committee of all branches of the trade, to be held in New York within a few weeks, at which it is expected formally to complete and finally agree upon a scheme of organization and the commercial plans for 1907.

After a busy day, Chairman Freeman and his associates, F. W. Wells, Joseph F. Becker, Jr., P. R. Atkinson and M. S. Seelman, gave a dinner for his confreres at Delmonico's, followed by a theater party. The day's activities concluded very pleasantly with a luncheon and smoker given by President Williams.

It was the unanimous expression that the day had been crowded as full of "co-operation," both business and social, as was possible, and this meeting doubtless marks a long step in the progress of this co-operative campaign.

Three-cent-fare Line in Cleveland.

On November 1st the first car on the Forest City Railway Company's lines in Cleveland was put in operation. With Mayor Tom L. Johnson as motorman and J. V. McGorray, Democratic candidate for sheriff, as conductor, the car passed over Denison Avenue and Fulton Road to what is known as the Circle on the west side of the Cuyahoga River. The people along the line showed their appreciation of the new three-cent fare car by coming out and cheering, with here and there a piece of bunting stretched across the track. The car was filled with city officials and their wives.

The power plant was put in by the Allis-Chalmers people and the power house is the old Division Street pumping station which has been leased by the company. The one car has been in regular service since it was started by the mayor. The company has received three cars from the factory.

Mayor Johnson asserts that the restraining order secured in the United States Supreme Court to prevent the city from interfering with the lines of the Cleveland Electric Railway Company is just what he wanted, since it will force an early hearing of the various contentions. There is some interest as to what will be done at the expiration of the 10 days, however, unless both parties are ready for a hearing. Cars have been running on all lines of the old company since the order was issued.

Director of Public Service Springborn is quoted as saying that the Cleveland Electric can get a blanket extension of franchise by offering a three-cent fare with universal transfers and agreeing to buy the lines of the Forest City Railway Company. Mr. Springborn said, according to the statement, that the mayor would grant the extension under these conditions.

City Engineer Andrew Rosewater of Omaha, addressing the Real Estate Exchange of that city recently, said that a Platte River power canal would greatly reduce the cost of electric power in Omaha.

A New Central Station in Scranton.

Scranton, Pa., has had another electric-lighting and power plant added to its list of utilities—that of the Lackawanna Light Company, a concern capitalized for $400,000, which has entered into competition for the business of the city of Scranton, and whose complete plant equipment from the breaking of ground to actual operation was built between March 23d and September 1st of this year.

This modern central station is equipped for a capacity of 1,500 kilowatts with several miles of iron pole line, 30 miles of underground conduit construction, 12 miles of underground cable laid, in addition to a whole electric-light system, including a sub-station. Placed at the corner of Sanderson Avenue and Glen Street, the power house is in convenient proximity to the fuel supply. Coal, which is cheap in Scranton, is obtained from the culm piles within the city limits, from which the finer sizes of anthracite can be obtained.

Four Stirling water-tube boilers in batteries of two give the plant a total horsepower steam capacity of 1,600. The grates used are designed specially for the use of the culm product fuel, with which a forced draft is employed. The two main generating units are identical in design, each consisting of a cross-compound Reynolds-Corliss engine built at the Scranton works of the Allis-Chalmers Company, direct coupled to an alternator made by the same company. The cylinder dimensions for the engines are 23 and 36 inches by 42 inches, designed for a continuous load of 1,000 horsepower. The alternators deliver 60-cycle, three-phase current at 4,100 volts. Each alternator is separately excited from a belt-driven exciter delivering 160 amperes at a potential of 125 volts.

The switchboard is composed of six black slate panels—two generator, one exciter, one regulating and two feeder. The three-phase, four-wire system of distribution is employed for convenience and economy in the secondary distribution systems. Over $40,000 has been expended in the underground system through the heart of the business section, sufficient to carry twice the existing lamp and motor load in the territory covered. A sub-station has been erected in the rear of the company's office, in which there are two motor-generator sets for transforming alternating to direct current.

Indiana Electric-railway Statistics.

During the year ended June 30, 1906, 14,778,887 more passengers were carried on electric roads in Indiana than were carried in the preceding year. The statistics in all branches of the traffic show a marked increase in prosperity. The total number of passengers carried was 127,616,952. The last year also shows a gain in the number of miles of track operated by electric roads. In 1905 only 1,002.19 miles of track were operated, while in 1906 the number of miles operated was 1,286.73, or an increase of 284.54 miles.

Four thousand and ninety-five men were employed on Indiana electric roads during the year, and were paid in wages $2,524,475.08. The motormen received an average of $1.88 and the conductors $1.89 a day. The linemen received $2.26 a day.

The Indiana electric roads during the year 1906 earned $1,955,045.50 more than during the preceding year, the year's total being $8,712,775.72. The total expense incurred by electric roads during the year was $5,551,456.50, while the earnings from the passenger traffic were $7,411,093.36.

The number of persons injured on electric railroads in Indiana during the year ended June 30th exceeds the number hurt on steam roads in the same period by 817. The number killed on steam roads was, however, much greater than the number who lost their lives on electric roads. Passengers to the number of 2,204 were injured on electric roads, while only 282 employes were hurt during the year. Of the passengers injured, 1,954 were hurt through their own carelessness, while only 250 were injured from causes beyond their control. Carelessness caused the death of eleven passengers and seven employes. Thirty-four persons, however, were killed in crossing accidents and from live wires, all but two of them being responsible for their own death. Fifty-six employes were injured accidentally, while 226 were hurt through carelessness. Of injured persons not employes or passengers, but who were struck by cars, or burned by live wires, 2,343 were themselves responsible and only 23 were hurt through causes beyond their control. Traction roads in Indiana paid out $166,927.62 for damages for personal injury during the year. The total number of persons killed on electric roads from all causes were 53, while the injured numbered 4,852.

Chicago Electrical Show.

There is every reason to believe that Chicago's second annual electrical show, under the auspices of the Electrical Trades Exposition Company, which will be held in the Coliseum from January 14th to 26th, will be far more successful than that of last year. This prospect is particularly gratifying when it is recalled that the electrical interests brought to the Coliseum in two weeks last January more people than ever before known in the history of the many trades expositions held in recent years in this building.

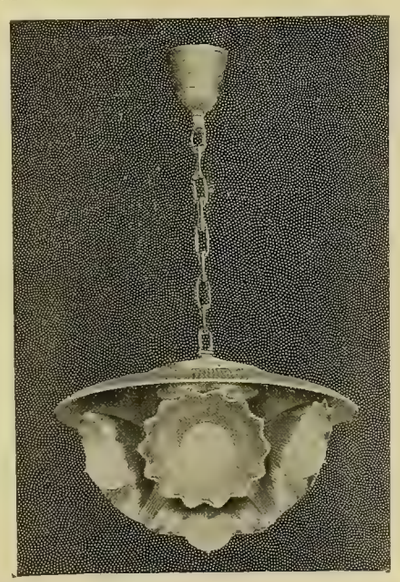
It is something more than ten weeks before the 1907 show, yet Managing Director Homer E. Niesz reports that the space already sold is far in excess of that disposed of at the 1906 show, and the requests are coming in so fast that the Coliseum Annex will be used for exhibitors. Nearly every firm that made a display in the last show is in this year, and many of them have doubled their space, notably the Allis-Chalmers Company, the Westinghouse Company, the Chicago Telephone Company, the American Telephone and Telegraph Company, the Western Electric Company and the Stromberg-Carlson Company. The complete list of exhibitors to date is given below. The word "Company" is usually omitted.

Allis-Chalmers,
American Steel and Wire,
American Telephone Journal,
Armour Institute,
Brilliant Electric,
Bryant Zinc,
Burns, W. J.,
Central Electric,
Central Electric Manufacturing,
Chicago Battery,
Chicago Edison,
Chicago Lamp and Reflector,
Chicago Pneumatic Tool,
Chicago Telephone,
Commonwealth Electric,
Cook, Frank B.,
Crockett, W. P.,
Duncan Electric Manufacturing,
Dixon Crucible,
Diehl Manufacturing,
Electrical World,
Erwin & Co.,
Electrical Review,
Electrocraft,
The Engineer,
Electric Storage Battery,
Electric Service Supplies,
Electric Rotary Floor Polisher,
Electric Appliance,
Edwards Electric Headlight,
Fort Wayne Electrical Works,
Federal Electric,
General Electric,
Guarantee Electric,
Grubbe, Emil, M. D.,
Gould Storage Battery,
Holcombe & Co.,
Haller Machine,
Haines, J. Allen,
Holtzer-Cabot,
Johns-Manville,
Kellogg Switchboard and Supply,
Lang, J.,
Matthews & Co.,
Metropolitan Electric Supply,
Monarch Electric and Wire,
National Battery,
National Carbon,
Niagara Tachometer and Instrument,
Ohio Brass,
Oliver Manufacturing,
Peabody Coal,
Petersen Manufacturing,
Phœnix Glass,
Reynolds Dull Flasher,
Rock Island Battery,
Roth Bros. & Co.,
Schureman, J. S.,
Shelton Electric,
Schott, W. H.,
Simplex Electric Heating,
Stanley-G. I.,
Sterling Electric,
Stolz Electrophone,
Stromberg-Carlson Telephone,
Swedish-American Telephony,
The Consumers' Company,
The Crane Company,
Universal Electric Storage Battery,
Vesta Accumulator,
The Vim Company,
Vulcan Electric Heating,
Wagner Electric Manufacturing,
Western Electrician.
Westinghouse,
Ætna Electric and Stage Lighting,

Mr. Niesz, it will be remembered, was a director of last year's exposition, serving as chairman of the committee on publicity and promotion. In this capacity he had much to do with the success of the show. He is now managing director, with an office in the Monadnock Building, and will be glad to consider applications for the small amount of space still left.

New Holophane "Reflecting Arc."

Much attention is attracted by the new Holophane "reflecting arcs" which have been placed upon the market. This illuminating device utilizes the new Gem high-efficiency lamps of 40 candlepower, consuming 100 watts per lamp. The six-light cluster, therefore, consumes practically the same energy as a 5¼-ampere direct-current enclosed arc. More and better illumination, it is said, is combined with a fixture of great artistic appearance. These reflecting arcs are made up with four, five or six lights.



NEW HOLOPHANE "REFLECTING ARC."

Photometric tests showing the distribution of candlepower compared with that of an arc lamp, and other information, may be had from the Holophane Glass Company, New York city.

The Feather River Power Project.

Further developments are reported from San Francisco in California's latest large power-transmission project. The Great Western Power Company of California, which is the operating company of the Western Power Company of New Jersey, has 400 men at work enlarging the Big Bend Tunnel from its former large dimensions to 16 by 18 feet. This large tunnel, over two miles long, was originally driven to conduct water for mining purposes from the Feather River at the Big Bend in Plumas County. M. A. Viele, of Viele, Cooper & Blackwell, engineers, has just arrived from the East and will employ a large number of additional men to push the construction as rapidly as possible this winter. The transmission line will be completed to San Francisco in less than two years, if possible.

The initial plant will be equipped for 40,000 kilowatts. It is proposed to induce eastern manufacturing concerns that need large amounts of power to locate factories at points on the Coast that will be easily accessible to the Western Power Company's system. While the cost of labor on the Pacific Coast is much higher than in the East, there are some lines of manufacturing that require a maximum of power and comparatively few operatives, and, as the Western Pacific Railway is being constructed through the territory to be traversed by the new power line, such factories will have the advantage of competitive freight rates on their products. The fact that all the electric power companies now operating plants on the Coast are unable to supply the demand for power, makes the field very promising.

Beside a number of heavy eastern capitalists backing the new corporation, President C. A. Coffin, of the General Electric Company, is said to be interested in the Western Power Company of New Jersey, in which powerful financial interests are reported to be interested.

Foreign Trade Opportunities.

Jules Parent, 34 Rue de la Victoire, Paris, France, writes to the Department of Commerce and Labor: "I would be glad to have an opportunity for introducing in my business American goods concerning chemical works, electrical and agricultural machinery."

Consul John W. O'Hara reports from Montevideo that "a law has been enacted by the Congress of Uruguay providing for the expenditure of $1,200,000 Uruguayan gold, equal to $1,240,800 American gold, for the improvement and extension of the electric-lignting system of the city of Montevideo and suburban towns." Full information may be obtained by addressing J. A. Capurro, Minister de Fomento, Montevideo, Uruguay.

Consul J. N. Ruffin writes from Asuncion, Paraguay, that bids were to be opened October 1st for the construction of the works of public health, electric light and power and electric tram service for the city of Asuncion. He adds that the time was too short to expect bids from the United States, but suggests that American manufacturers forward catalogues with full information on accessories necessary for these different enterprises.

Concrete Stack Question in Peoria.

Reference has already been made in the Western Electrician to the collapse of a concrete powerhouse stack of the Illinois Traction Company in Peoria. It now appears that considerable trouble is experienced in the rebuilding. A Peoria daily newspaper of recent date says: "The rebuilding had reached a height of about 20 feet when it was discovered that the new structure was not plumb. An attempt was made to straighten it by means of block and tackle, but this was found to be impracticable. This morning the work of again wrecking the stub was commenced and it will again be razed to the ground. Some of the workmen say that it is their understanding that rebuilding will again be resumed about Tuesday next. The circular cleats and forms are considerably warped, and it is thought that new ones will have to be made, or the work will not be satisfactory at all. The cool weather of the past week is also thought to have had its effect upon the work, and the building may be abandoned until spring in any event."

A new power house is to be built at Brazil, Ind., by the Terre Haute Traction and Light Company.

THE SMALL CENTRAL STATION.

Practical Hints on Its Construction and Operation.

CHAPTER XVI. *(Continued.)*

GENERAL DATA.

Contract Blanks for Power Service.—Two power-service or motor-service application blanks as used by the Chicago Edison Company are given as examples. The first is on a plain meter basis, while the second is for the maximum-demand system.

POWER SERVICE APPLICATION.

(Straight Meter System.)

The subscriber, hereinafter called the consumer, requests the Chicago Edison Company, its successors and assigns, hereinafter called the company, to furnish electricity for the operation of.....electric motor..of.....horse-power rated capacity, to be used only for power purposes in the premises at No.....Chicago, Ill., for a period of.....year.., commencing.....190.., and ending .....190.., and thereafter until this agreement is terminated by 30 days' written notice being given from one party to the other.

The consumer agrees to pay the company for such electricity monthly within ten days of date of bills at the rate of ten cents (10c) per thousand watt-hours of electricity consumed, as measured by a meter to be furnished and installed by the company, subject to the following discounts, varying according to the monthly consumption:

SCHEDULE OF RATES.

Under 200,000 watt-hours, 10 cents per 1,000 watt-hours.
Under 200,000 watt-hours, 10 cents per 1,000 watt-hours, 15 per cent. discount.
Under 300,000 watt-hours, 10 cents per 1,000 watt-hours, 20 per cent. discount.
Under 400,000 watt-hours, 10 cents per 1,000 watt-hours, 25 per cent. discount.
Under 500,000 watt-hours, 10 cents per 1,000 watt-hours, 30 per cent. discount.
Under 600,000 watt-hours, 10 cents per 1,000 watt-hours, 33⅓ per cent. discount.
Under 800,000 watt-hours, 10 cents per 1,000 watt-hours, 37½ per cent. discount.
Under 1,000,000 watt-hours, 10 cents per 1,000 watt-hours, 42 cents per cent. discount.
Under 1,200,000 watt-hours, 10 cents per 1,000 watt-hours, 45 per cent. discount.
Under 1,400,000 watt-hours, 10 cents per 1,000 watt-hours, 47½ per cent. discount.
Under 1,600,000 watt-hours, 10 cents per 1,000 watt-hours, 50 per cent. discount.
Under 1,800,000 watt-hours, 10 cents per 1,000 watt-hours, 52½ per cent. discount.
Under 2,000,000 watt-hours, 10 cents per 1,000 watt-hours, 55 per cent. discount.

For any amount of electricity between any two consecutive amounts above specified, the charge for the excess over the lower of such two amounts shall be a proportional part of the difference in price of such two amounts.

No discount to be allowed on any bill not paid within ten days from its date.

The consumer guarantees to pay the company each month during the period of this agreement not less than one dollar ($1.00) per horsepower, or fraction thereof, in rated capacity of motor or motors connected.

The rules and regulations of the company endorsed on the back hereof are hereby made a part of this application.

This application shall not be binding on the company until accepted in writing by its second vice-president, and cannot be varied or waived by any representations or promises of any agent, solicitor or other person, unless incorporated into this agreement in writing before such acceptance.

Dated, Chicago,.....190..

.....
Consumer.

Accepted.....190..
Chicago Edison Company,
By.....
Second Vice-President.

RULES AND REGULATIONS

Referred to in, and made a part of, the above application.

All wiring and other electrical equipment in said premises (except meters) shall be furnished by the consumer, and shall be maintained by the consumer at all times in conformity with the requirements of the Department of Electricity of the city of Chicago, and with the reasonable rules and regulations of the company's inspection department in force from time to time. The consumer shall protect and indemnify the company in respect to injury to the company, to the consumer and to others, resulting in any way from defective electrical equipment in said premises or from any negligence on the part of the consumer.

The properly authorized agents of the company shall at all reasonable hours have free access to said premises for the purpose of examining, repairing or removing its meters, and the consumer agrees to protect at all times such meter or meters from interference or damage.

The consumer agrees that, during the continuance of this contract, no electricity for lighting, heating or power purposes, other than that furnished by the company, will be used in said premises; and also that no electrical conductors for light, heat or power purposes, other than those used in connection with the company's service mains, will be installed or maintained in said premises.

The company is hereby authorized and empowered to cut off the supply of electricity and remove its meters and other property whenever any bill is in arrears, or upon violation by the consumer of any of the terms or conditions of this contract or of any other contract with the consumer, or to protect itself from fraud or abuse; and in case of such cutting off by the company, in addition to the amount then due, there shall immediately become due and be payable to the company, as liquidated damages, not as a penalty, a further sum equal to the minimum amount guaranteed under this contract for the remainder of the term of this contract.

The company agrees to use reasonable diligence in endeavoring to provide a regular and uninterrupted supply of electricity to the consumer under this agreement, but it shall not be understood as guaranteeing a constant supply of electricity. The company shall not be liable for any damages which the consumer may sustain in consequence of the company's failure at any time to supply electricity to the consumer, unless such failure shall be due to negligent or wrongful conduct on the part of the company toward the consumer, and particularly shall not be liable for any damages in case of a failure to supply electricity to the consumer in consequence of a strike, a fire or other casualty, but whenever it shall be disabled temporarily by a fire or other casualty, it will use prompt and diligent efforts to make needed repairs, so as to restore the supply of electricity as soon as practicable.

POWER SERVICE APPLICATION.

(Maximum Demand System.)

The subscriber, hereinafter called the consumer, requests the Chicago Edison Company, its successors and assigns, hereinafter called the company, to furnish electricity for the operation of.....electric motor..of.....horse-power rated capacity, to be used only for power purposes in the premises at No.....Chicago, Ill., for a period of.....year.., commencing.....190.., and ending .....190.., and thereafter until this agreement is terminated by 30 days' written notice being given from one party to the other.

The consumer agrees to pay the company monthly for such electricity at the following rates per kilowatt-hour, as measured by meter to be furnished and installed by the company:

Ten cents per kilowatt-hour for an amount of electricity equivalent to the first 30 hours (or fraction thereof) per month use of the maximum demand.

Low-rate consumption—

Eight cents per kilowatt-hour for an amount of electricity equivalent to the next 30 hours (or fraction thereof) per month use of the maximum demand.

Six cents per kilowatt-hour for an amount of electricity equivalent to the next 30 hours (or fraction thereof) per month use of the maximum demand.

Four cents per kilowatt-hour for an amount of electricity equivalent to the next 450 hours (or fraction thereof) per month use of the maximum demand.

Three cents per kilowatt-hour for an amount of electricity equivalent to the last 180 hours (or fraction thereof) per month use of the maximum demand.

The consumer shall be allowed the following discounts from the net low rate portion of all bills figured as hereinbefore described each month in which such net low rate portion amounts to over $20.00:

Under $20.00, no discount.
Under $40,00, 15 per cent. discount.
Under $60.00, 25 per cent. discount.
Under $80.00, 30 per cent. discount.
Under $100.00, 35 per cent. discount.
Under $200.00, 40 per cent. discount.

Intermediate discounts shall be determined by interpolation.

The terms, "low rate consumption" and "low rate portion," as used in this contract, shall be construed as meaning respectively such portion of the consumption of electricity and such portion of the bill for same as is charged to the consumer, before discount is deducted, at the rate of eight cents per kilowatt-hour or less. The terms, "maximum demand," as used in this contract, shall be construed as meaning the maximum number of kilowatts used at any one time during the period covered by a bill for electricity, as shown by a maximum recording meter or meters installed by the company.

The company agrees to charge the consumer at the rates and discounts herein mentioned only upon such bills as shall be paid at the company's office on or before the tenth day after their dates. Whenever the consumer shall fail to pay the company on or before the tenth day after the date of the bill rendered, the consumer shall pay for the electricity consumed as stated in the bill, at the full rate of 10 cents for each kilowatt-hour.

The consumer guarantees to pay the company each month during the period of this agreement not less than one dollar ($1.00) per horse-power, or fraction thereof, in rated capacity of motor or motors connected.

The rules and regulations of the company endorsed on the back hereof are hereby made a part of this application.

[These rules are the same as in the foregoing application.]

This application shall not be binding on the company until accepted in writing by its second vice-president, and cannot be varied or waived by any representations or promises of any agent, solicitor or other person, unless incorporated into this agreement in writing before such acceptance.

Dated, Chicago,.....190..

.....
Consumer.

Accepted.....190..
Chicago Edison Company,
By.....
Second Vice-President.

Instructions and Cautions.—Several years ago James I. Ayer, former president of the National Electric Light Association and at that time general manager of a large central-station company in St. Louis, prepared a set of "Instructions for Employes" which was excellent. In many respects it would be hard to improve upon these rules at the present day. What follows is taken from them:

INSTRUCTIONS AND CAUTIONS.

1. Do not handle any electric-light apparatus while you are standing on the ground.

2. Never use both of your hands while handling dynamos, or anything pertaining to same, while said dynamos are being used.

3. Do not touch a water pipe, iron post, or any stone, brick or iron structure while in contact with a lamp, line, dynamo, or anything connected with the electric-light apparatus at the same time, unless you are provided with rubber gloves and other insulating material, which the company has declared to you to be necessary and sufficient to fully protect you from accident by the electric current.

4. When your business necessitates your going through the station, keep as far as possible from the machinery and belting, and do not meddle with anything unless you are ordered by the man in charge, and then only after receiving careful instructions.

5. No one is permitted to in any manner work on the switchboards except when directed so to do by the man in charge of dynamo room, and then only after receiving careful instructions.

6. Keep away from the lightning arresters and the wires leading to them.

7. Linemen or others operating on lines must handle each and every wire at all times as if it were charged with electric-lighting current and grounded.

8. When obliged to pass over, under, or by an electric wire, avoid touching it in any manner, and especially with any uncovered portion of your person. Damp or wet clothing makes chance contact with wire dangerous.

9. Tools used by linemen and others who have occasion to work on lamps or apparatus which may be charged with the current must have handles well covered with rubber or other insulating material, and it shall be the duty of every lineman to look after his tools and see that they are in good condition for use, and especially as to the insulation of the handles.

10. If it is at any time necessary to stand on the ground or any surface not insulated from the ground while handling electric wires or apparatus, heavy gum boots or an insulated stool must be used; and under no circumstances allow yourself to make contact between two or more wires at the same time.

11. Lamp trimmers and others engaged in taking care of and trimming lamps must see that the switch on the board from which the lamp hangs is closed before they proceed to handle the lamp. Instructions laid down in Article 3 of these rules must be observed in connection with the work of handling the lamps.

12. In the event of any one in any manner being caught on live wires, where it is possible to get to them, pull the one caught away by grasping any portion of his clothing or body protected by clothing. There would be no possible danger to the one rendering help, no matter where you may be standing. If the one caught should be on a pole or ladder, he could usually release himself by kicking himself loose from the supports or drawing up his knees, thereby causing the body to fall. It is understood that employes will wear and use their safety belts when working above ground on poles or ladders, especially when handling wires.

13. Rubber gloves, rubber insulating material for tools used by employes and other protective articles will be found in the storeroom. Employes have every access to these goods at all times through the storekeeper. They should examine their gloves and the insulation of their tool handles daily, and if they discover any defects therein return the same to the storekeeper and select themselves perfect tools in place thereof. No charge has been made or will be made for goods thus exchanged. Employes who have been provided with tools must return them on leaving the service of the company, or the cost of the tools will be charged against their account.

14. Any employe known to violate any of the above rules, or disobey any of the instructions or cautions, thus endangering his own life or the personal safety of others, will be immediately dismissed from the service if complaint is made at the office.

I hereby certify that I have received and am in possession of a copy of the above and foregoing instructions and cautions relative to risks; also a copy of the general instructions to employes of the Municipal Electric Lighting and Power Company as a that I am fully acquainted with the contents thereof, and that I have accepted employment from the Municipal Electric Lighting and Power Company as a ....., knowing fully the risks incident to my said employment and the business carried on by said company.

.....

St. Louis, Mo.....190.....
Witness.....

GENERAL INSTRUCTIONS.

1. All employes are requested to report anything of interest to the company which they may learn, whether in their department or not, so that the best results may be obtained at all times in all departments.

2. All instructions which follow must be read and observed by all employes, wherever they may apply to any work they are required to do, whether designated for the government of the department they are in or not.

3. At the station, papers and books are supplied relating to the business, and you are urged to spend and hour or two using them when you can.

4. All necessary line tools that you are required to have will be furnished by the company on application to the storekeeper, except pliers, connectors, climbers, screwdrivers, belts and other similar small tools. These tools all linemen must own. If desired, they can be purchased of the company, and on leaving they can be returned and the money will be refunded. All tools above mentioned issued by the storekeeper will be charged and deducted from your pay.

5. Do not use defective tools or appliances, whether yours or those of the company. If you have defective tools, ladders or other appliances you are hereby ordered not to work with them, and no foreman or others must be regarded who instructs you otherwise.

6. A written report of all accidents, whether to persons or property, wherein this company could possibly be interested, must be made on the accident blanks and forwarded to the office as soon as possible after the accident occurs.

LINE WORK.

When cutting wire grip the line with the cutting jaws of the pliers and move up and down at right angles with the wire two or three times so that you cut the insulation part of the way round on both sides; then hold your pliers firmly, bend the wire once or twice up and down with your left hand and the wire will break. Never try to break the wire by twisting your pliers unless you first move the line out of the cutting jaws. There is no excuse for nicks in the cutting jaws of Stubb's pliers, and careful linemen rarely have it happen.

7. In stripping the end of wire to make a connection always cut along the wire toward the end in much the same manner as if whittling a stick. Never

cut round the wire with the edge of the knife or pliers, except when cutting the wire.

8. In making joints, be careful never to let the cutting jaws or edge of your tools "score" the wire. If you do, don't cover it up, but make a new joint.

9. After a joint is made with not less than four turns each side of the connectors, dip or moisten with acid. If you are on the ground, dip the joint in melted solder and hold it there a few seconds to thoroughly heat the joint, then take it out. If well "tinned," dip it in water to remove any acid which may be on the ends of the wire near the insulation.

10. If where you cannot dip the joint, but have to use the ladle, pour the solder frequently over the joint until it leaves a thin, smooth coating on the wire. It is not properly done if the solder is in lumps or on in a thick layer.

11. If you are obliged to use a "blow pot," hold the joint in the flame until the solder will easily melt when held against the wire after the flame is removed. When this is accomplished, apply the solder with the flame, and not before.

12. Solder is put on the joints to keep them from corroding, thereby insuring good contact where the two wires come together, and is of no use if not well applied.

13. After the joint is well cleaned of acid after being soldered, paint it thoroughly with insulating compound, then cover with a layer of tape, which you will start on one side of the joint, against the insulation of the wire, but not over it. Have the first layer cover the joint and bare wire only. When this is done, paint it, then start back over the joint and tape until you have run over the line insulation about two inches, then wrap two more layers, painting each when done.

14. In wrapping tape, cover what you have half, or lap one-half. After four layers are on, paint the whole thoroughly.

15. Whenever you find a break in the insulation on the line anywhere, paint it first, then tape and paint it. Don't forget this.

16. In "tying in," never draw the tie wire so as to bend a kink in the line or cut through the insulation with the tie. A tie will properly hold the wire in place without drawing it so tight as to do either.

17. In using pulley blocks on the line, avoid the use of "come-alongs" when possible, by taking a series of half-hitches, or making a "noose wrap" with a small line on the wire to hook the block to. If you do use "come-alongs," see that you do not score, cut or kink the wire, and always paint and tape broken insulation.

18. Groundmen are especially cautioned to watch the line in "paying out" and prevent "kinking." Should a short kink get pulled into the line, cut it out rather than take the risk of its breaking, though you should straighten it out.

19. Never use porcelain knobs where exposed to moisture or the weather, and never use them anywhere else if glass can possibly be used.

20. Porcelain knobs circuit breaks may be used where necessary, providing not more than two lamps are on the loop. In making them, paint and insulate with tape the joints in connecting wire of loop.

21. In making house connections where wires enter building, be sure to have not less than six inches clearance from cornices of walls. All wiring running over cornices or other building projections must be protected with rubber tubing, thoroughly taped and painted at the end. Never let a wire, however well protected, come in contact with any outside portion of the building.

22. In placing tubing on wire, carefully paint and tape at he upper end, leaving the lower end open, so that moisture could escape if it got in.

23. Always run wires in straight parallel lines, and make square turns where possible. Twelve inches between wires is the proper space for arc-lighting circuits, where practicable.

24. Never fasten a cut-out box against the wall. Always place glass or porcelain knobs between the box and the wall.

25. Never fail to put in "drip loops" in line where entering building.

26. In all electrical work, remember where insulation is desired it can never be too good, or when contact is desired, you can never make it too good or strong.

27. In removing lamps ordered out, always close the loop at the line where it was originally cut in, and remove all dead wire. Never leave dead or unnecessary wire in circuit.

28. Always use iron pins on arms where wires turn a corner or leave the line.

29. Never screw an insulator on iron pin or bracket very tight, nor without first putting inside the glass a strip of paper folded twice or three times. This will prevent the glass being broken, as iron expands with heat nearly twice as rapidly as glass, and unless there is room enough, the difference in temperature between winter and summer would burst insulators in summer which were placed in winter.

30. In connecting line to lamps hung from suspension wire, put on safety loops by making a half-connection with a short flexible wire on each side of the insulators at the pole and on the lamp hood. Solder and tape same as other joints. Arrange the length of wires leading to lamp so the lamp will not shadow the roadway of either street.

31. No joints are permitted to be made and left without being soldered.

32. When working on an arc circuit, always keep it closed, unless you are able to have it tested O. K. during the day from the station at one o'clock, and from three to four, or as agreed with the chief inspector.

33. When placing guard wires on street crossings, always use iron pins and glass insulators to attach both ends of guard wires to. Never tie on cross-arm on pole. In stormy weather, when they may be of use, they would be dangerous every way.

34. In working on lines, all circuits must at all times be regarded as alive and grounded. With the hundreds of miles of wire throughout the city, some of which are carrying heavy current at all times, many using ground return, the line you are on may "come alive" at any time. Be careful.

35. Always avoid temporary work. It is your orders at all times to do what you do thoroughly.

36. When working on poles, be careful to stand so, if you should slip or get a shock, you would fall on your belt rather than on the wires.

37. Avoiding leaning over or crowding through wires when possible, and do not put yourself in a position where you would fall on wires, should an accident occur.

38. Always, in making connection on poles, work from below rather than above, when possible.

39. Examine cross-arms and see that they are sound and firmly fastened before trusting your weight on them.

40. Always report anything found defective, especially cross-arms or poles.

41. Be careful that all tools are securely fastened in your belt when working on pole or ladder, and, in handling wires and lines on poles, have a proper regard for the safety of those walking or driving below.

42. When working on poles, always use your safety belt, as well as other safety devices which you are requested to use. It takes but a little time to make yourself safe, and many weeks to mend a broken bone.

43. Never lay tools down when above the ground.

44. The company demands that you take the necessary time and precaution for your own protection and that of others at all times.

[*To be continued.*]

BOOK TABLE.

INDUCTION COILS: How to Make and How to Use Them. By Percival Marshall. Revised and enlarged by Kurt Stoye. New York: Spon & Chamberlain, 1906. Pages (5 by 7¼ inches), vii., 70, with 35 illustrations. Price (paper), 25 cents.

This is a revision of an English book on induction coils, and in six chapters the subject, within the limitations set at the outset, is well covered. Directions are given for making various coils, and experiments to be performed with the induction coil are set forth. The illustrations add much to the value of the book.

DICTIONARY OF ENGINEERING TERMS IN ENGLISH AND SPANISH. By Andres J. R. V. Garcia. New York: Spon & Chamberlain. 1906. Pages (4 by 5½ inches), xxxii., 150. Price, $1.

The purpose of this little book is to provide a help for engineers, electricians, manufacturers, exporters and others who have dealings with Spanish-speaking peoples. But the task has been performed, evidently, by one whose English is acquired rather than native, and who is not, moreover, well acquainted with technical language. In the English column (there are two columns on each page) are some curious-looking terms, as "about-sledge," "acerous of the slitting roller," "adjoint piece," "adjust dints," "adjutage," "aero-steam machine," "agricultural ploughing tackle," and the like, to say nothing of "yachter" and "zax" at the other end of the alphabet. However, such practical words as "alternator," "arc," "incandescent," "insulator," "telephone," "transformer" and "trolley" are not given. We are afraid that the electrical user, therefore, will find the list unsatisfactory.

PRACTICAL ALTERNATING CURRENTS AND POWER TRANSMISSION. By Newton Harrison, E. E. New York: W. L. Hedenberg Publishing Company. 1906. Pages (5 by 7½ inches), 375, with 172 illustrations. Price, $2.50.

This is a treatise which considers in the most practical manner and with the least mathematical presentation the principles and applications of alternating currents to the central station and power house plants, and includes the elements of power transmission. In the first part of the book examples are given of the conditions to be considered in planning central and sub-stations and choosing the kind of current to be used. The author then takes up the different classes of alternating currents with the devices in common use for generating, transmitting and transforming the power. Many comparative diagrams are used, which, in connection with the clear descriptions, will give the practical man an easy insight into the subjects considered.

Indiana Telephone Men Meet.

The second quarterly meeting of the Ninth District of the Indiana Independent Telephone Association was held at Vincennes on November 1st. The meeting was well attended—practically all of the companies of the entire district being present. A. C. Lindermuth, president, of Richmond, and C. S. Norton, secretary, of Indianapolis, officers of the State Association, were also present. After the routine business was out of the way, Philip Dilly of Huntingburg presented a paper on "The Value of Rural Telephone." Mr. Dilly cited the manifold uses to which the telephone has been put to by the country people, and concluded by advocating standard construction, and insisted that rural telephone companies should not go into the telephone business without receiving a fair rental from their investment. Mr. Dilly's paper was discussed by Mr. Henry Landgreve and others, who extolled the manifold blessings that the telephone has brought to the isolated rural districts.

Charles McGregor of Mt. Vernon made a talk on the progress being made by the Independent telephone companies in the Ninth District. He said that the Independent companies in the Ninth District had increased at least 15 per cent. during the past year, and the companies were making extensions and taking on new subscribers as rapidly as they can do so. He cited the fact that the Dubois County Telephone Company, with headquarters in Huntingburg, has just completed a No. 10 standard copper line from Huntingburg to Princeton, a distance of 47 miles.

Following Mr. McGregor's remarks, five-minute talks were had from a large number of the delegates present. These indicated a healthy condition among the telephone companies, and a determined disposition to stand aloof from any alliance with the Bell people. Encouraging reports were made by President Lindermuth and Secretary Norton, showing that the condition of Independent telephony throughout the state was the best in the history of the business. The delegates were handsomely entertained at the Grand Hotel as the guests of W. H. Golmer and W. H. Moore of Vincennes.

Telephone Company Not Compelled to Connect with Other Extension Apparatus.

In the case of Beach and others against the Chicago Telephone Company Judge Windes of the Cook County Circuit Court has decided that the company is not bound to furnish its service to a telephone extension installed by a subscriber and of a type of apparatus not approved by the company. The plaintiffs held that they could buy extension apparatus in the open market and attach it to the company's wires so long as they paid the bill for service. But the court ruled on this interesting point differently, as will be seen by the following extract from the opinion:

"The court further finds that, considering the character of the service that the defendant company has to render, the extent of that service, and especially the concession of complainant's counsel in this case, that inferior instruments and improper installations would have a detrimental effect upon the service that the defendant is performing for the public, the respective contracts of the complainants with the defendant, whereby the said complainants as lessees agree not to make, permit or use any electrical or mechanical connections, contrivances or apparatus with the lines, instruments and equipment furnished under said contracts by the defendant as lessor, without the consent of said lessor, are not invalid contracts, and that the regulation of the defendant in that regard is not an unreasonable one. That to protect the telephone service rendered by the defendant and make that service practicable to its subscribers in Chicago requires that the defendant not only has the right to inspect and repair all its apparatus, but that it should have the complete control of the apparatus, and should have the right, under reasonable regulations, to say whether or not there shall be any foreign attachments to its telephone system, in the city of Chicago."

Wisconsin Telephone Gathering.

Two district meetings of the Wisconsin Telephone Company's officers and managers were held in Janesville, Wis., recently. The sessions were held jointly in the Grand Hotel, and among those who spoke were A. Burt of Milwaukee, president of the company, and E. B. Cottrell, state manager, also from Milwaukee. Those in attendance were Edward Barron, Delavan; H. O. Jacobs and W. H. Drew, Racine; H. T. Jenkins, R. D. Evans, E. L. Edwards and A. P. Helm, Beloit; A. Hayden, Shullsburg; C. Showers, Darlington; H. J. Lake, Elkhorn; Olaf Johnson, Whitewater; James Brewer, Mineral Point; M. J. Carney, F. J. Mayer, F. H. Lincoln, F. E. McKenna and J. P. Brennan, Milwaukee, and F. E. Johnson, J. L. Fletcher, James Fraser, Joseph C. Shuler, Charles Tallman, B. A. Oliver and L. J. Madden of Janesville.

Ohio Telephone Notes.

The Queen City Home Telephone Company has applied to the Probate Court of Hamilton County, asking that it direct in what mode the company may construct telephone and telegraph lines along certain roads and streets in Cincinnati. A franchise, which was applied for last July, has been refused by the Council, the application says, and the application must now be made to the Probate Court. It will be remembered that the predecessor of this company fought a case through all the courts of the state some time ago and was beaten because of some technicality in the organization. This, it is believed, has been corrected and another hard fight may be looked for, as the Independents have not yet gained an entrance to Cincinnati.

As soon as the new exchange is installed at Manchester a metallic circuit from that point to Waverly will be established. The line will work in connection with the Home Telephone Company of Waverly. A new line is being built from Waverly to Sohn's Corner.

The new West exchange of the Cincinnati and Suburban Bell Telephone Company will be built on York Street, and the building will be of the same kind as the Canal exchange. The building will cost about $70,000 and the switchboard $78,000. The present West exchange will be discontinued as soon as the new one is completed.

All the securities in the treasury of the Federal Telephone Company, not optioned by the Brailey syndicate, have been underwritten by the Everett-Moore people, and it has been planned that the company shall be dissolved about December 1st. If the Brailey people do not take the remainder of the securities by that time, they, too, it is said, will be taken by the Everett-Moore syndicate, so that the old company will be able to go out of existence and in good shape.

G. M. Fink of Salem has brought suit against the Columbiana County Telephone Company to recover $400 which he alleges is due him for services. In 1903 it is said that the members of the Salem Business Men's Association had planned to boycott the company's service, and Fink asserts that he made a contract with the company to keep it informed of all action taken by the association at its secret sessions and to argue in favor of the company whenever opportunity was given. He now wants pay for the work alleged to have been done in this way.

C.

Indiana Telephone Items.

The Mutual Telephone Company of Crandall, Ind., has incorporated to construct and operate a telephone exchange and plant. The capital stock is $5,000; J. L. Walk, James Crandall and William Rundell, directors.

The Monrovia Mutual Telephone Company of Monrovia, Ind., has increased its capital stock with a view of installing a new switchboard and making other desired improvements.

The Dubois County Telephone Company has completed the construction of a standard copper toll line from Huntingburg to Princeton, a distance of nearly 50 miles. This new toll line will provide all the companies of this portion of the state a direct outlet to Louisville and the South. Heretofore long-distance to Louisville was secured by way of Indianapolis.

The Portage Home Telephone Company of Chesterton, Ind., has applied for admission to the city of Valparaiso. This company is composed largely of farmers, but has a large patronage.

The Independent Telephone Company in the vicinity of Union City is making a determined effort to establish an exchange in Union City.

The Citizens' Telephone Company of Columbus, Ind., has at last entered upon the work of rebuilding the company's plant at Elizabethtown. The Citizens' company still controls the local situation, but the Central Union Company is getting its new $40,000 plant in shape to become a formidable competitor for business.

The Rushville Cooperative Telephone Company is extending its lines to all parts of the city and reaching out to the rural districts of the county.

The Indianapolis Telephone Company has let the contract for its new exchange building, and the work will be pushed to completion as rapidly as possible. The new building will provide a large operating room for a new and modern switchboard, which the company is now endeavoring to procure in the market.

S. S.

Telephone News from the Northwest.

The Commercial Club of Fargo has voted in favor of admitting the North Dakota Independent Telephone Company to the city for long-distance service.

The Elgin Telephone Company of Elgin, Minn., has been sold to the Greenwood Prairie Telephone Company and is merged with that system.

The Northwestern Telephone Exchange Company will rebuild the local exchange in St. Cloud, Minn., at a cost of $50,000. There will be 20,000 feet of underground and 25,000 feet of aerial cable.

The Deer Creek Telephone Company of Deer Creek, Minn., has filed articles of incorporation with a capital of $25,000.

The Tri-State Telephone and Telegraph Company of Minneapolis contemplates building a long-distance line from the Twin Cities to Chicago. If the controversy in Chicago comes out in favor of the Independents, this company will proceed to build the line without delay.

The Pierpont Telephone Company of Pierpont, S. D., has filed articles of incorporation with a capital of $10,000. E. X. Knight heads the list of stockholders.

Andrew Goff has sold the telephone systems at Cooperstown and Binford, N. D., together with a number of rural lines, to a syndicate of Cooperstown business men.

The Nebraska Telephone Company will move its exchange and offices at Oakland, Neb., into a larger building shortly.

The Northeastern Iowa Independent Telephone Association held its semi-annual convention at Mason City on October 30th. The association covers 30 counties.

E. H. Martin and M. M. Martin have incorporated the Martin Telephone Company of Webster City, Iowa, with a capital of $200,000.

Articles of incorporation have been filed for the Farmers' Mutual Telephone Company at Ord, Neb. Capital, $25,000.

An injunction has been granted restraining the receiver of the Montgomery County Telephone Company from selling the plant at Red Oak, Iowa, to pay off the indebtedness.

L. O. Pillsbury has resigned his position as manager of the Midland Telephone Company of Milford, Iowa.

R.

Sale of Automatic Telephone Plant in Chicago.

A new telephone company, which may expand the automatic system of the Illinois Tunnel Company into a service for the whole city and also give long-distance connections with the outlying systems represented in the Independent Telephone Association, has contracted to take over the entire telephone outfit of the tunnel company, according to a statement made by Martin W. Littleton, a New York lawyer and former president of the borough of Brooklyn. President Albert G. Wheeler of the Illinois Tunnel Company confirmed Mr. Littleton's statement.

"The Illinois Tunnel Company has made an arrangement whereby its telephone business will be taken over for operation in connection with the Independent lines," said President Wheeler. "This step has been taken because we wish to be free to handle only our rapidly expanding freight business. The transfer has nothing to do with any part of the subway property except the telephone system."

The Illinois Tunnel Company has about 7,600 subscribers at present, and to hold its franchise it must have 20,000 subscribers by July, 1908.

Ed L. Barbour of Indiana and J. C. Powers of Louisville, Ky., are expected to supervise the practical work of extending the Independent telephone service in Chicago, according to Mr. Littleton.

GENERAL TELEPHONE NEWS.

The Chicago Telephone Company reports for October a net increase of 1,391 telephones in use in the city and 772 in the country, a total gain of 2,163. The total number of instruments the company now has in service is 165,995.

Revised inventories of damages sustained in and near Ogden, Utah, by the recent windstorm in that city place the property loss at $150,000. The heaviest loss is said to have been sustained by the Rocky Mountain Bell Telephone Company, but, owing to the energy of the local management, it was the first company to get communication through to Salt Lake, and also to have all its toll lines to the north in working order. The company had 100 55-foot poles destroyed within the limits of Ogden, and lost 12 miles of line south of Ogden, with a gap of three miles between the limits of Ogden and Hot Springs. A force of 75 men was gathered, and the work of reconstruction went on with success. Over the poles of the Bell company the lines of the Postal Telegraph Company were restored to service. P. H. Irwin, superintendent of the Utah division of the Bell company, complimented Resident Manager E. E. Harrison on the rapid repair of the damage.

The Washington Waterpower Company has just completed at Post Falls, Idaho, northeast of Spokane, a movable dam of the bear-trap type, said by experts to span a wider channel than any other similar structure. W. C. Weeks, superintendent, says it closes an opening 110 feet wide and is operated by one person. The purpose is to provide an easily controlled opening for the passage of an immense volume of water, laden with debris and drift.

CORRESPONDENCE.

Continental Europe.

Paris, October 23.—A project is reported from Berlin relating to a suspended electric railway on the plan of the Elberfeld-Barmen system, which is to run between Gesundbrünnen, Alexander Platz and Rexdorf. Some objections have been made to the building of such a line on account of its rather unsightly appearance. Nevertheless, it seems that a concession is now granted to the projectors by the municipality for the construction of a trial section of road, and efforts will be made to give the structure as handsome an appearance as possible. Prominent Berlin architects are designing the overhead structure and the stations.

The cities of Valladolid and Salamanca, together with the town of Zamora and a certain extent of territory, are to have a supply of current from a new hydro-electric plant which will be one of the largest ones so far erected in Spain. A fall of about 40 feet can be secured from the Douro River, which is to be utilized for this purpose, and the station will be set up at Zamora. The Alioth three-phase system is adopted, and the plant is to contain two alternator sets of 500 horsepower and five larger groups of 1,000 horsepower. In the lower story are the turbines, and the alternators are mounted in the upper floor upon the vertical shafts of the wheels. The machine voltage of 6,000 is raised for the lines to 20,000 and 40,000 volts. From the plant to the city of Valladolid the distance is about 70 miles.

Not long ago the German cruiser Muenchen (Munich), carrying a set of space-telegraphy apparatus, started on a trip through the North Sea, all the while keeping up communication with the large station of Norddeich, near Emden. This it was able to do for a good part of the cruise, but the limit seems to have been reached at Cromsoe, a distance of 1,150 miles, as the mast was not high enough to send the signals at that distance. With a higher mast it is expected to do better, and for this purpose a second vessel, the Vineta, will be sent over the same route, using a mast which is 360 feet high above sea level.

Experiments carried on between the Eiffel Tower and the island of Porqueralles show that wireless signals can be sent between these points, and if the results are satisfactory it is expected to set up a permanent station on the island so as to connect it with Paris.

In the alkaline accumulator it is found that nickel scales added to the active matter of the anodes serve to increase the conductivity and are an advantage. A new method of forming such scales has been brought out in Germany by the Cologne Accumulator Works. In a bath of a nickel salt is placed as a cathode an aluminum or zinc plate, and a thin layer of nickel is deposited on it. Then the plate is dipped in a caustic alkali bath, which does not attack the nickel, while the underlying plate is dissolved. In this way the surface film of nickel is detached in the form of scales, whose size depends on the nature of the electrode and the solution.

A new electric coffee roaster has appeared in Austria, using a hot-air blast for the heating, and the coffee is said to have a better aroma and a larger amount of soluble matter than when roasted by coke. The apparatus consists of a resistance coil heater, combined with a motor-driven shaking tray and an electric fan which sends the current of hot air over the trays.

The city of Budapest will no doubt have an extension of some of the tramway lines, as the Budapest Electric Railway Company is planning to make connection between its system and the Budapest Szentlörinczer narrow-gauge electric railroad. Some of the other electric traction lines of the city are to be extended, according to the most recent reports, and the municipality of Prague is also to increase its tramway lines, and expects to use steam-turbine units to give the required current for the purpose. The first turbine to be installed will give 4,300 horsepower, and is to run a three-phase alternator of 3,000 kilowatts.

An extension of the underground conduit tramway has been recently made at Paris by the French Thomson-Houston Company in the shape of a branch line. The main line runs from the Place de la Bastille to the Etoile. Near the Montparnasse Depot a branch is now running which extends towards the southern part of town, and it now carries considerable traffic. The same company has been making experiments upon three-phase motors for tramways upon the Malakoff line.

A. de C.

Great Britain.

London, October 24.—Amid the difficulties which most of the electric-power companies in Great Britain admit they are experiencing the one bright spot would seem to be that northeast corner of England over which Mr. Merz, of London power fame, has waved his fairy wand. Industry in this part of England is thriving on a cheap supply of electric power, and, conversely, this admits of the requisite development of the electric supply authority which leads to the maximum efficiency. Many developments have taken place under Mr.

Merz's guidance, the latest of which is the consolidation of all the electric-power interests represented by three companies, each having a large area under parliamentary authority. There are some who call this a "trust" and similar things, but this particular one would appear to be unaccompanied by that menace to public interests usually associated with such organizations, for the strongest municipal argument in the world cannot remove the fact that electrical energy is cheaper in this district than anywhere else in the kingdom. The fusion of interests mentioned above has been quickly given practical effect. In the southernmost portion of the area, viz., Cleveland, hitherto the most undeveloped, an overhead network of mains is being erected which will at first carry some 6,000 kilowatts, and the power station which, before the amalgamation, was intended to contain as the first installment about 3,000 kilowatts will now have 5,000 kilowatts.

The Marylebone (London) Borough Council has been involved in an interesting legal case, which, while allowing no moral to be drawn from it, is noteworthy from more than one point of view. The Borough Council was summoned by one of its large electric-light consumers for failing to maintain a proper pressure, and was fined the full penalty allowed by the law. The case is an echo of the trouble experienced in connection with the changeover from 100 volts to 220 volts, the particular consumer having, for valid reasons, objected to going on to the higher pressure for the time being. The business of the firm was, however, seriously affected by the difficulties experienced at the power station in maintaining the 100 volts for a few customers, but in view of the decision of the court, special arrangements have been made to maintain the pressure in future. Many of the older London undertakings experienced this difficulty, the expedient resorted to generally being to charge the highest price allowable under the provisional order to those consumers who will not come over to the 220 volts.

At Greenwich (London) Major Cardew, late electrical adviser to the Board of Trade, has been retained by the Borough Council to make some experiments and report upon the purification of the atmosphere of the sewers by ozone electrically obtained. The local authority has authorized the expenditure of $250 upon the experiments, exclusive of Major Cardew's fees.

The motion which was recently brought before the Hull corporation to the effect that negotiations should be entered into with the postmaster-general for the sale of the municipal telephone undertaking has now been negatived. The Hull license expires in 1911. The Brighton municipal telephone undertaking has now been handed over to the Postoffice, and it has been arranged that the difference between the original capital expenditure and the amount received from the government shall be met by a call upon the rates. Swansea is still holding out for a better offer from the postmaster-general, which does not seem to be coming along, however.

New physical and engineering laboratories have recently been opened at Liverpool and Edinburgh. The former is the gift of Mr. E. K. Muspratt to the Liverpool University and has cost about $80,000, while the latter has cost $120,000, and forms part of the memorial to the late Professor Tait, who organized the physical laboratory in Edinburgh University as far back as 1868. Mr. Carnegie, too, has offered a donation of $57,500 for a physical laboratory at University College, Dundee, and $50,000 for something similar at St. Andrews, also in Scotland.

A 250-horsepower Kjellin electric steel furnace is in course of erection at the Sheffield works of Vickers, Sons & Maxim. This is the first furnace of this type and size to be put into commercial operation in Great Britain. G.

Dominion of Canada.

Winnipeg, Man., November 3.—The City Council and the Water Commission, upon the invitation of Chief Engineer Cyril B. Smith, visited the city's latest acquisition, the Pointe du Boise Falls. Mr. Smith, the designing engineer and the chief engineer in charge, has estimated the cost of the works at $3,250,000, which will include the cost of the transmission line and buildings. This will provide, it is estimated, 17,000 horsepower, which can be increased, if necessary, to 60,000 horsepower. The engineers expressed the opinion that power can be developed at Pointe du Boise Falls sufficient for Winnipeg for many years to come. A tramway has been surveyed which will be 22 miles long. Mr. W. M. Scott will have charge of the preliminary work. He will enlarge upon the survey already made and will forward the result to Chief Engineer C. B. Smith after it is in shape. After that the transmision line to Winnipeg will be surveyed. This line will be 75 miles long in a northeasterly direction. Pointe du Boise is 22 miles from Lac du Bonnet, where an immense power has been developed for the Winnipeg electric street railway and the Winnipeg Electric Light and Power Company, both companies being owned by the Mackenzie and Mann syndicate. R. D. Wilson, assistant city engineer, who has been at the head of a survey party laying out the course of the tramway to be built from Lac du Bonnet to Pointe du Boise in connection with the city power scheme, has returned to the city having completed the work. This means that everything is now ready to start on the construction of the electric tramway.

The Winnipeg Street Railway Company has approached the Town Council of St. Boniface for right-of-way over the Seine River Bridge as soon as that structure is completed, and it is the intention of the company to run their cars up to the site of the Grand Trunk Pacific Shops.

As a result of the application by the Strathcona Radial Tramway Company for a franchise in Edmonton, the City Council has decided that it was not advisable for the city to part with a street railway franchise to a private corporation, and the question has been shelved for two weeks. Mayor Sheppard of Strathcona wants Strathcona and Edmonton to combine in their efforts and public enterprises, and has outlined a scheme whereby the towns should be connected in their public enterprises, such as electric light, telephones and waterworks for their mutual benefit. The outcome would be a complete union.

The corporation of Port Arthur, Ont., has placed contracts for an important extension to its municipal hydro-electric plant. The waterwheel portion of the equipment will consist of a pair of 30-inch special Crocker turbines. The contract for the turbines was placed with the Jenckes Machine Company, Toronto. The turbine unit will be direct connected to an Allis-Chalmers-Bullock generator. A special meeting of the Town Council was held to consider the offer of the Nepigon Pulp and Paper Company of electric power at the price of $15 per horsepower laid down in Port Arthur. The company has a pulp and paper mill on the Nepigon River, where power is to be developed. The power is to be brought across country about 50 miles to Port Arthur and the town given 3,000 horsepower at the rate named. Then 7,000 additional horsepower is to be delivered in Port Arthur as occasion may require at a cost of $20 per horsepower.

Barrie, Ont., now has two propositions before it for an electric street railway, one from Fred Nicholls of Toronto for a 25-year franchise, with heat and power, the other from local men for a 30-year franchise, with the right of renewal. If Fred Nicholls gets it, his company will put a fast steamer on this lake, the object being to connect with the Canadian Pacific Railway as well as to do a large local business.

The management of the Montreal Street Railway Company announce that after the annual meeting on November 7th a special meeting of the shareholders will be called for the purpose of authorizing the board of directors to issue $2,000,000 more capital. This will bring the issued capital up to $9,000,000. New stock will be issued at a premium of 75 per cent. The present market price of the stock is 276. The money is to be expended on new improvements and extensions. H.

New England.

Boston, Mass., November 3.—The strike of the New York chauffeurs of electric cabs has not been felt in this city. There are very few public electric cabs in Boston, and people in charge of the leading garages state that so far as they know, no Boston chauffeurs have gone to New York to take the places of the strikers, largely because the Boston chauffeurs are receiving as good wages as those demanded by the New York strikers.

In the United States Circuit Court, Judge Colt has referred the suit of the National Telephone Manufacturing Company vs. the American Bell Telephone Company, to an auditor. The suit is an action for damages for alleged malicious prosecution, the Bell company having sued to prevent an infringement of the Berliner transmitter patent by the National company. The Court of Appeals held that the patent was invalid and the National company wants a financial recompense for the action brought against it.

The Goff's Falls, Litchfield and Hudson Electric Railway Company has nearly completed its road between Manchester and Nashua, N. H., via Goff's Falls, Litchfield and Hudson, a distance of 17 miles. When this road is in operation there will be a continuous electric-railway line between Boston and Concord, N. H., a distance of 75 miles. The road will be on private land the greater part of the way, and the cars will be run at a high rate of speed, the highest grade being only 1½ per cent. There is a trestle on the road that is 400 feet long and 40 feet high.

The Newton, the Waltham, and the Lexington and Boston street railway companies have asked the Waltham, Mass., aldermen for freight franchises in that city. All the municipalities between Boston and Waltham have granted franchises for freight transportation by electric railway companies.

The Consolidated Railway Company is surveying for an electric railway between Canaan, Conn., and Great Barrington, Mass.

The Massachusetts Railroad Commissioners have approved the Blue Hill Street Railway Company's plan to carry freight and express between Mattapan and Canton.

Dr. George W. Pierce, professor of physics at Harvard University, gave a talk on wave lengths in wireless telegraphy before the Boston Society of Arts, on the evening of October 25th, illustrating his remarks with stereopticon views. He gave a detailed history of the origin and growth of the magnetic wave theory. He stated that Lord Kelvin was the first to prove mathematically the correctness of the theory, and Federson's experiments proved its correctness, beyond doubt, by photographing the oscillatory discharge of sparks from a Leyden jar connected with a coil of high induction. A revolving mirror reflected the sparks as they passed to and fro and the photographic plate showed blotches of regular character instead of one streak, as it would have done had the sparks been continuous. Dr. Pierce has perfected a wireless receiving apparatus and has installed three of his receivers at United States naval stations. He stated that wireless messages could be sent 1,200 miles.

The Marlboro Electric Machine and Lamp Company having reached the limit of its space at its Marlboro, Mass., factory, has decided to establish a manufacturing plant at Worcester, Mass. The Marlboro factory is turning out 12,000 lamps a day.

The Hanover, N. H., automatic telephone exchange of the New England Telephone and Telegraph Company was destroyed by fire on Tuesday. B.

New York.

New York City, November 3.—The proposition to third-track the Second and Third Avenue elevated roads has been revived by the Rapid Transit Commission, and arguments in favor of the scheme were heard yesterday. The opposition contented itself with putting in a list of the organizations which were against the plan, and at the close of the meeting the matter was referred to the committee on plans and contracts with instructions to see what could be done and report back to the full board.

Applications for space are being received by Dr. William H. Tolman, 287 Fourth Avenue, for the exposition of safety devices which the American Institute of Social Service proposes to hold here January 28 to February 9, 1907. A notice which the Institute is sending out says that gratifying interest is being shown by the inventors and manufacturers of devices for protecting the lives and limbs of workers and the general public. Commissioner General Kohlsaat desires to secure the entire exposition for the enrichment of the Jamestown Exposition.

A class of six engineers of the New York, New Haven and Hartford Railroad has been selected from 153 engineers who expressed their willingness to learn the working of the electric locomotives which are soon to replace the steam engines on that road. The class received instructions in the operations of the new motor at Rye, N. Y. While the New Haven men are being instructed in the operation of the third rail, still the latter is only used within the New York yard limits to conform with the New York Central system, the power on the main line of the New Haven being conveyed by means of the overhead trolley. The new motors which were built by the Westinghouse Electric and Manufacturing Company are single-phase and are different from those to be used on the Central, which came from the General Electric Company, and are operated on direct current.

Some little excitement was caused at the Manhattan end of the Brooklyn Bridge on Wednesday evening by the failure of both power and light. The same electric plant supplies the power to run the cars and the current to light the surface loop on the bridge. The trouble was in the power house and lasted about eight minutes.

The November meeting of the Illuminating Engineering Society will be held at the Edison Auditorium, 44 West Twenty-seventh Street, at 8:15 p. m. on Friday, November 9th. Papers will be read on these subjects: "Fixture Location in Residence Lighting," by F. N. Olcott; "Fixture Design and Location," by Major E. L. Zalinski; "Location of Lamps and Illuminating Efficiency," by Preston S. Millar.

It is expected that President Roosevelt will take a hand in the launching in this city on November 16th of the national movement in behalf of "industrial education" in the public schools to displace the "classical" training. A letter from him will be read at a public meeting to be held in Cooper Union on the evening of that day. President Carman of Lewis Institute, Chicago, is an accredited delegate. Addresses will be made by Frank A. Vanderlip, vice-president of the National City Bank; Frederick P. Fish, president of the American Telephone and Telegraph Company; Miss Jane Addams, Chicago; Dr. Nicholas Murray Butler, president of Columbia University, and Frank P. Sargent, United States commissioner general of immigration.

Southeastern States.

Charlotte, N. C., November 2.—The contract for installing the lighting system in the new addition to the McGhee Manufacturing Company's new

mill at Greenville, S. C., has been let to the R. G. Auten Company of Charlotte, N. C.

The electric-light plant of Sanford, N. C., owned by F. I. Thompson & Son, was burned recently, the loss being estimated at $7,000. There was no insurance on the plant. Mr. Thompson says that it will be rebuilt without delay.

The town of Statesville, N. C., is considering bids and plans for the new electric-light and power plant, power for which will be supplied by the Southern Power Company of Charlotte. Several sites are also under consideration.

The Concord, N. C., Street Railway Company is a new concern which proposes to build an electric line in Concord, with a $125,000 capital stock. W. C. Johnson of Charlotte is president.

The lighting plant at Blue Ridge, Ga., is to be moved to Marianna, Fla., by the owner, John H. Carter of Blue Ridge.

The newly organized Birmingham and Huntsville electric railway is being enthusiastically supported by the farmers along the route and little difficulty is expected in securing right-of-way. The route is to be gone over at once and grades reported on by engineers. F. T. Petty is treasurer and general counsel.

The Suburban Transit Company of Columbia, S. C., has been chartered to build numerous lines to new residence suburbs about the South Carolina capital.

W. Williams & Co., Nashville, Tenn., were the lowest bidders for the construction of the Jonesboro and Nettleton electric railway and will also finance the entire bond issue of the road.

The Montgomery Traction Company of Virginia is a new concern at Christiansburg. C. A. Johnson is president. The purpose of the company is to build a 2¼-mile line connecting Christiansburg and Cambria, Va.

The Commercial Association of Danville, Va., is agitating the question of securing electric power for commercial and manufacturing purposes. The Danville Street Railway has asked for a 30-year franchise for the supplying of power for manufacturing purposes and the petition is now pending.

A great project is on foot at Charleston, S. C., in which Lawrence M. Pinckney and others are interested, with C. R. Van Etten as engineer, to build a system of electric lines virtually covering the state of South Carolina by electric line. The road is projected by the South Carolina Public Service Corporation, and it is ultimately desired that the line shall extend as far north as Charlotte, N. C. It may connect Charleston, Augusta, Columbia and other towns in the central and northwestern part of the state. L.

Ohio.

Cleveland, November 3.—The incorporation of Columbian Company in West Virginia has given rise to the report that a gigantic merger of the gas and electric properties of Cleveland and Cincinnati is to be formed. It is said the company will probably have a capital stock of something like $75,000,000, of which $50,000,000 will be common and $25,000,000 will be five per cent. first-mortgage bonds. The idea is that the company will own a large body of oil and gas lands in West Virginia, from which natural gas will be piped to the cities named. According to report the company is also to take over the Cincinnati, Newport and Covington street car line and the suspension bridge at Cincinnati. Negotiations have been under way between A. S. White and the owners of the railway for some time, and Mr. White is said to be interested in the company just incorporated. The officers of the lighting and power companies in Cleveland say that they do not know anything about the report that they are to be taken over by the holding company. The matter was talked of once before, about the time the Cincinnati Gas and Electric Company's properties were taken over on a lease by the Union Gas and Electric Company, but nothing has been said since, until a few days ago.

The Eastern Ohio Traction Company has increased the wages of its motormen and conductors. Hereafter the first-year men will receive 20 cents an hour instead of 19; the second-year men have been advanced from 20 to 22 and the third-year men from 21 to 23 cents. The freight men will receive 24 cents an hour, an advance of one cent.

The People's Heat and Power Company has applied for a 25-year franchise to furnish heat and power in Toledo, but nothing is said regarding lights. The company was organized by Homer T. Yaryan.

Construction work on the Ohio and Southern, from Columbus to the Hartman farm, has been commenced. It may be extended to Washington C. H.

The Toledo and Point Place Railroad Company and the Ottawa Beach Company of Toledo, both owned by the Toledo Railways and Light Company, have been consolidated. They will be bonded for their cost and the capital stock will go into the treasury of the old company. The new company will be the Toledo, Ottawa Beach and Northern Railway Company.

Judge R. W. Tayler of the United States Circuit Court has ordered the sale of the Toledo and Western to take place on Wednesday, December 5th. Commissioner Bradford has placed the valid claims against the company at $337,574.70 and the property cannot be sold for less than this amount.

Walter A. Black of Dayton has retired as secretary of the Columbus, Delaware and Marion Railway Company.

The Akron and Youngstown Electric Railway Company has asked for an air-line franchise through Portage County. It will be built mostly on private right-of-way. O. M. C.

Indiana.

Indianapolis, November 3.—Frank D. Norveil has been promoted from the position of assistant general freight and passenger agent to that of general passenger and freight agent of the so-called merger traction lines in Indiana, which comprise the Indianapolis and Northwestern, Indianapolis and Western, Indianapolis and Martinsville, Indianapolis and Eastern, Indianapolis Coal Traction, Richmond Street and Interurban and Indiana Union Traction Company. Mr. Norveil succeeds F. D. Wheeler, resigned. The promotion is a deserved one, as Mr. Norveil has grown up in the interurban business. He entered railroad service nearly 20 years ago as a telegraph operator.

The announcement is made that the McGowan & Schoepf syndicate will shortly place on sale a new interchangeable 1,000-mile book good for the bearer and any number of persons traveling with him on all the so-called merger lines of Indiana and Ohio for $15. This will be the first straight mileage book ever issued by an electric line in this section of the country. This book will be good on about 12 or 13 electric roads in Indiana and Ohio.

Statistics compiled by D. H. Macabee, chief of the Indiana Department of Inspection, go to show, it is declared, need of further legislation in Indiana in regard to the laws regulating boiler inspection. Mr. Macabee's figures show that during the last seven years there have been 64 boiler explosions, resulting in 49 deaths and 105 injuries.

Judge Carter, of the Superior Court, has issued a temporary restraining order against the city of Indianapolis to restrain the authorities from compelling local and electric lines to pay for electric light at street crossings, and also restraining the local light company from turning out 96 lights at crossings in compliance with a recent order of the City Council. The matter will come up for a permanent hearing next Thursday.

Experts employed by a citizens' committee in Terre Haute to investigate the service of public utilities have reported that the gas supplied by the Citizens' Gas Company is a mixture of coal and water gas, which is low, both in heating power and candlepower. It is also charged that the street lights, which are contracted for at $70 a year, are also lacking in power. The electric railway service is also marked for improvements, and the waterworks company is also charged with certain inefficiencies.

The City Council of Kokomo is asking for bids for the construction and installation of an electric telegraph fire-alarm system for the city of Kokomo, said system to consist of not less than 20 signal boxes, together with all the necessary telegraph lines and central-station equipment, with gongs, indicators, tower-bell striker and all other necessary equipment for a modern and efficient system.

The Manufacturers' Light and Power Company of Fort Wayne, Ind., has incorporated with a capital stock of $50,000 to construct and equip a plant in Fort Wayne, to generate electricity for power and light purposes. John E. Roth, Edward N. Odenburgh and S. S. Hanna are directors.

It is gratifying to remark that the new traction and terminal building of the Indiana Union Traction Company, just completed at Muncie, is a fine station and compares favorably with those at Indianapolis, Toledo and Milwaukee. It will serve as a passenger and freight terminal for the four interurban lines radiating from Muncie, three of which are operated by the Indiana Union Traction Company. It is the plan of this company to erect commodious stations in all of the cities at junction points on its lines in order properly to care for the rapidly increasing business. The Muncie station is the second completed this year. A station at Tipton was the first. Two others are now in the course of construction, one at Kokomo and the other at Logansport. The Muncie station is built on a plan similar in general features to that of the Indianapolis station. In addition to all of the facilities usually provided for the convenience of passengers, a reading room for train men and employes is also provided. The freight station adjoining is complete in all its arrangements.

The Toledo and Indiana Railway Company has completed arrangements for the extension of its line westward from Bryan, Ohio, across Northern Indiana, to Fort Wayne, by way of Waterloo. From that point the company will operate its cars over the tracks of the Toledo and Chicago Interurban, commonly called the "Seagrave Line." A trolley line is in process of construction between Chicago and South Bend, and soon the gap will be closed to enable cars to make a through passa e from Ohio across Northern Indiana to Chicago.

The promoters of the Plymouth, Goshen and White Pigeon electric railway announce that they have successfully financed the road and construction will begin soon. The scheme is to connect a large section of Indiana with Kalamazoo and several smaller towns in Michigan.

The extension of the Rushville division of the Indianapolis and Cincinnati Traction Company's line to Connersville has been opened and the officials are very much elated over the increased patronage. The Greensburg division will be next completed and this, it is thought, will double the receipts.

The City Council of Rushville has rejected all bids for improvements and the installation of new machinery in the city water and light plant. This is done on account of the bids being irregular, one of the specifications being overlooked by the bidders. New bids will be invited at once.

The railroads entering Indianapolis have decided to fight the enforcement of the ordinance recently passed by the City Council to require them to maintain arc lamps at grade crossings. This ordinance includes trolley lines as well as steam lines. The city authorities are threatening to enforce the penalty, which is $100 per day for each light.

The announcement is made that the Standard Steel Car Company of Butler, Pa., will build an immense plant at Hammond for the construction of steel cars for both steam and interurban lines. S. S.

Illinois.

Peoria, November 3.—Receiver Irwin, of the Peoria and Pekin Terminal, has returned from a conference of the stockholders of the road. He believes that some of the stockholders of the Chicago, Rock Island and Pacific and of the Chicago and Alton will be interested in the reorganization of the road. The road has a bonded indebtedness of $980,000, a floating indebtedness of $150,000 and other claims will aggregate $30,000. The receiver is preparing schedules showing the liabilities and assets to file in the United States Court. The court has ordered the line to continue in operation until further orders.

The merchants' committee has decided to draw up a new ordinance to submit to the City Council for the Peoria Gas and Electric Company. The ordinance introduced by the company has been laid over for two weeks.

The McKinley syndicate has purchased depot sites in Morton and Danvers. The buildings to be erected will contain sub-stations also. Land in or near Springfield has also been purchased to build a belt line around the city. This will be used for all through traffic and be six miles long.

Grading of the Peoria-Bloomington railway is being pushed so as to be completed before cold weather sets in. The poles are set and the wire will soon be strung. The first boiler has been completed and tested in the new power house here. The connections into East St. Louis are practically finished.

Rock Island telegraphers have asked for an increase of pay.

So many interurbans are planning to enter Springfield that a committee of merchants of that city is investigating the feasibility of building a road through the city for their use.

The Springfield and Southeastern, which purposes to build a line from Springfield to Pana, has introduced an ordinance in the City Council asking for a franchise through certain streets.

The Aurora, De Kalb and Rockford Electric Railway Company is desirous of rushing the construction as fast as possible and has decided to let the contract to complete the road at once.

The Henkle Bros. Company of Springfield has changed the name to the Plumbing, Heating and Electrical Company of Springfield.

The Spring Valley Telephone Company of Spring Valley has increased its capital stock from $10,000 to $15,000.

The Central Electric Company of this city is moving from the Telephone Building to another location. This is occasioned by the increasing business of the Central Union Telephone Company, which needs the room for its offices, so the toll board can be enlarged. V.

Northwestern States.

Minneapolis, November 3.—The big concrete dam across the St. Croix River at Taylors Falls, Minn., is now completed. The canal near the power house still has a few day's work on it, and then the plant will be placed in operation.

The farmers of Sully County, S. D., have raised over $100,000 by popular subscription for the purpose of constructing an electric line from Gettysburg to Okoboji.

The City Council of Milwaukee has selected a site for the new municipal lighting plant, paying $60,000 therefor.

William Burgess has been appointed receiver for the Duluth (Minn.) Electric and Construction Company.

The Kenmare (N. D.) Light and Power Company's plant was destroyed by fire at a loss of $10,000.

The Black Hills Traction Company is planning a further extension of its power plant on Red-

water Creek, S. D. It will use a canal six miles long at a cost of $300,000 and will furnish power to the mines in the Black Hills.

Preliminary steps are being taken looking to the construction of a trolley line between Sioux City, Iowa, and Sioux Falls, S. D.

The agitation in St. Paul for a maximum rate clause in the proposed electric franchise ordinance of the Northern Heating and Electric Company has resulted in steps being taken to regulate the electric rate of all companies furnishing electrical service in that city. An ordinance will undoubtedly be introduced in the near future.

H. T. Clarke, Jr., of Omaha, has been granted an electric-light franchise at Beatrice, Neb. R.

Pacific Slope.

San Francisco, November 1.—The Chehalis-South Bend Electric Railway Company which was recently incorporated in the state of Washington, has a capital stock of $150,000, fully subscribed. The objects of the new concern include the construction and operation of an electric road from South Bend, Wash., to Chehalis.

November 15th is the date decided upon by the Hanchett Company for commencing operations on the local electric car service in the town of Palo Alto, Cal. A great celebration of the day is being planned by the citizens. An interurban service will be inaugurated later on by the same company.

The Town Trustees of Colton, Cal., have sold a street car franchise to Daniel Johnston, the only bidder. An application for an electric railway franchise down Eighth Street from J to Congress, in the same town, has been filed by A. C. Denman.

The City Council of Pasadena, Cal., has opened bids for the proposed municipal electric-light plant. Charles C. Moore & Co. of San Francisco were the only bidders on the complete plant with electrical equipment at $36,000. The Baker Iron Works of Los Angeles and other companies sent in bids on portions of the plant.

The City Trustees of Redlands, Cal., will, on November 23d, sell two franchises for electric railways under the applications made by A. G. Hubbard and by N. Buckmaster.

The Westinghouse Electric and Manufacturing Company has purchased a building site on the tide lands at Seattle, Wash., for $75,000, and is expected to make improvements, including freight warehouses, etc.

The Mountain View Gas and Electric Company has purchased a site at Mountain View, Cal., and will begin at once the construction of a lighting plant.

The United Railroads of San Francisco will restore the cable system on Powell, Sacramento and Clay streets as soon as the pressure of rebuilding its electric system is relieved. The rehabilitation of the large cable road power house at the corner of Washington and Mason streets will be commenced soon. The company is rushing work on additional electric lines and will put in some temporary tracks on Seventh Street for a distance of several blocks to enable cars to get around to Howard Street at Freelon Street. This detour will be necessary in order to permit the resumption of electric car service on the Howard Street line before the completion of the large sewer, which is being built in Fourth Street. The continuation of the Polk and Larkin Street line south of Market Street will be made, at first, via the old Tenth Street electric line in order to save the time that would be required to change over the old cable road on Ninth Street. A.

PERSONAL.

On November 1st James J. Martindale was made assistant civil engineer of the Michigan United Railways.

Mr. H. B. Kirkland resigned his position as general sales manager of the American Circular Loom Company of Chelsea, Mass., on October 10th, according to an announcement card from that company.

F. B. Patten, manager of the advertising department of the American Electric Fuse Company at Muskegon, Mich., has resigned to take a position with the Rolfe Electric Company of Rochester, N. Y.

George Herring, chairman of the City of London (Eng.) Electric Lighting Company, and the Electric and General Investment Company, died in London on November 2d after an operation for appendicitis.

Charles B. Horton, superintendent of the Western Union Telegraph Company at Omaha, died at his home in that city on October 20th. Mr. Horton was 56 years of age and a telegraph man of wide experience.

George W. E. Atkins, for many years superintendent of the contract and free-service departments of the Western Union Telegraph Company, New York, has been elected to the position of acting vice-president in charge of the contract department. The Telegraph Age remarks that this elevation confers upon Mr. Atkins an added dignity and widens the scope of his influence and operations, and may be accepted as a just recognition of the ability and faithfulness with which he has conducted the affairs of his important office.

It is reported that Sir William Ramsay, the distinguished British chemist, has been sounded as to his acceptance of the secretaryship of the Smithsonian Institution in Washington and that he answered that his work in London would prevent him from accepting the honor.

C. W. Hutton, formerly superintendent of the Sacramento (Cal.) Electric Gas and Railway Company, has been promoted to the position of superintendent of the Sacramento division of the California Gas and Electric Corporation. He will have general charge of power houses and transmission lines.

John H. Merrill, secretary of the Central Electric Railway Association, has resigned to accept the position of general manager of the Choctaw Electric Railway and Lighting Company of McAllister, Okla. William F. Millholland, treasurer, of the association, will fill out Mr. Merrill's unexpired term, which will end next January.

Captain Roald Amundsen, said to have discovered the magnetic pole and first navigator of the Northwest Passage, was in Chicago on November 2d, and was accorded many honors. He refused to make public his detailed discoveries regarding the magnetic pole, explaining that his formal report to the Norwegian Geographical Society would have to be made first.

James J. Chambers, president of the Salt Lake Public Service Company of Salt Lake City, was in Columbus a few days ago, conferring with a number of members of his board of directors. Mr. Chambers has great faith in the future of his city, and the prospects for the company of which he is the head are bright. A number of Columbus men are interested in the company.

Helenus E. Farrington has resigned the position of master mechanic for the Boston and Northern Street Railway Company, to accept the superintendency of rolling stock for the United Railways of San Francisco. Mr. Farrington has been employed by the Boston and Northern Company and its predecessor for 26 years. He is a past-president of the New England Street Railway Club.

H. C. Abell, manager of the interests of the Muskegon (Mich.) Traction and Lighting Company, has been appointed general manager of the American Light and Traction Company's property at Long Branch, N. J., known as the Consolidated Gas Company. He will move to Long Branch but will make frequent visits to Muskegon as president of the Muskegon Traction and Lighting Company.

These changes, relating to electrical operation on the New York Central Railroad, are announced: Edwin B. Katte has been appointed chief engineer of electric traction. George A. Harwood has been appointed chief engineer of Electric Zone improvements exclusive of electric traction and signals. John D. Keiley has been appointed electrical engineer, and Carl Schwartz engineer of power stations.

Mr. F. S. Kenfield, as president of the Kenfield Publishing Company, has acquired control of the Motor Way, a weekly automobile paper published in Chicago. Mr. Kenfield is now the president of the company publishing the Motor Way, which bears the name of the Technical Press of America. As publisher of the former Street Railway Review, he is widely known in the street-railway and electrical field.

Mr. B. H. Warren died suddenly in New York city on October 20th. He was prominent in the electrical field, having been for six years with the Westinghouse Electric and Manufacturing Company as assistant general manager and second vice-president, and later president of the Allis-Chalmers Company from March, 1904, to September, 1905. He resigned from the Allis-Chalmers Company, and, after a brief rest, with the late J. C. Kafer and A. M. Mattice, formed an engineering firm in New York. Mr. Warren was a member of many engineering societies and in his earlier days held important engineering positions. He was a Bostonian and graduated from the engineering corps of the United States Naval Academy in 1874. Mr. Warren died suddenly from apoplexy at the Collingwood Hotel. His wife, one son and two daughters survive him. Arthur Warren, also well known in the electrical field, is a brother of the deceased.

B. H. WARREN.

Prof. George Walker Wilder, Ph. D., has severed his connection with the Armour Institute of Technology as professor of telephone engineering and opened an office in the Monadnock Block as a telephone engineer. During the last three years Dr. Wilder has built up a department in telephone engineering at Armour which has attracted wide attention. He has also been engaged in several important telephone investigations and has made many improvements in methods of electrical testing, especially as applied to telephone apparatus. He is a graduate of the University of Wisconsin and took two years of special electrical work in the national Polytecknium of Switzerland at Zurich, where he obtained the degree of doctor of philosophy. In 1903 Dr. Wilder accepted a position at Armour Institute of Technology, where he devoted his time to building up the telephone courses. He has written "Telephone Principles and Practice" and contributed several articles to the technical press.

GEORGE W. WILDER.

ELECTRIC LIGHTING.

Geo. W. Burkitt will construct a modern electric-light plant in Palestine, Tex.

Andrew Morrisey is seeking a franchise for an electric-light plant in Deer River, Minn.

The Weston Lumber Company of Weston, W. Va., is in the market for machinery for an electric-light plant.

The Atlantic City Electric Company of Atlantic City, Va., has been incorporated with a capital stock of $50,000.

F. D. Smith of Indianapolis, Ind., is arranging for the establishment of an electric-light and power plant at Wiggins, Miss.

R. J. Claflin, vice-president of the electric-light company of Carthage, Mo., contemplates installing an electric-light plant at Gravette, Ark.

Hersey, Mich., now has electric lights, the current being generated at the local grist mill, and the business houses and county building are being lighted.

A. S. Maltman, president of the Kankakee (Ill.) Electric Light Company, is reported as contemplating the erection of a new electric-light plant to cost $125,000.

The Board of Aldermen of Napoleonville, La., has awarded the contract for the construction of the electric-light plant to Henry Widmer of New Orleans, whose bid was the second lowest—$7,264. Work will be started at once.

The village of Coopersville, Mich., has ordered through the Lewis Electric Company of Grand Rapids a 35-kilowatt generator, switchboard and about 3,000 pounds of wire and miscellaneous material for its new lighting plant.

The La Crosse Gas and Electric Company has been awarded the contract for lighting the city buildings in La Crosse, Wis. The contract calls for a rate of three cents a kilowatt-hour. Heretofore the company has charged the city five cents.

The Current Motor Company of Atlanta, Ga., has been incorporated, with a capital stock of $1,000,000, for the purpose of establishing an electric-light and power plant. E. F. Peckham, H. E. Tolman and A. Madison are among the incorporators.

At a special meeting of the City Council at Wymore, Neb., H. T. Clarke, Jr., of Omaha was granted an electric-light franchise, Messrs. Philbrick and Reuling of Wymore withdrawing their application. Mr. Clarke will commence at once to build a new plant.

The Richfield Electric Light and Power Company has been incorporated for the purpose of operating an electric-light and power plant in Richfield, Utah. The company holds a franchise for 100 years. Thomas Brown is president of the concern and William H. Seegmiller is general manager.

The $600,000 plant of the Wilmington (Del.) Light, Power and Telephone Company, which is practically a duplicate, except as to size, of the plant of the Baltimore Electric Power Company, has been formally opened. George R. Webb, vice-president and a large stockholder of the concern, and David E. Evans, president of the Maryland Telephone Company, were among those present from Baltimore at the opening. A large number of guests were also in attendance from New York, Philadelphia and Wilmington. The new plant is located on the Brandywine Creek, ground having been broken on April 5th last. The capacity is 2,000 kilowatts. The company also con-

trols an automatic telephone system which connects with the Maryland Telephone Company.

The Merchants' Light and Power Company of Memphis, Tenn., is rapidly pushing the work on its power plant and subway system in that city. Their station at Keel Street and Wolf River is expected to be finished in a few weeks and the subway system is already practically completed. The generating units, in the first instance, will be two in number and of 1,000 kilowatts each.

Among the electric-light companies which have recently been incorporated are the following-named: Perkins Electric Light and Power Company, Perkins, Okla., capital $5,000; City Electric Light Company, Stillwater, Minn., capital $10,000; Joplin Light, Power and Water Company, Joplin, Mo., capital $25,000; Jacksonville Ice and Electric Company, Jacksonville, Tex., capital $75,000.

A well-built electric-lighting plant owned by local business men of Basin, Wyo., has just been put in operation in that city. The equipment includes a 125-horsepower Murray-Corliss engine, driving a 75-kilowatt Warren alternator, 60 cycles, 1,100 volts, single-phase. Six-glower Nernst lamps are used for street lighting. The plant cost about $15,000. F. H. Stannard was the consulting and erecting engineer.

Announcement is made by the officials of the Green Bay Gas and Electric Company of the following reduction in the rates for electric lighting and power service to take effect January 1, 1907. For lighting from 17 cents to 12 cents per kilowatt. For power the maximum will be 10 cents per kilowatt with a discount to heavy consumers. A Westinghouse-Parsons turbo-generator is being installed and is expected to be in operation by December 1st.

Artesian-well hydraulic power for the operation of electric plants in South Dakota, described some years ago in the Western Electrician, is still in use, although it had been reported that some of the wells had given out. Thus the Aberdeen (S. D.) Daily News of October 31st reports that "C. M. Barnes & Co. have sent an electrician to the big ranch of the Northwestern Land Company, in Edmunds County, to wire the house and other buildings for lighting. The company has its own dynamo, driven by artesian power."

A subsidiary corporation has been formed in Stillwater, Minn., to build an annex to the Stillwater Gas and Electric Light Company's new gas house, to be used as a sub-station for electricity. The entire plant is controlled by the Western Gas and Investment Company of Chicago. Included in the holdings is the electric-power dam at Riverdale, near Somerset, Wis., from which power is transmitted to Stillwater. The company will next year build another dam on Apple River. The new corporation will operate the electric-power plant in Stillwater as a branch of the other business. It is called the City Electric Light Company.

ELECTRIC RAILWAYS.

The City Council of Sumner, Wash., has granted Fred J. Chamberlain a franchise to operate an electric railway through the town of Sumner.

The citizens of Elk Horn, Iowa, have pledged $1,200 for the work of a preliminary survey from Atlantic to Elk Horn for an electric railroad.

C. B. Harman of Oskaloosa, Kan., is promoting the proposed interurban electric line between Topeka and Atchison by way of Oskaloosa and Lawrence.

W. C. Pickings of Memphis, Mo., proposes to build an electric railway between Mexico and Cedar Rapids, Iowa, via Edina, Shelbina and Paris, Mo.

The Iowa-Missouri Traction and Power Company of Fairfield, Iowa, will construct a line of electric railway betwen Fairfield and Memphis, Mo., via Keosauqua.

J. W. Orr of Vinita, Ark., W. C. Meeker and S. B. Porter of Caney, Kan., and J. R. Harris of Fayetteville, Ark., propose to build a railroad from Caney, Kan., to Fayetteville.

The Clendenen Construction Company of New York, N. Y., will build the Frey interurban railway between Xenia and Wilmington, Ohio, by way of Clifton, Cedarville and Jamestown.

Highway commissioners at Danville, Ill., propose the construction of an electric railway from the College Street bridge over the Vermilion River to De Soure Lane, a distance of one mile.

The Concord (N. C.) Street Railway Company has been organized for the purpose of building and operating a street railway. C. W. Johnston of Charlotte, N. C., is an incorporator.

The St. Joseph (Mo.) Belt and Interurban Railway Company has been incorporated with a capital stock of $1,500,000, for the purpose of building an interurban line northward through Savannah and the rich agricultural section of northwest Missouri. As an adjunct to the interurban line, it is proposed to build a belt line around and through St. Joseph, Mo. John S. Logan, Louis Huggins, John Townsend and others are the incorporators.

The City Council of Atlanta, Ga., has granted a franchise to the Atlanta and Carolina Railway Company for the use of certain streets in the construction of an electric railway line between Conyers, Ga., and West Point, Ga.

The United Railways of St. Louis reports for September: Gross earnings $784,260, increase $55,958; surplus $79,942, increase $31,883; for nine months, gross $6,749,657, increase $513,381; surplus $337,574, increase $393,159.

The West Shore Traction Company of Nyack, N. Y., has been incorporated with a capital stock of $250,000 for the purpose of building a new traction line. Frank J. Whan, 62 West Sixty-sixth Street, New York, is interested.

Col. J. E. Brady, president of the Germania Mutual Savings Association of Chicago, Ill., L. L. Reading and J. D. Westbrook of Chester, S. C., have secured a franchise for the purpose of building an electric street railway in Chester.

The Pittsburg and Westmoreland (Pa.) Traction Company has been incorporated, with a capital stock of $72,000, for the purpose of constructing a 12-mile line from Greensburg to Latrobe, Pa., Wesley F. Raymond of Middletown is president of the concern.

The Englewood extension of the South Side Elevated Railway in Chicago is now in use. The station at Harvard Avenue is the finest of the new stations of this line. It is of the suspended pattern, instead of being on the street level, and is constructed of steel and "transite," the latter being both fireproof and a dielectric. The partitions and roof are of asbestos. All the new suspended stations of the line are to be of this pattern.

Two more electric locomotives are to be built by the Illinois Traction system, to be used on the Danville-Champaign line and later on the Decatur-Springfield-East St. Louis line. The locomotives will be built at the Danville shops, where three engines already have been built. Two of these are in service hauling coal during the night time beween Danville and Champaign and performing services at the mines during the day. Work has been commenced on the private car for General Manager L. E. Fischer. This also is under construction at the Danville shops. The car will be 45 feet in length and will be finished in mahogany.

PUBLICATIONS.

The Scientific American has issued a little paper-bound pocket-size book of 64 pages entitled "The Scientific American Handbook on Patents, Caveats, Designs and Trademarks." It explains briefly and clearly the essential features of patent practice.

The November number of Graphite, issued by the Joseph Dixon Crucible Company, contains illustrations of working men of the different trades. The pictures and the idea are good. The article illustrated is entitled "All the World Uses Dixon's Graphite."

Examples of rapid milling are clearly presented in the fourth series of an attractive book published by the Cincinnati Milling Machine Company of Cincinnati, Ohio. Sixty fine half-tone illustrations give as many examples of work being done by Cincinnati millers. These machines are said to be cutting costs in half in many shops. A number of pages in the book are devoted exclusively to direct-connected motor-driven machines.

The Allis-Chalmers Company has issued Bulletin No. 1508, September, 1906. It treats of Christensen straight air-brake equipments and contains a complete illustrated description of the apparatus. The Allis-Chalmers Company has recently obtained control of Mr. Christensen's patents and is now prepared to fill orders for complete brake equipments as well as repair parts.

Catalogue No. 20 of the Chicago Pneumatic Tool Company, issued October, 1906, contains a valuable mass of information about Franklin air compressors for all kinds of pneumatic tools and appliances. The catalogue is a book of 116 pages and is beautifully illustrated. It contains not only a complete description of the Franklin compressor but also many tables and diagrams giving practical detailed information in relation to air-compressing machinery. At the end of the book there is a list of "Don'ts" which will be found to contain many valuable hints. Users of pneumatic tools and appliances will do well to put themselves in possession of this useful catalogue.

The General Electric Company has issued a cloth-bound catalogue of 231 pages covering its railroad supplies. The catalogue is well illustrated with half-tones of most of the articles listed and the frontispiece is a view of the company's Schenectady works. The catalogue contains information which will enable the company's customers readily to select parts for the maintenance of their equipments and lines and other supplies that are suited to their various requirements in the construction and operation of complete electric-railway systems. The various classes of material are arranged to facilitate the selection of repair parts most often required. The company calls attention to recent improvements in its product and to the new catenary construction devised especially for high-speed interurban work.

The Whitney Electrical Instrument Company has issued a neat little price list of the Whitney electrical measuring instruments. It is well illustrated with cuts of the various instruments and contains a brief description of the mechanism of direct and alternating-current voltmeters and ammeters. Machado & Roller, 203 Broadway, New York, are general sales agents.

SOCIETIES AND SCHOOLS.

The Boston Branch of the American Institute of Electrical Engineers has elected the following-named officers: Chairman, H. E. Clifford; vice-chairman, C. B. Burleigh; secretary, C. H. Porter; executive committee, A. E. Kennelly, C. L. Edgar, J. I. Ayer, R. Fleming and C. S. Gibbs.

The decennial Founder's Day exercises of the Thomas S. Clarkson Memorial School of Technology, Potsdam, N. Y., will be held in the chapel hall of the institution on November 30th. The address will be delivered by Dr. Henry S. Pritchett, president of the Carnegie Foundation for the Advancement of Teaching.

With the October issue the Proceedings of the American Institute of Electrical Engineers came out in improved form, with more original matter prepared under the supervision of Editor Ralph W. Pope. To make the Institute of the highest value to the members the Proceedings should be read. "To meet this desideratum the publication itself should be made of sufficient interest to entice the owner to remove it from the envelope," in the language of an editorial declaration. A feature is a summary by Mr. E. B. Katte of the engineering features of the electrification of the New York Central Terminal. There are also editorials, a book review, personal items and news notes not pertaining to the affairs of the Institute. Thus the magazine is made of more general electrical interest.

TRADE NEWS.

The Long-distance Telephone Manufacturing Company, formerly located in Chicago, but now in its new factory at South Bend, Ind., says that it is meeting with great success in its venture. This company makes a specialty of manufacturing long-distance telephone apparatus. At its head is the Hon. Marvin Campbell, while Stanley A. Duvall, so well known in telephone circles, is vice-president. C. K. Seibert is secretary. The company has a large and efficient corps of expert telephone engineers as well as an excellently equipped factory. It bids fair, therefore, to hold its own in the telephone field.

The illustrated lectures which Mr. A. J. Marshall, illuminating engineer of the Holophane Glass Company, is giving before the central stations and gas companies on the question of light and illumination are proving very successful. Mr. Marshall lectured on October 25th before the West Penn Electric Company, Connellsville, Pa., and an enthusiastic audience displayed great interest. The Holophane Glass Company wishes to state that while this lecturing is planned for some time ahead, it will, nevertheless, be pleased to consider applications for this kind of work.

One hundred and nineteen members of the clerical force of the Western Electric Company were given a banquet at the Grand Pacific Hotel on November 5th by the management of the company. The banquet was in the nature of a preliminary meeting looking to the formation of a great social club to embrace members of every department of the corporation, which will have for its purpose social gatherings to foster a fraternal feeling between all employes and the management of the company. The gathering was addressed by J. W. Johnston, manager of the Chicago branch of the corporation, and H. A. Halligan, the assistant manager.

A new cedar and lumber concern has been organized by W. C. Sterling of Monroe, Mich., the name being the Sterling Cedar and Lumber Company and the capital stock $100,000, all paid in. The officers are: President, W. C. Sterling; vice-president and secretary, W. C. Sterling, Jr.; Treasurer and manager, C. H. Slocum, Bay City; mill and store manager, W. S. Beck, Bay City. The lands of the new company are located 15 miles north of St. Ignace, in Mackinaw County, along Carp River and St. Martin Bay. They cover 4,000 acres of timber land and contain over 25,000,000 feet of hard wood, 50,000 cedar poles, 250,000 cedar ties, 250,000 posts and 15,000 cords of pulp wood and a large amount of bark. Shipments can be made by rail from Mackinaw City by towing the product across the Straits at Mackinaw, a distance of about 12 miles from the field of operations. The operations of the company will be di-

rected by W. C. Sterling, who is known as one of the most capable men in the cedar business today. He started therein 26 years ago and he now is at the head of several cedar firms.

The Albany, N. Y., Times of October 30th says that the General Electric Company is said to be negotiating with the government for the purchase of the Watervliet arsenal plant. This would mean, it is said, the closing of the General Electric Company's plant at Pittsfield, Mass., and the transfer of the work done there and at other subsidiary factories to Watervliet.

BUSINESS.

The Crocker-Wheeler Company has recently received orders for generators and motors from the Peter Doelgers Brewery, New York city; Pittsburg and Conneaut Dock Company, Conneaut Harbor, Ohio; Buckwater Stove Company, Royersford, Pa.; Eaton, Cole & Burnham Company, Bridgeport, Conn.; Midvale Steel Company, Philadelphia, Pa.; National Tube Company, McKeesport, Pa.; Brown & Bigelow, St. Paul, Minn.; Keller-Pike Company, Esopus, N. Y., and William Anderson, Philadelphia, Pa.

A. P. Munning, general sales manager for the Cutler-Hammer Manufacturing Company, passed through Chicago last week. Mr. Munning says that the phenomenal demand for Cutler-Hammer products has not abated—in fact, his company is obliged to work night and day to meet the demand.

The cry to-day all over the United States in the electrical business is that "business is good." No better evidence of the immense development, for instance, in the Independent telephone field can be offered than a statement of the fact that the Home Telephone Company of Detroit has recently placed with President Ernest L. Clark, of the Valentine-Clark Company, Chicago, an order for 5,500 poles, all 30-foot seven-inch and longer, with special butt measurements, and all to be delivered within three months. A point in connection with this order illustrates the large facilities now required in the transaction of an extensive pole business. To deliver this number of poles will necessitate the transportation of over 100 cars and will tax the facilities of three yards of the above-mentioned company. No better illustration than this can be had of the necessity of the up-to-date pole man having the necessary concentration yards for the handling of big stocks with the utmost dispatch.

The Central Electric Company of Chicago is sending to the trade circulars and bulletins descriptive of the Columbia incandescent lamp for which it is sales agent. The Columbia lamp is well and favorably known, and as this is the time of the year when the majority of lamp contracts are made, the Central Electric Company invites consumers to write for its yearly contract plan. The company believes that it has a money-saving proposition, and will be pleased to submit it to anyone interested.

ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued (United States Patent Office) October 30, 1906.

834,272. Telephone System. William W. Dean, Chicago, Ill., assignor to Kellogg Switchboard and Supply Company, Chicago, Ill. Application filed December 29, 1902.

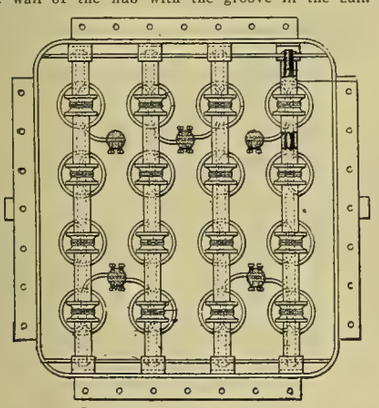
Telephone lines having their cut-off relays legged to ground from one of the sides of the lines, have a diagonally connected cord circuit for establishing connections with the lines for conversation. The cord circuit is divided into two portions, each of which forms a separate circuit for the current actuating the signaling devices in that portion of the talking circuit.

834,274. Electric Pump Governor. Edward H. Dewson, Edgewood Park, Pa., assignor to the Westinghouse Air Brake Company, Pittsburg. Filed August 22, 1905.

There is a piston which is subject to the pump pressure. A controlling device is operated by the piston, an adjustable spring opposing the pressure. An electromagnet is provided, which exerts its pull to assist the spring, and there are means for adjusting the holding power of the magnet.

834,302. Trolley-wheel. Henry L. Humphrey, Monroe, Mich. Filed November 13, 1905.

A fixed ball has a circumferential groove formed, which is triangular in cross section, the apex of the triangle cutting the surface of the ball and forming a slot therein. A hub on the wheel forms a socket to receive the ball, and an oil chamber on the wheel surrounds the hub and communicates through openings in the wall of the hub with the groove in the ball.



NO. 834,424.—RESISTANCE DEVICE.

834,327. Means for Keeping Switch and Signal Apparatus Free from Snow and Ice. Francis G. Shaw, Boston, Mass., assignor to the International Switch and Signal Company, Boston, Mass. Filed March 15, 1906.

Heating coils are arranged adjacent to the movable parts of a switch or signal apparatus and means are provided for covering the coils except at those points adjacent the movable parts.

834,336. Automatic Electric Braking. Louis H. Thullen, Edgewood, Pa., assignor to the Union Switch and Signal Co., Swissvale, Pa., Filed December 22, 1903.

There is a normally open circuit including the armature and field of the motor of the car. The motor is geared to the axle. A double-acting switch controls the normally open circuit and is operated by means located on the railway track.

834,352. Case for Loading-coils. Henry F. Albright, New York, N. Y., assignor to Western Electric Company, Chicago, Ill. Filed April 22, 1905.

There is a case containing groups of loading coils with connecting wires leading from the coils to the exterior of the case. Supporting spindles for the groups of coils are secured to the bottom of the case. A spider to which the free ends of the spindles are secured is supported by the inner wall of the case, and maintains the spindles in a rigid position. Means are provided for hermetically sealing the case.

834,355. Magnetic Power Control. Daniel Bacon, Brooklyn, N. Y., assignor to Magnetic Control Company, New York, N. Y. Filed January 28, 1905.

Means are provided for adjusting and energizing a magnet so that it operates an armature to produce direct revolution of a driving shaft. A system of beveled gearing connects a pair of revolving electromagnets so that the armatures operated by them are caused to impart a reverse revolution to the driving shaft and the mechanism driven by it.

834,392. Strain-insulator. George A. Mead, Mansfield, Ohio. Filed April 22, 1905.

A flanged cap which is threaded interiorly is applied to one end of an insulated body and means provided to prevent its rotation in respect to the body. An eye is threaded into the cap and means provided to prevent its displacement. An eyebolt having a threaded shank extends into the body, and a nut is applied to the shank. Means are provided which are operatively related to the body and engage the nut for rotatively securing it in position.

834,404. Signaling System. Frank B. Rae, Ridgewood, N. J., assignor to Rae Electric and Manufacturing Company. Filed August 5, 1901.

The signal-operating shaft has a plurality of locking arms, each of which is, at different times, adapted to lock the shaft against movement when in engagement with it. A pair of magnets are placed adjacent to each of the locking arms and are adapted to move them into or out of engagement with the shaft according as one or the other of the magnets is energized. A motor adapted to move the shaft is provided, and there are connections for establishing circuits through the respective magnets and through the motor.

834,406. Lamp-socket for Ceilings. William H. Rattenbury, Chicago, Ill. Filed September 30, 1905.

A lining tube is fixed in an opening in a ceiling or partition and a lamp is provided with a cup-shape holder adapted to fit in the tubular lining. A rib in the tube engages the lamp holder to hold the lamp inside the tube so that it projects through.

834,424. Resistance Device. William L. Waters, Milwaukee, Wis., assignor to National Brake and Electric Company, Milwaukee, Wis. Filed April 28, 1905.

A supporting frame adapted to be removably inserted in a tank containing an insulating fluid has upper and lower supporting rods carrying insulators. There are spacing members on the rods between the insulators. Resistance coils, secured to the insulators, are extended between the upper and lower bars and are suitably connected to main terminals extending from the tank. (See cut.)

834,449. Electric-light Hanger. James W. Carter, Abilene, Tex. Filed May 11, 1906.

There is a hanger which is provided with means for attachment to a support. A roller journaled in the hanger has notches formed in one side thereof and a spring locking member carried by the hanger is adapted to engage the notches for locking the roller against rotation in one direction. A flexible lamp-supporting conductor engages the roller, and a weight is carried by the conductor and forms a counterbalance for the lamp.

834,480. Coil-former. Julius W. Lundskog, Lynn, Mass., assignor to General Electric Company, New York. Filed March 25, 1904.

This is composed of a number of superimposed slabs laterally displaced from each other, each of the slabs having a raised portion along one edge of a width equal to the desired distance between coils.

834,483. Trolley-track Switch. Robert W. McIlvaine, Western Springs, Ill. Filed December 21, 1905.

A bracket, rigid with respect to the main-line track, extends off laterally from it. There is a movable member whose length is made up of two sections pivoted together, one section being pivoted to the main-line track, and means are provided in the bracket for guiding in a definite path a point on the other section remote from the pivot of the two sections to each other.

834,496. Oscillating-current Lamp. James E. Seeley, Los Angeles, Cal., assignor to Synchronous Static Company, Los Angeles, Cal. Filed July 12, 1905.

There are back and front plate members, the front plate member having an opening. A primary coil is located and supported between the members to form a peripheral wall of the lamp. A secondary coil is within the primary coil and is of smaller longitudinal dimensions than the primary coil so as to leave a space within the primary coil and in front of the secondary coil. Electrodes are arranged within the space, in the rear of the opening in the front plate member and are connected so as to be energized by the coils.

834,520. Sound-magnifier for Telegraph Instruments. Frederick O. Hanson, Victoria, Kan., assignor of one-half to William Schrenkler, Walker, Kan. Filed February 26, 1906.

A fixed frame receives blows from an armature lever and has a point extending from it which is connected to a diaphragm in a sound box.

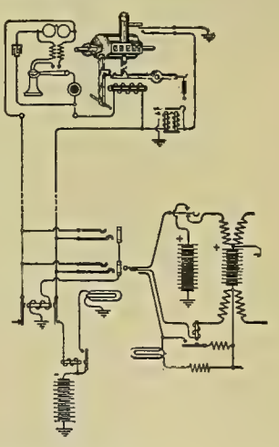
834,525. Voltage-regulator. Ray P. Jackson, Wilkinsburg, Pa., assignor to Westinghouse Electric and Manufacturing Company, Pennsylvania. Filed June 12, 1905. Renewed April 28, 1906.

In a distributing circuit a transformer has leads extending from several points of it. There are two inductive windings, and means for connecting the winding between different alternate transformer leads. A third inductive winding has its terminals connected to points intermediate the terminals of the other two windings and has a point intermediate its terminals connected to a distributing circuit.

834,533. Insulator. James F. Nicols, Plainfield, Ark., assignor of one-half to C. D. Stevens, Magnolia, Ark. Filed September 11, 1905.

This comprises a body composed of complemental sections abutting at adjacent faces and with grooves formed on the adjacent faces to receive a wire. A tie plate is placed on top of the sections, and pins passing through the ends of the tie plate to secure it are arranged at opposite sides of the body to prevent displacement of the sections.

834,538. System and Apparatus for Measuring Telephone Service. Harold D. Stroud, Chicago, Ill., assignor to The Stroud International Measured Service Company, St. Louis, Mo. Filed May 13, 1904.



NO. 834,538.—SYSTEM FOR MEASURING TELEPHONE SERVICE.

A counter is provided with means by which a telephone user may cause it to register a charged call. An electromagnet associated with the counter controls means to prevent the counter from registering when a call is sent, means being provided at the central office for energizing the magnet over a telephone line extending to it from the central office. (See cut.)

834,563. Electric Motor-control System. William Cooper, Wilkinsburg, Pa., assignor to Westinghouse Electric and Manufacturing Company, Pennsylvania. Filed May 22, 1905.

There is a number of electric motors and a control system comprising a master controller and a number of unit switches. Means are provided for changing the motors from a series to a multiple-circuit connection without involving any variation of the motor currents, that comprises a bridge circuit which connects the motors in series without resistance in circuit, and means are provided for automatically opening the bridge circuit after multiple connections have been completed, with resistance in series with each motor, and when no current is flowing through it.

834,567. Insulator. Richard A. Falkenberg and Solomon S. Simon, San Francisco, Cal. Filed August 29, 1905.

The body portion is formed near the upper edge with a transversely arranged groove and with longitudinally arranged recesses adjacent the terminals of the groove. A head projects from the body portion and is cut away at diametrically opposite points to provide a space between it and the upper edge of the body portion adjacent each of the recesses.

834,570. System of Transmitting Power. George P. Finnigan, Greene, N. Y., and George T. Hanchett, Hackensack, N. J.; said Hanchett

assignor to said Finnigan. Filed August 30, 1905.

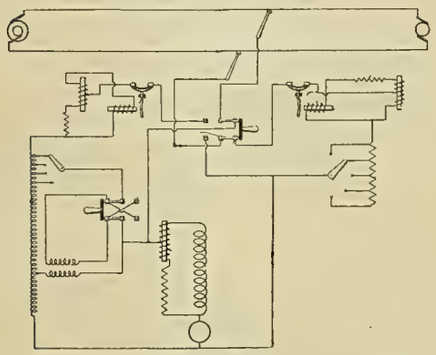
A number of magnets are provided with means for intermittently engaging the shaft of an electric motor and so that each restores the other to an operative position.

834,582. Controlling Device. Benjamin G. Lamme, Pittsburg, Pa., assignor to Westinghouse Electric and Manufacturing Company, Pennsylvania. Filed January 3, 1905.

A translating device is adapted to make circuit connections with either a source of direct current energy or a source of alternating current energy. Means are provided for interrupting the circuit connections when the character of energy supplied therethrough is not suitable for the translating device. (See cut.)

834,597. Electric-current Interrupter. Julius B. Wantz, Chicago, Ill., assignor to Victor Electric Company, Chicago, Ill. Filed November 22, 1905.

A frame with a speed indicator has a train of gears with actuating means therefor mounted in it, and a body of insulating material is operatively connected with the gears to be rotated by them. A current makes and breaks contact on the body, which rotates so as to cause the contact to encounter the brush once in each rotation. A governor regulates the speed of rotation of the body, and mechanism is provided for controlling the governor from the indicator.



NO. 834,582.—CONTROLLING DEVICE.

834,636. Electrical Contact for Trolley Systems of Electric Railways. Wesley T. Oviatt, Stratford, Conn., assignor to William Gunow, Jr., Bridgeport, Conn. Filed August 29, 1905.

Two contacting bars are yieldingly supported in close proximity to the trolley wire, one of the bars being electrically connected to it and the other insulated from it and connected to a translating device. The electrical contact between the trolley and the trolley wire is of a rolling nature and between the trolley and the bars of a frictional or sliding nature.

834,656. Metallurgical Process for the Extraction of Metals from Their Ores and the Conversion of Iron into Steel. George H. Benjamin, New York, N. Y. Filed December 26, 1902.

The ore is first reduced; a combining body is then introduced and both bodies are subjected, while in motion, to the effects of an electric arc.

834,659. Telegraph Cut-out. Fred A. Clogston, Bridger, Mont. Filed November 11, 1905.

There is a series of pivoted devices each adapted to be electrically connected to a sounder. A common return device is movably mounted above and normally makes contact with all of the pivoted devices. Means are provided for actuating any one of the pivoted devices to raise the return device out of contact with the remaining pivoted devices.

834,664. Basket for Incandescent-electric-light Bulbs. Charles Duncan, Montreal, Quebec, Canada, assignor to the Duncan Electrical Company, Limited, Montreal, Canada. Filed December 7, 1905.

A protecting basket has oppositely disposed clamping members pivotally secured to it and provided with openings therein and locking means comprising locking fingers disposed through the openings in the clamping members, a spring on each locking finger and a pin on each locking finger adapted to receive the thrust of one end of each of the springs.

834,669. Test and Wire-connector. William A. Fricke, Chicago, Ill. Filed October 24, 1904.

A slotted member is arranged to receive the tongues of a number of intermittently tongued perforated plates and a plurality of unaligned wires. Means are provided for clamping the plates and wires in the slot.

834,684. Connector for Conduits for Electric Wires. Clarence C. Sibley, Perth Amboy, N. J., and George A. Lutz, New York, N. Y. Filed July 18, 1904.

A conduit is provided with a removable sliding cover. A connector has a socket receiving the conduit and provided with a tubular extension and has a lug lying in the path of the cover of the conduit.

834,685. Conduit for Electric Wires. Clarence C. Sibley, Perth Amboy, N. J., and George A. Lutz, New York, N. Y. Filed October 26, 1905.

The conduit has outwardly extending flanges and a cover having a depressed portion between its outer edges. The edges of the cover overlay the flanges on the conduit and clips are provided over the cover having their ends engaging the flanges.

834,686. Base for Supporting Switches and the Like Upon Conduits. Clarence C. Sibley, Perth Amboy, N. J., and George A. Lutz, New York, N. Y. Filed October 26, 1905.

An electric fitting is mounted on a base which is provided with adjustable holding devices located between it and the fitting. Means are provided for connecting the fitting with the holding devices to hold it on the base.

834,687. Elbow for Conduits. Clarence C. Sibley, Perth Amboy, N. J., and George A. Lutz, New York, N. Y. Filed October 26, 1905.

The material is in channel form and has members extending at an angle to each other, the outer side wall being bent into sharp angle and the opposed inner corner being rounded.

834,689. Rail-bond. Charles R. Sturdevant, Worcester, Mass., assignor to American Steel and Wire Company, Worcester, Mass. Filed July 7, 1905.

The terminals are solid metal and each has a stud on one face and a reduced boss on the other face. There are conductor rails having hollow cup-shaped openings to receive the studs of the terminals, the cross-sectional area of each cavity being increased below the entrance or initial portion thereof.

834,690. Rail-bond. Charles R. Sturdevant, Worcester, Mass., assignor to American Steel and Wire Company, Worcester, Mass. Filed July 7, 1905.

A flexible connector has solid terminals, from the inner face of which there are a number of laterally extending integral studs. The studs are secured to the rails by expanding in the rail cavities by driving compression.

834,695. Fan-motor Support. Harold R. Wellman, Chicago, Ill., assignor to Western Electric Company, Chicago, Ill. Filed April 22, 1905.

A base carries a stem which is made up of two parts adapted to be connected with each other by a miter-joint to assume a position in alignment with each other or at right angles to each other. A motor-supporting member is mounted upon the outer part of the stem and is partially rotatable thereon for adjustment, and means are provided for simultaneously securing the parts together in either position of the stem and for locking the member in it adjusted position.

834,704. Electric Fluid-pressure Switching and Signal Appliance. Walter J. Bell, Los Angeles, Cal., assignor of one-half to Leon F. Moss, Los Angeles, Cal. Filed June 3, 1905.

There is a switching element, fluid-pressure means for moving the element, a signal, fluid-pressure means for moving the signal and connections between the two means, the signal-moving means being operated coincidently with the ends of movements of the switching element and controlling means for each of the fluid-pressure means including a pair of connected valves and means for alternately moving the valves.

834,708. Secondary Electric Clock. Henri Campiche, Geneva, Switzerland. Filed May 24, 1905.

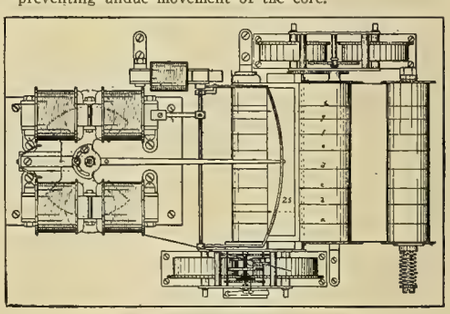
An electromagnet attracts an armature actuating a driving lever. A pawl on the driving lever engages a ratchet wheel on the axis of which there is a stop wheel. The stop wheel has stop levers which allow it to move only in the direction of the action of the driving lever.

834,742. Conduit for Electric Conductors. George A. Lutz, New York, N. Y. Filed October 26, 1905.

Opposed grooves face each other near its open side, and a cover closes the open side. The cover is rounded along one longitudinal edge, the rounded portion fitting in one of the grooves and the opposite edge of the cover fitting in the other groove of the conduit.

834,750. Voltage-regulator. Thomas M. Pusey, Kennett Square, Pa. Filed July 19, 1904.

A rocking beam is connected with a movable core in a solenoid and is movable therewith. The rocking beam is provided with electrodes and vessels are disposed adjacent to them, containing conducting liquids into which the electrodes may dip separately. There is an electric circuit controlling the solenoid and helical solenoids are connected electrically by the vessels and controlled by currents passing through them for the purpose of preventing undue movement of the core.



NO. 834,787.—METER.

834,755. Electric-light-bath Cabinet. Harvey H. Roberts, Lexington, Ky. Filed April 5, 1906.

A bath cabinet has a set of electric lights within it. A stool having a flat coil of insulated wire within the seat is used within the cabinet for conjoint electrical treatment.

834,764. Protective Apparatus for Railway Telephone Sets. Charles E. Scribner, Jericho, Vt., assignor to Western Electric Company, Chicago, Ill. Filed October 21, 1904.

Switches control the connections of a telephone set in a case with a telephone line so that if abnormal currents are present on the line fuses will be blown upon opening the door of the case.

834,787. Meter. Joseph Wills and Lorin E. Imlay, Niagara Falls, N. Y., assignors of one-third to the Niagara Falls Power Company, Niagara Falls, N. Y. Filed June 21, 1904.

Primary coils and shunt coils are mounted so as to act on the opposite wings of a secondary disk upon which is mounted an indicator. Chronometer mechanism for moving a record blank and mechanism for recording chronologically the record of the indicator are provided. (See cut.)

834,828. Junction or Outlet Box. George A. Lutz, New York, N. Y. Filed September 14, 1905.

The conduit has a movable cover. A cap for the conduit has a lug extending in line with the cover and a lip engaging the cover to hold the cap in place.

834,829. Means for Holding Receptacles and the Like to Conduits. George A. Lutz, New York, N. Y. Filed September 14, 1905.

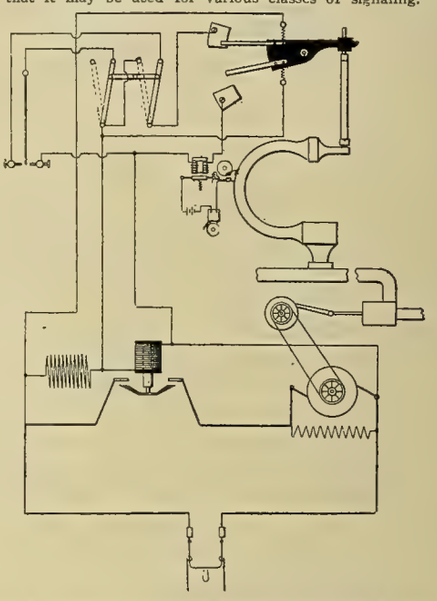
A conduit is provided with a movable cover, and with a cap made of insulating material having a lip projecting outwardly engaging the cover to retain the cap in place upon the conduit.

834,832. Means for Charging Storage Batteries of Telephone Systems. Talbot G. Martin, Chicago, Ill., assignor to Automatic Electric Company, Chicago, Ill. Filed February 3, 1905.

The features of this invention are an automatic exchange provided with a storage battery for furnishing the current necessary for operating the automatic apparatus thereof, another exchange provided with a source of charging current for the battery, a trunk line extending between two exchanges, and a normally closed charging circuit including the battery and source of current and a conductor of the trunk line.

834,869. Telephone Signaling Apparatus. William E. Butler and Morgan L. Lane, David City, Neb. Filed January 3, 1906.

This invention operates to change a direct current so that it may be used for various classes of signaling.



NO. 834,870.—AUTOMATIC CONTROLLING MEANS FOR FLUID-PRESSURE SYSTEMS.

834,870. Automatic Controlling Means for Fluid-Pressure Systems. Jacob C. Chamberlain, New York, and Albert T. Marshall, New Rochelle, N. Y., assignors to the Automatic Refrigerating Company, New York, N. Y. Filed June 21, 1905.

A pump for circulating a refrigerant is driven by a motor. An electromagnet controls the motor circuit and is controlled by a device responsive to the refrigerating temperature, and a device responsive to the pressure of the refrigerant causing the same to open and close the motor circuit upon the temperature or pressure departing from predetermined limits. (See cut.)

PATENTS THAT HAVE EXPIRED.

Following is a list of electrical patents (issued by the United States Patent Office) that expired on November 5, 1906:

414,191. Electrical Regulating Apparatus. H. J. Conant, Watertown, Mass.
414,220. Electric Battery. C. A. Hussey, New York, N. Y.
414,222. Tower Wagon for Electric Street-car Service. T. L. Johnson, Cleveland, Ohio.
414,245. Ring Armature for Electric Generators. G. Pfannkuche, Hartford, Conn.
414,266. Iron-cased Induction Coil for Alternating-current Transfer. E. Thomson, Lynn, Mass.
414,267. Thermostat. H. E. Thompson, Minneapolis, Minn.
414,280. Mechanical Telephone. J. C. Bates, Aspen, Colo.
414,288. Machine for the Manufacture of Secondary-battery Plates. H. H. Carpenter, Denver, Colo.
414,289. Switch for Electric Motor Trolleys. W. Christy, Akron, Ohio.
414,308. Burglar Alarm. A. A. Goucher, Euclid, Pa.
414,310. Electric Resistance Indicating Device. C. D. Haskins, Brooklyn, N. Y.
414,317. Battery Carbon. C. A. Hussey, New York, N. Y.
414,318. Electric Battery. C. A. Hussey, New York, N. Y.
414,327. Conduit for Electric Wires. J. W. Richards and J. B. Hall, Newark, N. J.
414,339. Time-recording Device for Dynamo-electric Machines. H. C. Spaulding, Boston, Mass.
414,343. Telltale Apparatus for Ship Telegraphs. W. T. W. Thackeray, Wandsworth, County of Surrey, and I. Hurn, County of Middlesex, England.
414,418. Electric Train Brake System. H. W. Leonard, Chicago, Ill.
414,422. Galvanometer. J. E. Lockwood, Detroit, Mich.
414,438. Secondary Battery. H. G. Osborn, Chicago, Ill.
414,492. Quadruplex Telegraphy. C. P. Carr, Chicago, Ill.
414,541. System of Electrical Distribution by Alternating Currents. J. Hopkinson, Westminster, England.
414,575. Brake for Electric-car Trucks. L. Pfingst, Boston, and S. A. Bemis, Springfield, Mass.
414,583. Trolley for Electric Railways. J. M. Reams, Meriden, Conn.
414,595. Meter for Alternating Electric Currents. O. B. Shallenberger, Rochester, Pa.
414,598. Dynamometer. H. C. Spaulding, Boston, Mass.
414,609. Spring Switch for Overhead Electric Conductors. C. J. Van Depoele, Lynn, Mass.
414,612. Electric Bell. E. Cox-Walker and A. A. C. Swinton, Westminster, County of Middlesex, England.
414,624. Lightning Arrester. C. I. Young, Princeton, N. J.
414,626. Induction Coil Apparatus. J. A. Barrett, Brooklyn, N. Y.
414,627. Electric Battery. J. A. Barrett, Brooklyn, N. Y.
414,645. Electric Railway Signal. W. P. Kookogey, Brooklyn, N. Y.
414,659. Dynamo-electric Machine. W. Seafert, Chicago, Ill.
414,668. Galvanic Belt. W. Laughton, Fulham, County of Middlesex, England.

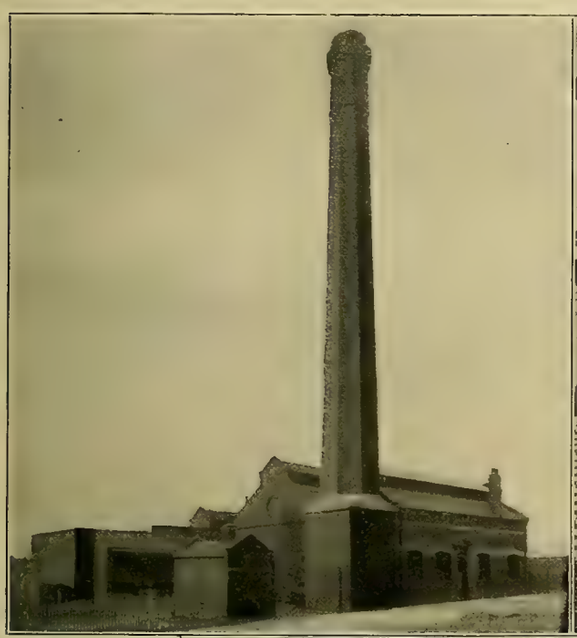
WESTERN ELECTRICIAN

EVERY SATURDAY

Vol. XXXIX. CHICAGO, NOVEMBER 17, 1906 No. 20

A Small British Refuse Destructor and Electrical Plant.

Despite considerable difference of opinion as to the economical combination of a refuse or rubbish destructor with an electric-lighting plant, from the current-producing point of view, the makers of refuse destructors have not relaxed their efforts to demonstrate that it is possible. The following particulars and pictures of a small plant of this description have been kindly supplied to the London correspondent of the Western Electrician by Mr. Ashton Bremner, the borough electrical engineer at Burslem, Staffordshire, a town of about 35,000 inhabitants. They are chiefly noteworthy from the figures obtained at the official test of the installation. Beyond that, the works have no special point of novelty about them.



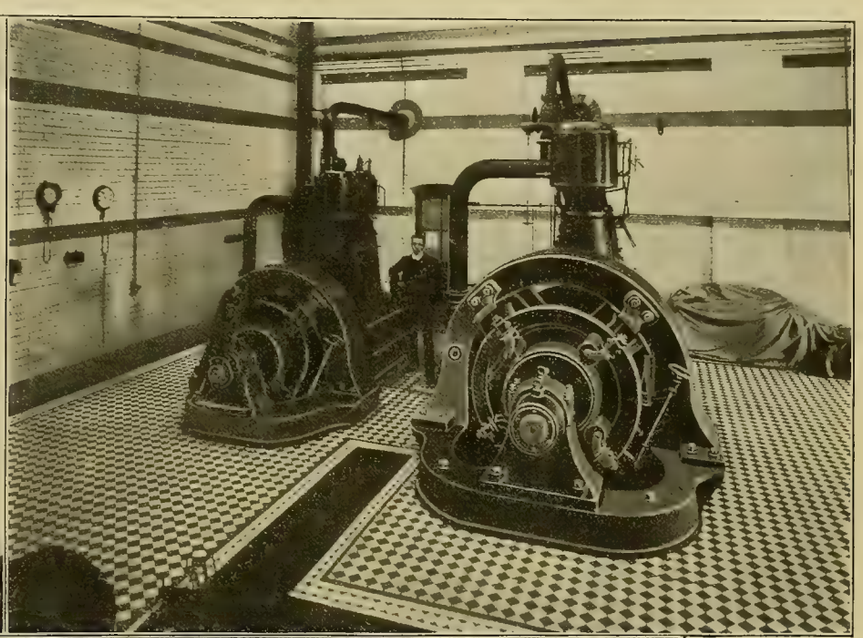


Fig. 1. Electric-light Plant at Burslem, England. Fig. 2. Engine-dynamo Units.

Fig. 3. View of the Clinkering Floor of Refuse Destructor.

A SMALL BRITISH REFUSE DESTRUCTOR AND ELECTRICAL GENERATING PLANT.

The buildings shown in the exterior view (Fig. 1) comprise a destructor house, boiler house, engine room, accumulator room and offices. The engine room is 40 feet long by 34 feet wide and has a five-ton traveling crane spanning it. The boiler house is 40 feet long by 36 feet six inches wide, and the destructor house is 37 by 33 feet. Only one boiler is at present installed, that being a Babcock & Wilcox water-tube boiler capable of evaporating 10,000 pounds of water an hour at a pressure of 160 pounds per square inch. The flat roof of the destructor house has been taken advantage of to form a storage tank to hold 24,000 gallons.

There are at present one 100-kilowatt and two 200-kilowatt four-pole generators direct coupled to compound double-acting enclosed engines, all of standard design. Two of these sets are shown in Fig. 2.

The type of destructor adopted is that known as the Heenan three-cell front feed (Fig. 3), the cells being capable of burning 25 tons of refuse per 18 hours to a hard and innocuous clinker. The makers guarantee that under ordinary working conditions one pound of water shall be evaporated per pound of refuse burnt. The cells receive the mutual assistance of one another, and the gases from each grate are deflected on each adjacent grate in turn, and travel along an undulating course over the whole range of cells, passing into the combustion chamber, which is at a right angle to the cells, and thence under and through the boiler.

Immediately the gases leave the boiler they pass through an air heater for heating the air of the forced draught to about 250 degrees Fahrenheit. The system of forced draught is by means of a centrifugal fan driven by an electric motor, and from 1½ to five per cent. of the power generatel by the plant is required to operate this system of forced draught.

The following are the particulars of the official test of the plant:

Duration of test, 7¼ hours.

Number of cells, three.

Total fire-grate area, 75 square feet.

Type of boiler, water-tube.

Heating surface of boiler, 1,966 square feet.

Class of refuse dealt with during test, trade and domestic.

ACTUAL RESULTS OBTAINED ON TEST.

Total refuse burned during test, 26,572 pounds.

Average rate of burning per hour, 3,665 pounds.

Average rate of burning per hour per square foot of grate area, 48.8 pounds.

Capacity of plant (three cells) for 24 hours at above rate of burning 39.26 tons.

Total water evaporated during test, 49,990 pounds.

Equivalent water evaporated from and at 212 degrees F., 57,581 pounds.

Evaporation per pound of refuse (actual), 1.87 pounds.

Equivalent per pound of refuse from and at 212 degrees F., 2.16 pounds.

Average rate of evaporation per hour (actual), 6,882 pounds.

Equivalent rate of evaporation from and at 212 degrees F., 2.16 pounds.

Average steam pressure maintained during test, 189.5 pounds per square inch.

Temperature of feed water entering tank, 45 degrees F.

Average initial temperature of feed water, 112 degrees F.

Average temperature of combustion chamber during test, 2,032 degrees F.

Maximum temperature of combustion chamber during test, 2,300 degrees F.

Minimum temperature of combustion chamber during test, 1,790 degrees F.

Total weight of clinker obtained, 7,056 pounds.

Percentage of clinker (by weight), 26.5.

ANALYSIS OF FURNACE GASES.

An average of seven samples of furnace gases, each sample being collected over about 50 minutes,

showed percentage by volume as follows: CO_2, 9.97; O, 6.20; CO, nil; N, etc., 83.83.

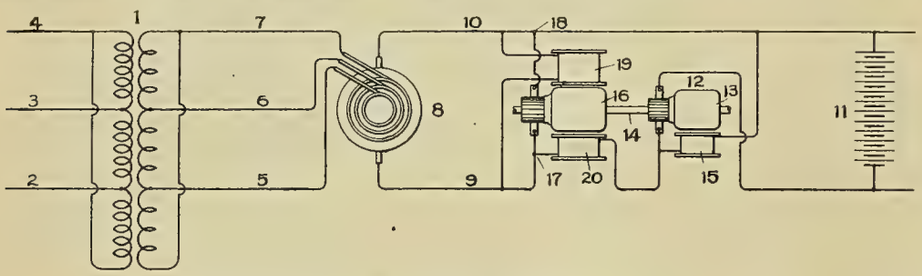
Regulating Voltage in Supply Mains in Response to Variation of Load.

An interesting system of electrical distribution for regulating the voltage of supply mains in response to variations of load has been devised by Ernst J. Berg of Schenectady, N. Y., who was granted a patent therefor on October 2, 1906. Mr. Berg employs a dynamo or booster with its armature in series with the circuit. This dynamo is driven at a speed variable in response to variation of the load.

The method of accomplishing the desired result may be seen by reference to the accompanying diagram, which represents a distributing system in which alternating current is first converted into direct current and then utilized in a consumption-circuit.

In the drawing at (1) is indicated a three-phase step-down transformer supplied with energy over the transmission lines (2) (3) (4) and with its secondary connected through leads (5) (6) (7) to a rotary converter (8). The direct-current terminals of the rotary converter are connected to mains (9) (10), by which direct current is supplied to a consumption-circuit (represented in part by the storage battery) (11).

Two machines—one operating as a motor and the other operating as a generator—are mechanically connected together. The generator is indicated at (12) and is connected with its armature (13) in series with the main (9) leading to the storage battery or other translating device. The field winding (15) is connected in shunt across the direct-current mains (9) (10). The generator (12) is



REGULATING VOLTAGE IN SUPPLY MAINS IN RESPONSE TO VARIATION OF LOAD.

connected through a shaft (14) with the armature (16) of a differentially wound motor. The motor has its armature circuit connected directly across the mains (9) (10) at points indicated by the numerals (17) (18) and is provided with two field windings acting in opposition to each other, one of these windings being connected in series with the main (9), and the other in shunt across the mains (9) (10). The shunt winding is indicated in the drawing at (19) and the series winding at (20). When the load on the direct-current system increases, the current through the series winding (20) of the armature increases. This cuts down the resultant field strength in the motor and it consequently speeds up.

In the generator (12), which is driven by the motor, there is an increase of armature electromotive force, which corresponds to the speeding up of the motor, and since this armature is in series with the direct-current circuit its electromotive force may be added to or subtracted from that impressed on the mains, depending on the manner in which the armature is connected.

In this way an over-compounding effect may be produced by proper adjustment of the force, or, instead of causing it to be added to the line, the machine may be so connected as to reduce the voltage upon increase of load, in which case the storage battery (11) assists in supplying current when the load is heavy and is charged at light loads.

Detroit Rejects Cheap Rush-hour Fares.

At the election of November 6th a proposed new franchise of the Detroit United Railways was submitted to vote. It was defeated by 13,316 votes for to 28,823 against. Mayor Codd, who advocated the ordinance, was also defeated for re-election. Under the proposed franchise the rates of fare would have been 10 tickets for 25 cents during five hours of the day and six tickets for 25 cents the other hours. The cheap tickets would have been good between five and eight o'clock in the morning and 4:30 and 6:30 o'clock in the afternoon. To give the citizens an opportunity to test the proposed rates of fare the company several weeks ago put them into effect on all lines. At midnight on November 7th the cheap rates were withdrawn. The opposition to the ordinance was based on the allegation that the cheap workingmen's fares was simply a bait to cause the acceptance of a measure which did not safeguard public rights.

Safety System for High-tension Transmission Lines.

With the high-potential systems of today, where the power output is large, it sometimes happens that the main switches are unable to stand the

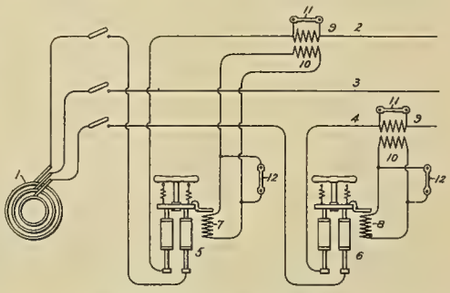


FIG. 1. SAFETY SYSTEM FOR HIGH-TENSION THREE-PHASE TRANSMISSION LINES.

strain of opening under excessive overload. This fact points to heavier and therefore more costly switches, or else a method of opening the circuit without throwing the full strain on the switch.

A system which, it is asserted, will accomplish this purpose and admit the use of even smaller and less expensive switches has been patented by John D. Hilliard, Jr., of Glens Falls, N. Y. Mr. Hilliard uses a series transformer connected in the line, two such transformers being used for a two-phase or three-phase circuit. Both the primary and secondary of this transformer are shunted by fuses or other automatic circuit-breaking devices; and across the secondary terminals is connected a trip coil to operate the automatic line switch.

In the accompanying drawings Fig. 1 is a diagram showing the invention applied to a three-phase alternating-current circuit, and Fig. 2 shows it applied to a direct-current circuit.

In Fig. 1 (1) represents a three-phase generator supplying current to the conductors (2) (3) (4), two of which are provided with automatic circuit-breakers (5) (6), which are released by the energizing of the trip-coils (7) (8). In each of two legs of the line is the primary (9) of a

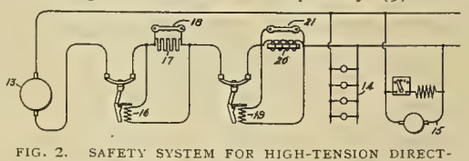


FIG. 2. SAFETY SYSTEM FOR HIGH-TENSION DIRECT-CURRENT OR SINGLE-PHASE TRANSMISSION.

series transformer. The secondary winding (10) of each transformer is in series with one of the trip-coils of the switch. In shunt to each primary winding is a fuse (11) of a wide-opening or arc-extinguishing type. The secondary windings are each short-circuited by a fuse (12).

Under normal conditions of service the drop across each primary winding is small, owing to the mutual induction of the primary and the short-circuited secondary. The current in the secondary does not affect the trip-coil, because this coil is shunted by the fuse (12); but when an excessive overload is applied to the line the increased current through the fuse (11) causes it to blow. The entire current is thereby thrown upon the primary, and the secondary current consequently increases and blows the fuse (12). This causes the secondary current to energize the trip-coil, release the switch, and open the line; but the instant the fuse (12) blows the secondary circuit is practically opened by reason of the great resistance and self-induction of the trip-coil, which is wound to give this effect. The reactance of the primary winding (9) is therefore greatly increased, causing a large drop across the terminals of that coil, and this affords a protection for the line switch against the liability of blowing up, so that smaller and less expensive switches can be used than would be safe otherwise.

In Fig. 2 a direct-current generator (13) is shown carrying a non-inductive load (14) and an inductive load (15). Two automatic circuit-breakers are shown in circuit with the generator, one of which has its overload-coil (16) shunted by a non-inductive resistance (17) and a fuse (18), arranged in multiple, the overload-coil (19) of the other circuit-breaker being similarly shunted by an inductive resistance (20) in multiple with a fuse (21). In the case of an overload the fuses (18) and (21) will blow and the resistances serve not only to protect the circuit-breakers from an excessive potential, but to force sufficient current through the coils (16) and (19) to trip the circuit-breakers.

The circuits and apparatus in Fig. 2 can remain the same if the generator is changed to a single-phase alternator.

New French Internal-combustion Engines for Dynamo Driving.

By A. de Courcy.

Many of the Paris builders of internal-combustion engines have been occupied with the question of stationary engines for use with direct-coupled

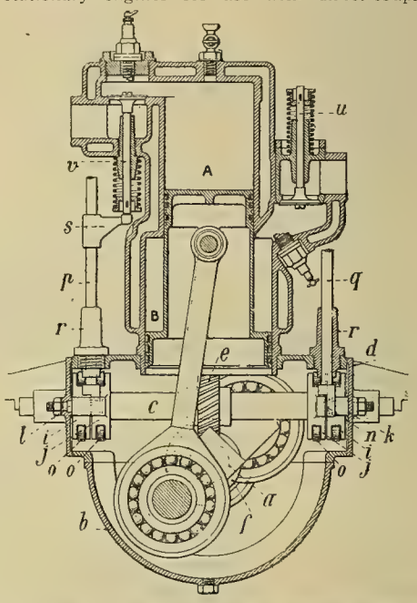


FIG 1. VERTICAL SECTION OF DUPLEX GASOLINE ENGINE.

generating sets. Some of the latest designs of motors are shown in the present description, and it is to be noted that the petroleum or oil-fuel motor is making good progress. A number of the new engines which are built at Paris have been designed to run with ordinary oil, and work very well with it.

A decidedly novel form of engine is the Bourdreaux-Verdet duplex. It is designed to secure the advantages of a four-cylinder engine, combined with a simple and cheap construction. A four-cylinder machine is well fitted for running dynamos, owing to its great steadiness. The division of the explosions has the effect of lessening the shocks, not only because each explosion is always opposed by a compression, but also because it is easier to have a mechanical balance between the masses in movement. Greater reliability, with fewer accidents, is the result. But the four-cylinder engine costs much more than the two-cylinder, owing to the considerable number of parts and the greater care which must be taken with the workmanship and material.

Briefly stated, the new principle of the duplex system lies in the use of an upper cylinder and piston (A), (see Fig. 1), combined with a lower cylinder and piston (B). The latter piston is of larger diameter, and is built integral with the upper piston. The pressures produced by the explosions in each separate cylinder are transmitted to the crank-shaft by a single crank. These explosions are successive, like those of an ordinary two-cylinder engine. A set of special compression chambers surrounds the lower cylinder, in which all the gas is compressed, and this cylinder acts only for the expansion of the gas. The upper cylinder works as usual.

Two such motors placed together and mounted on the same crank-shaft form a bi-duplex engine, using two opposed cranks. In this way the motor

with only two pistons and two cranks replaces a four-cylinder engine having four pistons and four cranks and often five bearings for the main shaft. The duplex has but two bearings. Many other advantages in the way of simplicity and economy are secured.

Fig. 2 shows a bi-duplex two-cylinder type coupled to a small dynamo. Such a group is very compact, and runs smoothly. A 200-hour test with a dynamo showed that 7,200 watts at 60 amperes, 120 volts, used on resistance load, were produced at a consumption of 300 grammes of gasoline per horsepower-hour, which is a remarkably low figure. The other advantages claimed for the duplex system are that the weight is 20 per cent. less than that of the ordinary two or four-cylinder motor, the fuel consumption 10 or 15 per cent. less, the price very much lower, about 40 per cent., and the space occupied by the motor is only one-half. Where a four-cylinder 18-horsepower engine costs $296 to build, a bi-duplex motor costs but $190, or a difference of $106 in favor of the latter.

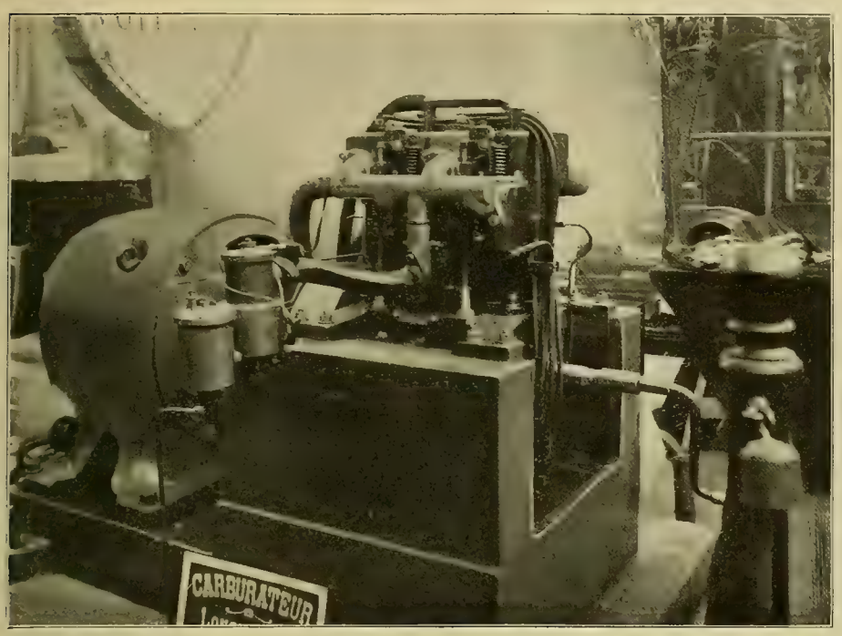


FIG. 2. BI-DUPLEX GASOLINE ENGINE COUPLED TO DYNAMO.

so as to secure the proper carburation for the motor. In the present case the Buchet people use an original method. Instead of a common carburetor for all the cylinders, they use a small device upon each cylinder at its intake. Oil and water are brought to each inlet and sprayed from a nozzle, forming a vapor which mixes with the inrushing air. There is an oil pump for each cylinder, also a water pump, and the engine is governed by varying the speed of the pumps. The motor which is shown here weighs about 2,650 pounds.

One of the latest engines which has been made for the use of oil, and which has been designed especially for running with dynamos, is built by the Marcel Masson firm. This engine, shown in Fig. 4, is of the four-cylinder type, with six-inch bore and 10-inch stroke, and is direct-coupled to a multipolar shunt-wound generator of the ironclad type. Proper compounding of the generator gives a practically constant voltage for all loads. The engine is well oiled and ventilated by special devices. It is of an improved type and has a very solid build, with a minimum exposure of the working parts. Side plates can be unbolted for reaching the inside of the crank case. The four cylinders, with their water jackets, are made in a single casting, and there is no piping on the outside of the motor. A special form of oil-vaporizing device is employed, so that ordinary petroleum can be used as the fuel. The present set will give 50 horsepower, or 30 kilowatts, working at only 425 revolutions per minute, which is a comparatively slow speed, much less than is usually found in gasoline engines, and is expressly provided so that dynamos can be run under better conditions. Some makers keep up high speeds of 700 or 800 revolutions per minute, which is too high for good use with generators.

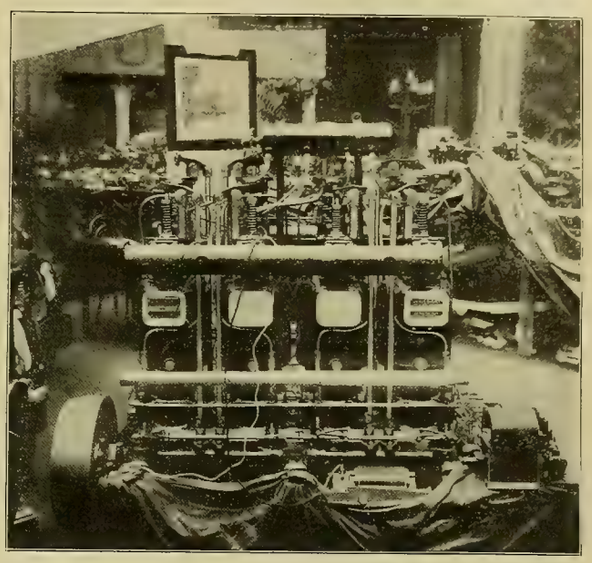


FIG. 3. BUCHET FOUR-CYLINDER 60-HORSEPOWER OIL ENGINE.

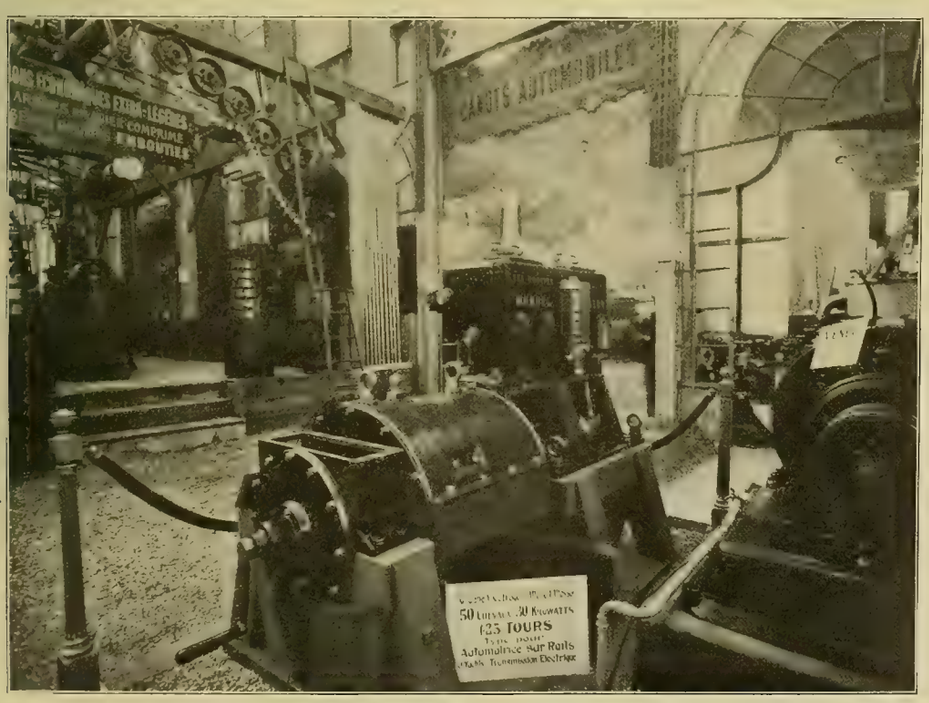


FIG. 4. MARCEL MASSON 50-HORSEPOWER GENERATING SET FOR OIL FUEL.

The Buchet Company, one of the well-known motor constructors of Paris, is building a new four-cylinder engine of 60 horsepower. A view of it is shown in Fig. 3. It is one of the new types which are made to run with ordinary oil instead of gasoline, and in this it has proved very successful. Oil engines are now the order of the day, and to make such a motor work, the first point is to find a good oil-spraying and mixing device

A Mysterious Announcement.

On October 27th, Mr. W. H. Hunter, as president of the Manchester (England) Association of Engineers, delivered an inaugural address of more than usual interest. For one thing, he suggested a new relation between engineering and the general community. Thus, there is an important connection between engineering and the supply of food, the speaker mentioning such measures as irrigation, afforestation, deforestation, drainage, etc., and especially the decline and ultimate extinction of the horse in favor of "mechanical efforts directed by human hands and minds." The displacement of animal for mechanical traction—horses being grain eaters—would set free a fresh supply of food. Finally, Mr. Hunter made the following statement:

"I speak with some measure of confidence when I say that it is possible that at no distant date the engineering world will be startled by the revelation of a discovery relating to motive power of such sort and of such far-reaching consequence that if I were permitted to describe it to you to night you would agree that it may of itself go far to establish the proposition which I have submitted to you this evening."

Coming from such a source, this Delphic utterance has attracted considerable attention.

New York Meeting of the Illuminating Engineering Society.

The monthly meeting of the Illuminating Engineering Society in New York was held at the Edison Auditorium on Friday evening, November 9th. President L. B. Marks called the meeting to order. Secretary Preston S. Millar said that at a meeting of the council on that afternoon the secretary reported that the membership list was about 850. The proper officers of the society are authorized to secure quarters for the society in the new Engineering Building at Thirty-ninth Street and Fifth Avenue.

President Marks introduced Mr. Albert E. Forstall, the chairman of the New York section, who made a few remarks, closing as follows: "I think the society has a great field before it in reducing the cost to the consumer, without reducing the income to the companies, and I hope we will be able to work out that feature."

After Mr. Forstall's talk the following papers were read: "Location of Lamps and Illuminating Efficiency," by Preston S. Millar; "Fixture Design and Location," by Major E. L. Zalinski, U. S. A.; "Fixture Location in Residence Lighting," by F. N. Olcott. The discussion following the reading of these papers was participated in by Major Zalinski, J. H. Hallberg, Dr. Hepburn, E. Y. Porter, Dr. C. H. Sharp, G. V. Williams, Dr. William S. Dennet and Mr. Elliot. The papers are given in abstract elsewhere in this issue.

Central-station Insurance.

Mr. W. H. Blood, Jr., of 84 State Street, Boston, has been retained by the National Electric Light Association, of which he is a former president, as insurance expert in the interests of the members. Any member companies having insurance troubles would do well to call upon Mr. Blood for services that will undoubtedly be of great assistance and will be promptly rendered.

The Electrical Operation of a Modern Cement Mill.

While there are many applications of electric motors in manufacturing establishments, there is probably no industry where the power demands are more exacting or the operating conditions more severe than in cement works. The heavy starting torque required by cement-making machinery, the nature of the load handled, the constant presence of dust and the inflammability of pulverized coal, used in the manufacture of cement, bring up problems in power transmission that require the most careful consideration.

Power transmitted mechanically from a central source is open to many objections, not only on account of the loss in long lines of shafting and belting, but to the lack of flexibility, and the necessity of laying out buildings to conform to such methods of driving add to the complexity of such systems.

These considerations led to a demand for a substitute that would in the main eliminate many of the objectionable features referred to and provide a source of power that is immune from fire risk and that can be subdivided and applied at the various points of application. The natural solution of the problem was the adoption of induction motors, which is aptly illustrated by the plant of the Bath Portland Cement Company at Bath, Pa. This plan was designed for an output of 2,500 barrels of cement a day, and is a typical example of modern practice in this industry, the credit for the successful design and operation being due to Mr. Frederick B. Franks, superintendent and chief mechanical engineer of the plant, and Mr. James A. Gish, assistant.

The buildings are compactly situated on four acres of ground and are constructed of concrete and steel, the extensive use of concrete being regarded as consistent with the cement business.

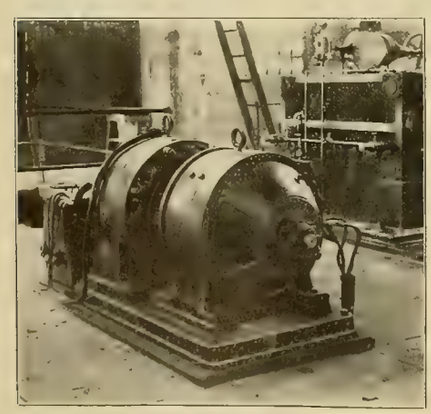


FIG. 4. MOTOR-GENERATOR EXCITER SET.

The company owns 320 acres of ground, on which is located, besides the buildings, an almost unlimited supply of cement rock, carrying approximately the correct proportions of material for Portland cement.

A view of the plant, taken to show the boiler and power house in the foreground, is given in Fig. 1. The power house is built 10 feet above the ground level, the lower part being used as a basement, which contains steam and air pipes, cables, overflow conduits from condensers and a receiving tunnel from the reservoir.

An interior view of the boiler room is given in Fig. 2. Here are located eight 300-horsepower Berry boilers, each 10 feet 6¼ inches outside diameter and 20 feet 9½ inches high. Bituminous coal is used for fuel, which is delivered on a trestle 12 feet high, 45-degree coal chutes delivering the coal into the boiler room. The boilers at the present time are hand fired, but the fronts are so arranged that they can be equipped with automatic stokers. A brick stack 175 feet high is located centrally in the building, with four boilers on each side. Each boiler is fitted with two 3½-inch pop safety valves, a Reliance water column, self-closing gauge cocks, stop and check valves and three blow-off cocks. The working pressure of the boilers is 150 pounds. Two horizontal 14-inch by 8½-inch by 10-inch duplex feed pumps supply water to the boilers through a 2,000-horsepower open feed-water heater.

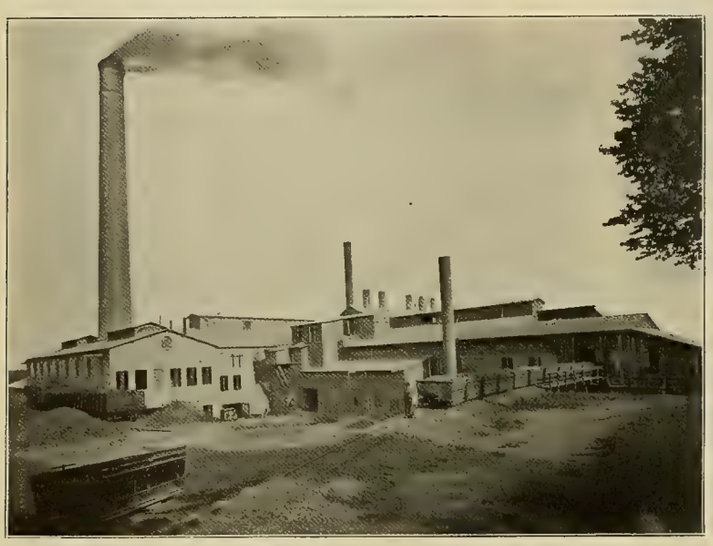


Fig. 1. General View of Plant Showing Power House in Foreground.

Fig. 2. View in Boiler Room of Power House.

ELECTRICAL EQUIPMENT OF A MODERN CEMENT MILL.

A large reservoir, located within 50 feet of the power house and having a capacity of 3,500,000 gallons, is used as a reserve for water supply during the season of the year when a creek, which furnishes the usual supply, is low. Water for condensing purposes is drawn from the reservoir and is returned, after which it must circulate throughout its entire dimensions before again entering the condenser suction pipes. The water supply for the reservoir, aside from the natural drainage of the surrounding grounds, is drawn from an artesian well 300 feet deep by a Deming pump operated by a 25-horsepower Westinghouse induction motor.

The engine and generator equipment consists of a 350-horsepower Wetherell-Corliss tandem-compound, condensing engine, direct connected to a Westinghouse 200-kilowatt engine-type three-phase 60-cycle 440-volt generator, operating at 120 revolutions per minute, and two 1,100-horsepower cross-compound engines of the same make, located parallel to each other, employed to drive the raw-mill department and the clinker department. These engines are of the heavy-duty Corliss type, with cylinders 24 inches and 48 inches by 48 inches. They are each fitted with a sheave flywheel 18 feet in diameter and 67¾ inches face, which drive 22 two-inch transmission ropes connected to sheave wheels on the main line shaft. To this line shaft are belted two Westinghouse 180-kilowatt 440-volt three-phase 60-cycle generators, operating at 514 revolutions per minute. Fig. 3 illustrates the direct-connected generating unit. All three engines are equipped with the Consolidated Engine Stop Company's apparatus, and any unit may be stopped from several places in the works in case of accident.

Fig. 4 is a view of a Westinghouse motor-generator set used for excitation. It consists of a 15-horsepower induction motor, 400 volts, 1,120 revolutions per minute, direct connected to a 10-kilowatt 125-volt type S generator.

The switchboard consists of white Italian marble panels mounted upon ornamental-iron legs, with the standard equipment of instruments for three-phase alternating-current circuits. Located immediately behind the switchboard are two 20-kilowatt Westinghouse oil-insulated self-cooling transformers with a secondary voltage of 120, which furnish current for 48 multiple alternating-current arc lamps and 1,500 16-candlepower incandescent lamps.

In order that a clear idea of the manufacture of cement and the various applications of electric motors in such industries may be gained, a description is given of the various processes from the time the rock leaves the quarry until the cement is packed in barrels.

In the quarry vertical holes are drilled into the solid rock by pneumatic drills, in which the blasting charges are placed and ignited by electricity. The loosened rock is conveyed to the mill in cars by means of gravity and is dumped into two No. 6 Austin gyratory crushers, where the material is reduced to sizes of 2½ inches and under. The empty cars then run to the foot of the incline, where an endless chain driven by a 10-horsepower induction motor draws them to the top, and they return to the quarry by gravity. This inclined tramway is shown in Fig. 5. The cars each have a capacity of four tons, and an average of 17 cars an hour is hauled up the incline.

FIG. 5. INCLINED TRAMWAY FOR QUARRY CARS.

From each crusher the rock is delivered to a continuous bucket elevator, which raises it to a small hopper that empties into two large Buchanan crushing rolls; here the rock is further reduced to sizes of three-fourths inch and under. From the rolls it is elevated on another continuous-bucket elevator and emptied into two revolving stone dryers 72 inches in diameter and 55 feet long, having four compartments, where the stone is dried. An exhauster is used in connection with the dryers, the stack being located on the outside of the building. From the dryers the stone discharges into a continuous-bucket elevator and is delivered into another set of Buchanan rolls driven by a 100-horsepower Westinghouse motor, shown in Fig. 6.

From this roll the stone is deviated and delivered into a storage bin in the storehouse or onto a reversible belt conveyor, traveling over the top of the stone storage bin, which conveys the stone into the raw mill and delivers it to a belt conveyor that discharges into 17 storage bins above the grinding mills. The storage bin in the storehouse is of concrete and steel construction and has a capacity of 1,200 tons of crushed stone. The stone is taken from this bin by a Scandinavian belt conveyor in a tunnel beneath and is emptied into

an elevator which in turn conveys the crushed stone over the bins in the raw mill. The large storage bin in the storehouse is kept filled to its maximum capacity, as this department only operates 10 hours a day, and enough excess material is stored to enable it to close down for three days at least. The machinery in this department is operated from the main line shaft, which is driven from the engine room, as already described.

The next process is taken up in the raw-grinding room, where 16 Fuller-Lehigh mills are located, and driven from the same line shaft that operates the machinery in the stone house, each mill having its independent clutch. Large storage bins are located over the mills which empty directly into their feed hoppers, ample room being provided for any necessary repairs. Passing through the mill, the material is delivered into a screw conveyor located in a tunnel beside the mill foundation, which empties into an elevator in the kiln house. In this house the machinery is driven by a line shaft belted to a 100-horsepower Westinghouse induction motor operating at 580 revolutions per minute. This motor also drives a 22.5-kilowatt 125-volt type S exciter which supplements the exciters in the engine room proper. An illustration of one of the kilns is given in Fig. 7.

The kiln house connects with part of the raw grinding room, and the rotary kilns are placed transversely across the building. There are six kilns, each 100 feet long, seven feet six inches in diameter at the large end and five feet six inches at the stack end. The stacks are 60 feet high,

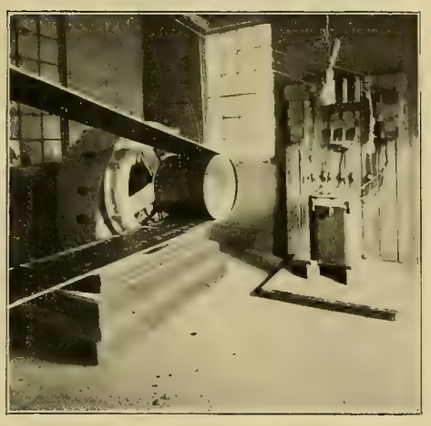


FIG. 6. INDUCTION MOTOR OF 100 HORSEPOWER OPERATING MACHINERY IN STONE HOUSE.

ranged so that a continuous flow of this ingredient enters and mixes with the clinker before crushing. From the pot crushers the clinker is conveyed on a belt conveyor and emptied into a second conveyor that discharges into an elevator delivering the material in the clinker-grinding room containing 24 Griffin mills. The unfinished clinker storage room will have a capacity of 100,000 barrels, with provision for increasing the amount if necessary.

The clinker, after passing through the pot crushers in the clinker storage house, enters the clinker-

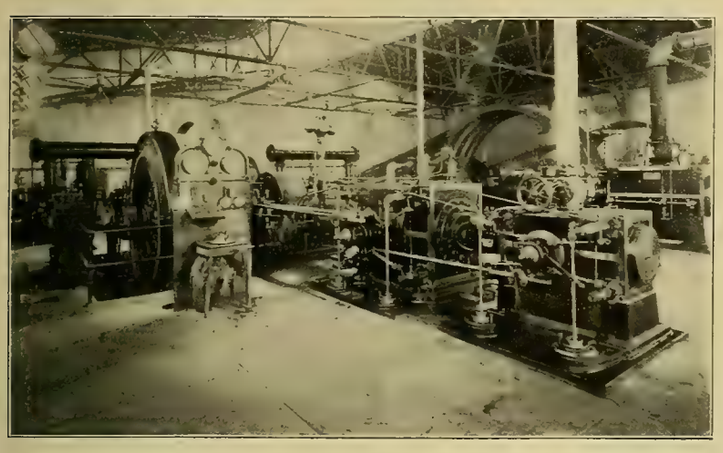


Fig. 3. Engine-Generator in Power Plant.

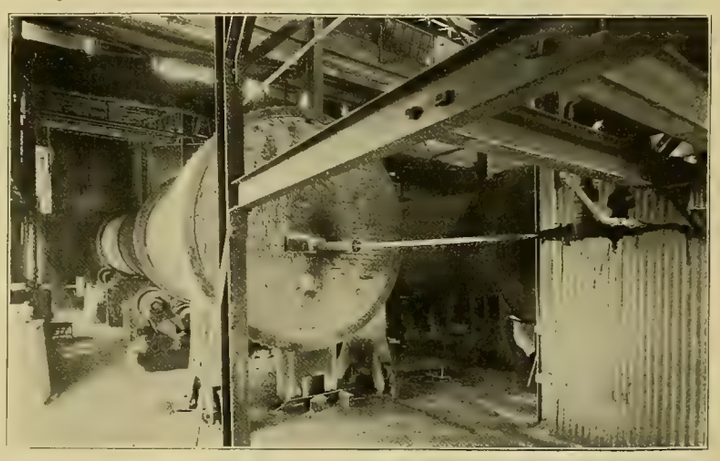


Fig. 7. Electrically Operated Kiln.

ELECTRICAL EQUIPMENT OF A MODERN CEMENT MILL.

five feet in diameter. Each kiln is driven from the line shaft by means of a Mosser speed regulator of the interlocking-cone pattern controlled by a tight and loose pulley that also controls the feeding of the raw material from the storage bins, which have a capacity of 200 tons each.

The raw material is raised by an elevator from the raw mill to a screw traveling transversely across the kiln storage bins. Another screw is also used to remove the spill and dust from the dust chambers at the feed end of the kilns, and, in turn, empties into the elevator that receives material from the raw mill. At the delivery end of the kiln the clinker discharges into a pit, forming a chute that empties into three bucket elevators, one elevator being used for two kilns. The clinker is then elevated and discharged into three clinker coolers 10 feet in diameter and 40 feet high, illustrated in Fig. 8. The elevators are operated by a 30-horsepower motor. The coolers are arranged with spouts which deliver the clinker into conveying machinery that extends to the clinker storage, where the clinkers are well seasoned before grinding.

Fuel for the kilns consists of pulverized coal, which is forced through pipes from the feeders to burners, as can be clearly seen in Fig. 7. The feeders, six in number, are each operated by a one-horsepower motor.

The clinker discharges from the coolers upon a belt conveyor traveling through the concrete foundations upon which they rest. The discharge from the cooler is controlled by a hand-operated gate. The first belt conveyor empties into a second belt conveyor, which delivers the clinker to an elevator that, in turn, delivers the clinker to a conveyor distributing from the clinker storage to a belt conveyor. This empties into an automatic measuring device, which discharges into a storage bin, thence to three pot crushers. An automatic gypsum measuring device is used and argrinding room on a belt conveyor and is emptied into a bucket elevator and conveyed to two sets of clinker-crushing rolls, where the clinker is reduced to about the size of peas, then elevated and conveyed to bins over 24 Griffin mills, where it is ground to cement. After the clinker-grinding room comes the cement stock house, where the finished product is stored. From the former department cement screws empty into a bucket elevator that elevates and delivers into an overhead screw operating right and left. This, in turn, discharges into two screws traveling longitudinally

FIG. 8. COOLERS IN CEMENT PLANT, SHOWING BUCKET ELEVATOR.

with the building, one of which empties into a large bin on one side of the building and into a number of smaller bins on the opposite side, where a screw conveyor in a large tunnel delivers the cement to the packing house. From the large bin there is also a screw conveyor for delivering cement to the packing house, which has a capacity of 4,000 barrels a day. All the machinery in the stock and packing house is operated by a 100-horsepower Westinghouse induction motor.

The coal-pulverizing plant, where the coal for the kilns is prepared, contains one self-contained coal dryer, a Mosser crushing roll and four Lehigh-Fuller mills for pulverizing the coal. After passing through the dryer the coal is delivered by a screw conveyor into the Mosser crushing roll, then into a bucket elevator that empties into a screw conveyor above the storage bins for the Lehigh-Fuller mills. After passing through the mills the coal is delivered by means of a screw conveyor and an elevator to the coal bins in front of the kilns. All the machinery in this department is driven by a Westinghouse 200-horsepower induction motor.

A modern machine shop, operated by a 10-horsepower induction motor, where all repairs are made, completes the equipment of one of the most modern and complete cement plants in this country.

Electrical Inspection in Western Cities.

At LaCrosse, Wis., a committee of the City Council has been appointed to examine the wiring recently installed in the City Hall. It will also investigate the electrical hazard in the theaters. Some of the aldermen favor the adoption of an inspection ordinance, and there seems to be a prospect of securing the appointment of an inspector before long.

The electrical inspection ordinance at St. Joseph, Mo., is rigidly enforced. The city electrician, under whose direction wiring is examined, has been connected with insurance inspection work. The standard for wiring is reported as excellent. Old work in the business district is examined semi-annually, and the most hazardous portions have been largely removed.

At Kansas City, Mo., the inspection ordinance is being effectively administered and the standard for wiring is practically in full compliance with Code requirements. Considerable progress is being made with old and defective wiring.

From Stillwater, Minn., it is reported that since the previous visit of the Underwriters' Electrical Bureau inspector, the municipal electrical inspector has severed his connection with the telephone company and is devoting all of his time to the city. The high-tension transmission line which at present passes through the heart of the city will soon be placed underground from the bridge to the new sub-station which is being constructed adjoining the new gas plant. Much of the old and defective wiring is coming in for attention, and the ordinance is being effectively administered.

At Topeka, Kan., the present administration is reported to be opposed to any additional expenditures for municipal service, and those best posted on the political situation advise that further efforts to secure electrical inspection be delayed until after the election of a new mayor. A large share of the new wiring at present being installed is of good character.

Surveys are being made by the Northern Michigan Traction Railroad Company for an electric railway which is to connect Manistee, Traverse City, Charlevoix, Petoskey and Cheboygan, with branches to Old Mission, Wallon Lake, East Jordan and Bellaire, making 225 miles of electric railroad in all, estimated to cost about $7,000,000.

WESTERN ELECTRICIAN

EVERY SATURDAY.

PUBLICATION OFFICES:

507 Marquette Building, - CHICAGO.

TELEPHONE, MAIN 1746.

Eastern Office, 150 Nassau Street, New York.

Telephone, 8220 Beekman.

Trade Supplied by Western News Co.

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SUBSCRIPTION, in advance, postage prepaid, $3.00 for a full year of 52 numbers; in clubs of four or more, $2.50, with free extra copy for eight subscriptions; foreign countries, $5.00 a year; single copies, 10 cents. When change of address is requested, the **old address** as well as the new should be given.

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DATES AHEAD.

Chicago Electrical Show (second annual exhibition), Coliseum, Chicago, January 14 to 26, 1907.

Northwestern Electrical Association (annual meeting), Coliseum, Chicago, January 16th, 17th and 18th.

FOLLOWING the recent failure of a concrete smokestack at a Peoria electric power house, the collapse of a large reinforced-concrete hotel in progress of erection at Long Beach, Cal., on November 9th may serve to raise some doubt in the minds of engineers and builders who are making such widespread use of concrete or steel-concrete for a great variety of purposes. While these particular accidents may be susceptible of explanation, it is possible that the use of concrete is being just a trifle overdone. At any rate, the cement and other constituents should be carefully tested and inspected, and the work of construction should only be done under competent supervision. Concrete lends itself to the employment of cheap labor, but it should not be too cheap, else it may prove very dear.

BOTH electrical men and the "commuters" along the line of the Illinois Central in Chicago will sincerely hope that the new administration of that railroad will proceed to "electrify" the suburban passenger service as soon as practicable. Mr. J. T. Harahan, the new president, is an able, progressive railroad man, who makes his home in Chicago and is familiar with Chicago's needs. He knows well the feeling of resentment excited in the tributary territory of the railroad on the South Side by the continued use of steam locomotives. These locomotives are noisy, dirty and air-polluting and make the use of the suburban-station platforms often very unpleasant. Electric traction would do away with all complaint. The principal competition in a considerable portion of this territory is afforded by the Alley "L" road, which is electrically equipped and which is just now perfecting an express service. Apparently it behooves the Illinois Central to "get in line" by the use of electric power or else sacrifice a considerable portion of its suburban business. This business is reported to be very profitable; and the Chicago patrons of the road will look to the new president to add to its attractiveness by the greatly desired electrical improvement.

IF THE CORONER'S jury ascertained the fact correctly, practically the entire blame for the electric-railway accident at Atlantic City on October 28th is thrown on the bridgetender, who is a man rather advanced in years. The jury reached its verdict on November 7th, and, after reciting the death of 57 persons, said that the victims came to their death "by the derailment and plunging into the waters of Beach Thoroughfare of the electric train on the West Jersey and Seashore Railroad," "said derailment being caused by the northwest end of the southwest rail on the draw of the bridge over Beach Thoroughfare in or near Atlantic City, in said county, being out of its proper position, due, we believe, to the neglect or oversight of the man in charge of the draw." And the jury added: "We strongly recommend that the men employed to operate the drawbridge inspect, each with the other, both ends of the draw before the signal is given for trains to pass the opening ends of the draw."

All the evidence tended to show that the railroad could have employed no better construction than that used. While the accident was a most regrettable one, it is gratifying to observe that the electrical equipment is found to be in no wise at fault.

THAT there may be some relation between electricity and the life principle in animal organisms has been surmised; and a press dispatch from San Francisco, dated November 11th, would seem, if true, to show that this conjecture is well founded. Somewhat condensed, the newspaper account is as follows:

"Before a number of medical men and scientists today Drs. Albert J. Atkins and E. J. Lewis succeeded in charging an electrical circuit with human electricity to such a degree that external sound waves were transmitted and heard through an ordinary telephone receiver. The experiment consisted of the application of two platinum electrodes to the walls of the living stomach. By means of copper wires the electrodes were connected with a telephone and microphone. There was no mechanical or chemical battery in the circuit, yet the moment the electrodes were swallowed sufficiently to touch the walls of the stomach human electricity flowed over the wires, rendering sounds audible. The electric charge measured from seven to eight millivolts. Drs. Atkins and Lewis assert that by this experiment they have demonstrated the law of action of the human senses. They reason that if sound is transmitted over a copper wire when it is charged with human electricity it is reasonable to consider the principle the same when the auditory nerve is charged with the same force. In other words, one hears when the auditory nerve is made sensitive with human electricity on the same principle by which one receives a telephone message. Furthermore, these scientists declare that by a series of experiments they have proved that digestion is an electrochemical process, that all life action in the body is dependent on the activity of the electrical forces within the organism, and that variations of sense manifestation, as sight, hearing, etc., are caused by the different rates of vibration set up by the human electrical currents acting on the sense nerves."

This is extremely interesting, and it sounds plausible. One would like to know, however, exactly the conditions under which the telephone, which is an extremely sensitive instrument, was employed. Perhaps if the experiment could be tried with the use of the stomach secretions in an artificial stomach the result would be the same. But in the latter case there would be no life, the secretions simply acting as an electrolyte to set up the slight current. Or possibly a test in the same manner with an animal immediately after death would give the same result. Very careful investigation should be made before it is concluded that life is essential, although, from the account given, it must be admitted that it is reasonable to suppose that such is the fact.

WITH the issue of December 1st the Western Electrician will begin the publication of a serial article on wireless telegraphy or radio-telegraphy, if that is the proper name, to run through the weekly issues of about three months and illustrated by over 80 illustrations and diagrams. This serial is written by Mr. Donald McNicol, A. M., A. I. E. E., who has the advantage of being not only an enthusiastic student of and experimenter with "wireless" for many years, but also a practical and experienced telegraph man in the ordinary use of the term, being at present manager for one of the great telegraph companies at Butte, Mont. Mr. McNicol is indeed well fitted for this congenial task, and he has written a series of articles which, we are confident, will be greatly appreciated by the readers of the Western Electrician. As a telegraph man engaged in active work, the author takes care not to neglect the practical side of his subject; he shows what has been actually done with "wireless" up to the present time, and, moreover, he gives directions for the making of experimental apparatus—a feature of the serial which is of especial value.

The following list of chapter headings is of interest as giving some idea of the scope of the work:

Introduction. Chapter I. Matter. Chapter II. Ether. Chapter III. Waves and Wave Motion. Hertz Waves. Chapter IV. The Generation and Propagation of Electric Waves. Chapter V. Electric Wave Detectors. Chapter VI. Aerial Conductors. Chapter VII. Syntonic Wireless Telegraphy. Directed Waves. Chapter VIII. Arrangement and Wiring of Apparatus Used in Practical Operation by Various Wireless-telegraph Concerns. Chapter IX. Commercial Applications of the New Method of Telegraphy. Chapter X. How to Construct Experimental Apparatus for the Demonstration of Different Methods of Wireless Signaling.

There is no more fascinating subject in the whole range of the science and art of electricity than space or wireless communication, and it has likewise assumed great practical importance, as is shown by the recently concluded "wireless" international conference at Berlin. With such a subject and closely following such world-wide recognition as the Berlin congress afforded, we are sure that Mr. McNicol's series of articles will be awaited with great interest by the readers of this journal.

It may be added that the popular serial on "The Small Central Station," which has been running since the issue of July 7th, will be concluded next week. The concluding chapter will be, fittingly enough, in view of present-day activities, devoted to "Business Getting" for stations of the class described.

The Location of Illuminating Units for Best Efficiency.

At the meeting of the Illuminating Engineering Society in New York city on November 9th three papers were presented of considerable importance. Abstracts of these papers are given below. An abstract of the discussion that followed their reading will be given next week.

Location of Lamps and Illuminating Efficiency.

BY PRESTON S. MILLAR.

It is the purpose of this paper to consider the relative efficiencies of four different methods of indoor illumination which are in common use today, using as a basis precise measurements of the intensity of illumination produced by incandescent electric lamps used with various fixtures variously placed.

Lack of opportunity to carry out a series of tests for incorporation in this paper has made necessary the adaptation to our purpose of tests made at the Electrical Testing Laboratories with other objects in view. The conditions are not in every case just what one might wish, but it is hoped that the results may be of practical value.

The experiments were made in a rectangular room, approximately 16 feet long by 11 feet wide and 12½ feet high. The ceiling and walls are finished in a light-buff color, the ceiling construction being steel girder and brick arch. The floor is painted light red. There are three windows, one of transparent glass six feet 11 inches high and three feet wide, one of translucent glass five feet six inches high by two feet six inches wide, and one of translucent glass five feet six inches high by two feet three inches wide. Fig. 1 shows the plan of the room and the location of test stations at which measurements of illumination on a horizontal plane three feet above the floor were made. As no other measurements of illumination were made, this study will be confined to the particular plane referred to without any reference to the effect upon the other portions of the room.

In this room lamps have been installed for test purposes at various times as follows:

Ceiling Installation.—Twelve 16-candlepower lamps in the ceiling, tip downward, one lamp located directly over each of the 12 illumination test stations, as shown in Fig. 1.

Drop-cord Installation.—Six 16-candlepower lamps on drop-cords, suspended at a height of nine feet above the floor, directly over the illumination test stations Nos. 1, 3, 5, 7, 9 and 11, as in Fig. 1. The peculiar arrangement of the lamps in this test was the result of considerations which are of no interest in this connection.

Chandelier Installation.—Four 16-candlepower lamps at a height of seven feet one inch above the floor, placed in a chandelier suspended in the center of the room. The arms of this chandelier were approximately one foot six inches long. The lamp axes formed angles of approximately 45 degrees with the vertical. The chandelier arms were diagonal with the vertical.

Wall-bracket Installation.—Four 32-candlepower lamps placed upright in wall brackets seven feet above the floor, located symmetrically one on each of the four walls.

All of the above lamps were of the oval-filament type and were operated at the voltage at which they gave their rated candlepowers. They were used alone and with reflectors and globes, as stated hereafter.

The results of the experiments appear in detail in Table I. In considering these, it should be remembered that no comparisons can be drawn between the reflectors and globes used, since the installations were radically different. Table II. shows efficiencies obtained with the various installations, and should be considered in connection with Table I. All efficiency values are based upon the numerical averages of the figures representing intensity of illumination at the various test stations, as shown in Table I. Such values are assumed to properly represent the mean intensity of illumination throughout the entire plane investigated, because the various test stations are located at the centers of equal areas symmetrically disposed.

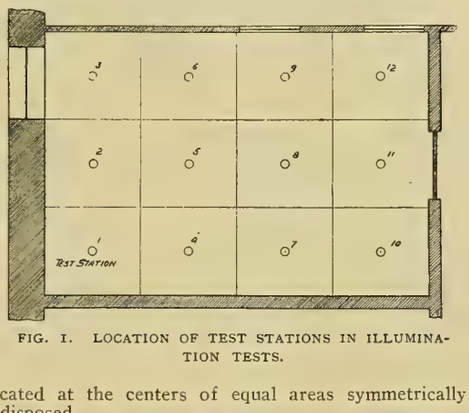


FIG. 1. LOCATION OF TEST STATIONS IN ILLUMINATION TESTS.

Attention is called to the method of stating relative efficiencies. The three large factors to be considered in determining the total efficiency of electric lighting are: The efficiency with which the energy is generated and transmitted, the efficiency with which the light is produced, and the efficiency with which the light is utilized. With the last two the illuminating engineer is intimately concerned. As respects a particular lighting installation, the efficiency of the lamps as illuminators may be expressed in "lux per watt." Separate and distinct from this is the term "lux per lumen," which expresses the efficiency of the illumination irrespective of the efficiency of the lamps. Both are of use, but have not necessarily any definite mutual relation. The "lux per lumen," being the ratio of the illumination to the flux of light, depend largely upon the location of the lamps, the nature of their distribution of luminous intensity and the nature of the surroundings. The "lux per watt," being the ratio between the illumination and the energy absorbed, depend upon all the conditions which determine the "lux per lumen," but in addition are a function of the efficiency of the lamps. The other expressions, such as "lux per candlepower" and "lux per square foot of floor space," are frequently used in practice.

One of the important features of the data presented in Table II. is the increased efficiency of illumination due to the use of reflectors in the drop-cord installation, where a gain of 46 per cent. in intensity of illumination is made. The reflectors used in the chandelier installation are not so effective, the opal reflectors increasing the illumination 17 per cent. and the prismatic reflectors 25 per cent. The smaller increase in illumination here observed is not chargeable to the nature of the reflectors, but is due rather to the fact that they are used upon the chandelier in the haphazard fashion common to such practice, where the use of reflectors is dictated by a desire to make the chandelier look complete rather than to improve the illumination.

Table III. shows the very great influence which the location of the lamps in this installation has upon the illuminating efficiency.

Table III.—Average Intensity of Illumination at Twelve Test Stations.

Installation.	Direct Illumination from Lamps (Computed).	Total Illumination (Measured).	Per Cent. Increase Due to Diffuse Reflection.	K.
	Lux.	Lux.		
Ceiling	8.5	22.5	166%	0.62
Drop cords	7.0	14.8	113%	0.53
Chandelier	8.9	14.0	69%	0.36
Wall brackets	11.6	16.7	45%	0.31

Note.—K is factor for wall reflection which appears in the formula $E = e\left(\frac{1}{1-K}\right)$.

General Conclusions.

From the foregoing it appears that in the room described with different locations of bare lamps:

1. The relative illumination in terms of that produced by the ceiling installation varies from 115 to 194 per cent.
2. The increased illumination on the plane investigated, due to diffuse reflection from ceiling and walls, varies from 45 to 166 per cent.
3. The factor K varies from 0.31 to 0.62.
4. The net reflecting efficiency of the ceiling and walls varies from four to 10 per cent.

Fixture Design and Location.

BY MAJOR E. L. ZALINSKI, U. S. A.

An examination into the laws governing the intensity and distribution of light here appears desirable. It is a fundamental law that the intensity at any distance from the source of light is inversely as the square of the distance. This assumes a radiant point of light as being the source. In other words, the intensity of illumination at various distances from the source is thus computed in the attempt to secure definite illumination. The lighting arrangements are then made to conform to this, some allowance being made for the color tone of the walls and ceilings. A modified formula will have to be used where the source of light is not a point, as, for example, in the cases of the Cooper Hewitt and Moore tubular or similar lights, which may be said to have more than one dimension.

There is some question as to the strict applicability of the law of inverse squares to the cases where reflectors are used, even with single incandescent lamps. But unless these reflectors are in whole or part of the parabolic type, securing a reflection approximately parallel to the axis, the law of inverse squares must still apply, approximately at least.

In cases where the reflectors are partially parabolic, the law of inverse squares will apply to the angles outside of the axial angle, the rays of light being parallel at the latter.

Generalizing, three cases may be assumed:

1. Reflectors parabolic throughout, where the law of inverse squares will not apply at all.
2. Reflectors partially parabolic, where the law will apply to the extraneous angles, but does not apply to the axial and immediately adjoining angles.
3. Ordinary conical and dome-shaped reflectors, where the law of inverse squares practically applies throughout the field, but must be based on actual photometric measurements at different portions of the field.

We may now assume that the reflectors used are not in part or wholly parabolic. Taking a concrete case, computations made on the basis of the law of inverse squares would indicate as follows:

The height of ceiling is taken at 16 feet. The plane to be illuminated is taken at three feet above the floor, or 13 feet below the ceiling.

Assuming an intensity of 16 candlepower at one foot distance, we have available at

4 feet = 1.0 foot-candle
5 feet = 0.64 foot-candle
6 feet = 0.44 foot-candle
7 feet = 0.32 foot-candle
8 feet = 0.25 foot-candle
10 feet = 0.16 foot-candle
13 feet = 0.09 foot-candle

The illumination demanded for ordinary good print reading is one foot-candle; for newspaper print two foot-candles; for the postal service four foot-candles, and for drafting 10 foot-candles.

Assuming the two foot-candles at the plane three feet above the floor as the basis, if the light were placed at the ceiling, 338 candlepower would be

Table I.—Details of Illumination Provided by Various Installations of Lamps.

Type of Lamp	16-cp. Oval Filament	16-cp. Oval Filament		16-cp. Oval Filament			32-cp. Oval Filament	
No. Lamps	12	6		4			4	
Installed	Ceiling	Drop Cords		Chandelier			Wall Brackets	
Height above plane	9 ft. 2 in.	6 ft.		4 ft. 1 in.			4 ft.	
Auxiliaries	None	None	No. 90 I. E. Co. Coated Refl.	None	7¼-in. Opal Reflectors	No. 2623 Holophane Reflectors	None	No. 2905 Holophane Gl. (sp'l)
Test Station No.	Lux.	Lux.	Lux.	Lux.	Lux.	Lux.	Lux.	Lux.
1	17.3	13.0	21.2	8.0	8.3	8.2	14.8	13.9
2	19.9	14.8	19.5	10.3	10.2	10.2	14.1	19.9
3	19.1	13.4	21.0	8.1	8.3	9.3	14.7	12.8
4	22.6	15.3	21.1	16.4	20.5	26.8	19.2	22.2
5	24.0	16.1	24.1	28.2	37.7	32.1	18.1	19.5
6	22.3	15.8	22.6	15.8	19.1	21.4	19.2	18.2
7	22.6	13.6	21.6	14.6	16.6	25.6	19.9	18.1
8	25.6	17.5	24.5	25.4	31.5	32.6	17.2	18.3
9	23.4	15.3	24.3	15.7	20.1	18.2	19.3	16.5
10	19.9	13.1	17.6	7.9	7.2	7.8	14.6	13.3
11	23.1	15.5	23.0	9.7	9.2	8.8	14.4	18.6
12	21.7	14.6	19.5	8.4	7.8	8.9	14.6	12.3
Average	21.8	14.8	21.7	14.0	16.4	17.5	16.7	17.0

Table II.—Showing Efficiency of Illumination. Conditions.

No. of Lamps	12	6		4			4	
Candlepower of lamps	16	16		16			32	
Watts per candle	3.1	3.1		3.1			3.1	
Installed	Ceiling	Drop Cords		Chandelier			Wall Brackets	
Height above plane	9 ft. 2 in.	6 ft.		4 ft. 1 in.			4 ft.	
Auxiliaries	None	None	No. 90 I. E. Co. Coated Reflectors	None	7¼-in. Opal Reflectors	No. 2623 Holophane Reflectors	None	No. 2905 Holophane Gl. (sp'l)
Efficiency:								
Average lux per candlepower	0.114	0.154	0.226	0.219	0.256	0.273	0.130	0.133
Lumen	0.0109	0.0148	0.0217	0.021	0.0246	0.0262	0.0125	0.0127
Watt	0.0364	0.0496	0.0728	0.0707	0.0828	0.0883	0.0421	0.0428
Sq. ft. floor space	0.124	0.084	0.123	0.079	0.093	0.099	0.095	0.097
Cu. ft.	0.0099	0.0067	0.0098	0.0064	0.0074	0.0079	0.0076	0.0077
Cu. ft. above plane	0.0130	0.0089	0.0129	0.0084	0.0098	0.0105	0.0099	0.0102
Uniformity:								
Average var. from mean	8.3%	7.4%	7.8%	37.8%	48.2%	49.1%	12.5%	15.9%
Range in intensity of illumination	—20.6% to +17.4%	—12.2% to +18.2%	—18.9% to +12.9%	—43.5% to +101.5%	—56.1% to +129.9%	—52.5% to +86.4%	—15.6% to +16.1%	—27.6% to +30.6%

required to secure the requisite illumination at the three-foot plane.

At four feet below the ceiling, this would be reduced to 162 candlepower, or a little less than one-half.

At six feet below the ceiling it would be reduced to 98 candlepower, or less than one-third.

At eight feet below the ceiling it would be reduced to 50 candlepower, or less than one-seventh. It is thus seen how very wasteful much of the usual lighting-fixture arrangements are in the available illumination.

It is obviously desirable, from consideration of

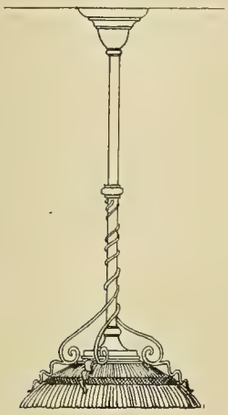


FIG. 2. DIFFUSING REFLECTOR, SIX LIGHT CLUSTER.

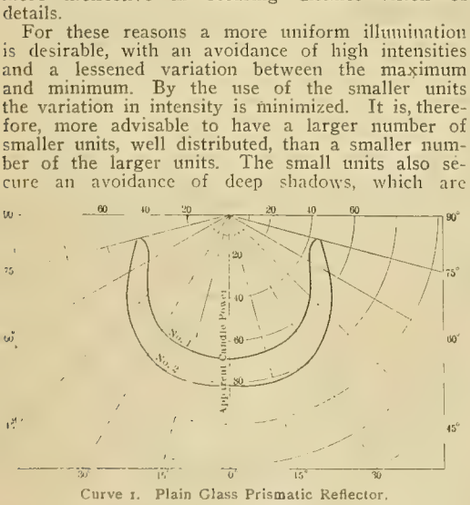
economy and efficiency of illumination, to place the lights as low down and as near the plane to be illuminated as possible, the gain thus secured increasing very rapidly. But various other considerations serve to limit and modify the extent of the lowering which is practically possible or desirable.

The high intrinsic brilliancy of the clear prismatic-glass reflectors, in the axial angles, render it necessary for comfort to raise the lamps high, to avoid the uncomfortable glare incidental thereto. The higher candlepower obtained at the axial angles renders this feasible, but this results in a reduced illumination at the extraneous angles. Diffusing reflectors having a less intrinsic brilliancy may be placed lower and nearer the eyes without injury to the latter.

The law of inverse squares has application not alone in the height of placement of fixtures, but has also direct application in the matter of most advantageous subdivision, lateral distribution and number.

Considerable variation in the maximum and minimum of the illumination becomes, for physiological reasons, most disadvantageous. The retina of the eye quickly adapts itself to the brightest lights, reducing its opening accordingly. Where adjacent zones are of a comparatively lower intensity, they thus are made to appear relatively darker, and the illumination consequently becomes more ineffective in securing distinct vision of details.

For these reasons a more uniform illumination is desirable, with an avoidance of high intensities and a lessened variation between the maximum and minimum. By the use of the smaller units the variation in intensity is minimized. It is, therefore, more advisable to have a larger number of smaller units, well distributed, than a smaller number of the larger units. The small units also secure an avoidance of deep shadows, which are



Curve 1. Plain Glass Prismatic Reflector.
Curve 2. Same Reflector with Diffusing Backing

FIG. 3. DISTRIBUTION OF LIGHT ABOUT THREE-LIGHT CLUSTER.

detrimental to clear vision, and a due appreciation of the proportion and relation of objects in the field of vision.

The lamps must be well above the head and eyes. A distance of eight feet from the floor is assumed as a minimum height, giving ample head room and being above the direct vision of the eyes.

Fig. 2 is a sketch of a fixture for a 13½-inch diffusing reflector with a Benjamin or other cluster, the stem being here of greater length than usually adapted to such fixtures.

Fig. 3 gives the distribution curves of reflectors as illustrated in Fig. 2. Curve (1) is of a plain prismed glass reflector, and curve (2) that of the same reflector with a diffusing backing. It is seen that the latter in this case gives superior results, both in the axial and the extraneous angles, to those from the plain prismed glass. The diffusing reflector is on a parity with the plain prismatic when at about 40 degrees on either side of the horizontal. This, of course, bespeaks for the former a superior distribution and more efficient illumination. Fig. 4 is a form combining the 13½-inch reflector with others mounted on the same electrolier in such manner as to secure a broad distribution.

A good general illumination is of the first consideration, but may be of a very moderate intensity according to the general conditions. But, besides this, there should be provided locally, illumination of higher intensity to provide for special conditions.

Fixture Location in Residence Lighting.

BY F. N. OLCOTT.

The introduction of electricity has changed the conditions previously existing. The danger of fire and smoke is practically eliminated at the light, and the designer is given an opportunity to create a lighter and more graceful fixture, gradually doing away with the old-type chandelier and developing the present ceiling electrolier. This gives a far more pleasant illumination, as the source is above the normal line of vision and the eye is not offended by the glare of the lamps. It also increases the apparent size of the room and sets off the decorations to a better advantage. When the hanging fixture is necessary for use or decorative purpose, the lights can be better screened and the fixture kept in proportion to the room. This is undoubtedly one of the reasons of the popularity of electric lighting over gas, the gas simply being used for emergency purposes and

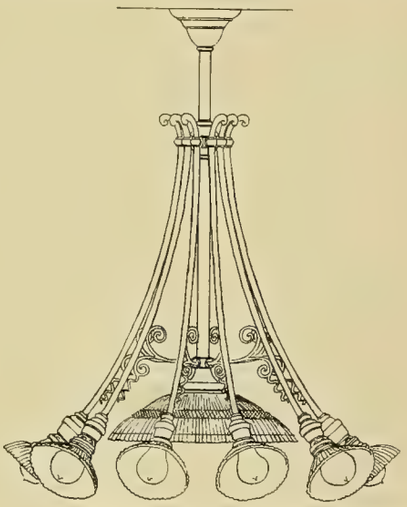


FIG. 4. SIX-LIGHT CLUSTER AND DIFFUSING REFLECTOR.

preferably on the side brackets and in the service portion of the house.

To properly light a residence with electricity, the first and most important principle is to have the wiring properly installed, with a full allowance of lights for each outlet, and the outlets carefully located for effective illumination of the entire room, and with the light so controlled by switches that the owner can conveniently use as many or as few lights as is desired. The proper allotment of lights at the time of installation is consequently of the utmost importance.

The present rules of the National Board of Fire Underwriters do not permit of a fixture being used with more lights than the wiring calls for, regardless of the candlepower of the lamp the owner intends using. The board takes the position that there is no way to prevent the owner from increasing at any time the candlepower, and consequently the current in the circuit.

The real problem in residence illumination is to create an efficient illumination without a glare at the source. This cannot be done if the lighting of the room depends upon a few lights of large candlepower. It therefore necessitates the use of a number of units of small candlepower, and this consideration should be given careful thought by the architect and illuminating engineer when laying out the wiring. It is very difficult to make any change after the residence has been completed, and poorly designed wiring layout may prevent the fixture designer from securing a satisfactory illumination, as the fixtures have to be supplied with lights within the wiring specifications in order to obtain the underwriters' certificate. The owner is then forced to put up with an insufficient amount of light or to exceed the specified capacity of the wiring by using a larger candlepower lamp. This procedure, aside from the risk from violating the rules, will not give a pleasing effect.

Insufficient and misplaced outlets are met with very often, and are one of the greatest hindrances to the fixture man in the execution of his part of the work; at the present time the fixtures are the last thing considered. When the question of fixtures is taken up, the house is practically completed, and to make any changes would mean the taking up of floors and often the cutting of walls, to which the owner will rarely agree. I feel that the members of this society can do much to overcome this condition, the main reason for which is the keeping down of the cost; but I feel confident that, in nine cases out of 10, if the necessity for more wiring and switches is properly explained to the owner, he will not hesitate at the expense.

A residence can never be illuminated on the principle solely of so many candlepower to a square foot, as there will always be a necessary waste of light in connection with decoration, which depends on the taste of the owner, and this factor should be carefully considered at the time of installation and the owner impressed with its importance.

The present tendency is toward wall brackets. These should be distributed around the room so as to overcome all shadows, permit of a shaded light, and yet give enough illumination to supplement the ceiling fixture in complete illumination.

The fixture with the light at an angle has practically been done away with in the better residences on account of the unpleasant effect on the eye, it having been found that a more satisfactory effect is produced with the lights either up or down on both the brackets and ceiling fixtures, as this permits of shading the lamp from the eye by means of decorative shade. Installing a lamp upward on the bracket has proven to be the most practical method for general use, for then, with the ordinary open-glass shade, the lamp is screened from the eye and its light reflected on the ceiling, which adds to the general illumination.

Electrical Conditions in Indianapolis.

An interesting report on the electrical conditions at Indianapolis, Ind., has been made by the engineering party of the National Board of Fire Underwriters, consisting of A. C. Noble, engineer in charge of party and structural work; R. W. Bogart, Jr., engineer in charge of hydraulic work, and G. C. Heckman, engineer in charge of fire department work, with their assistants.

The supervision of electricity is delegated by ordinance to the Indianapolis Fire Inspection Bureau, which maintains four electrical inspectors in the city to look after inside work. F. H. Moore, chief electrical inspector for the bureau, is in charge. He was appointed in May, 1905, prior to which he was an electrician with the Indianapolis Light and Power Company. He is assisted by three practical electricians of at least five years experience.

Examinations are made before work is concluded and after final installation of fixtures and service switches. A final certificate of approval is issued upon satisfactory completion of entire installation; the contractor is charged a graded fee for each certificate of approval.

An ordinance passed in June, 1904, adopts the National Electrical Code, including future amendments, and requires that, upon satisfactory completion of new work or alterations, notice shall be given to the Indianapolis Fire Inspection Bureau, and that no current be supplied until a certificate of approval of such installation or repairs has been issued. Penalty of not more than $100 is provided for any violation of this ordinance. But it is complained that the ordinance does not provide for the proper supervision of outside wiring and that this work receives little or no attention. A special ordinance requires that all wires within the district bounded by North, South, East and West streets shall be placed underground, but this is said to be disregarded to a great extent.

In June and July, 1906, inspections were made by National Board engineers of 74 installations, mainly in mercantile and manufacturing sections. New wiring was generally found in conformity with the Code, nearly all defects being in work installed before 1904, the date of the electrical ordinance. In the 74 installations examined there were 1,009 defects, or an average of about 14 defects per equipment. The more prominent and frequent defects were: Porcelain-base link-fuse cut-outs; wire used instead of fuses; unapproved flexible cord for both pendants and portables; flexible cords used to support clusters, too long where used with pendants, used as line wire, used in show windows and not properly supported; wires in contact with or not properly separated from conducting materials; wires old and frayed. In a general way these defects may be divided as follows:

Due to use of unapproved materials....	409 or	40.5 per cent.
Due to absence of proper safeguards...	256 or	25.4 per cent.
Due to poor workmanship.....	215 or	21.3 per cent.
Due to wear and tear or age.....	129 or	12.8 per cent.
Total	1,009 or	100.0 per cent.

A large proportion of the defects are such as should have been prevented by a rigid enforcement of the Code.

Outside electrical construction work is said to receive practically no supervision and to be in an unsatisfactory condition. Most of the overhead wires in the underground district have been removed, but many are still found in the alleys and a few along the streets. The Indianapolis Light and Power Company supplies municipal light from 2,500-volt series arc machines; commercial light and power from 2,300 volts, alternating current, stepped

down to 110-220 volts and 220 volts; and a small amount of power at 500 volts, direct current. The Merchants' and People's heat and light companies furnish commercial light and power from 2,300 volts alternating current, transformed to 110-220 volts. The street-railway company operates about 130 miles of electric surface road at 500 volts direct current, with overhead trolley and ground return. Rails are generally well bonded and return cables have also been installed. Telephone and telegraph wires are mainly underground in the thickly settled portions of the city, but are overhead from distributing poles in centers of blocks. Fuses are provided at exchanges or at subscribers' premises and at changes from undeground to overhead construction.

In connection with electrolysis the chief of the Fire Department reports some trouble from lead-pipe connections which run under street-car tracks. The Water Department says that it has experienced no trouble in recent years. The street-railway company makes systematic tests to ascertain the condition of bonds, and rebonds rail-joints where necessary, using a good riveted copper bond. Return cables have been installed and connect rails in affected districts to power-house bus-bars. Additional cables are installed where need is evident.

The supervision of new inside work is handled in a fairly satisfactory manner by the Indianapolis Fire Inspection Bureau, but old work and all outside wiring are generally in poor condition, it is declared.

Questions Discussed by Chicago Illuminating Engineers.

Discussion of a pre-arranged list of questions, rather than the reading of a paper, was the distinguishing feature of the after-dinner meeting of the Chicago section of the Illuminating Engineering Society, held in a restaurant on the evening of November 6th. This plan met with general approval, and a large proportion of those present took part in the informal discussion. These were the questions presented:

1. To what extent in practice can the distribution of light about a lamp be modified by shades, or otherwise, to throw the light in certain directions?

2. To what extent can the rule for keeping lights out of the range of vision be followed in halls, churches, theaters, etc.?

3. Is there any standard that can be used in the selection of gas mantles, and what is the best economy with gas mantles—to purchase a high-grade mantle and use it until it breaks, or purchase several cheaper grades for use the same length of time as the one of high-grade quality?

4. What is the best method of lighting high rooms, using small units, to get good distribution on the lower five feet of the room?

5. To what extent can electric lamps that give off fumes be used for interior lighting, and for what purpose is the new flaming arc lamp best adapted?

6. Are trough or cone reflectors the most efficient for lighting the majority of show windows? To what extent are high-candlepower units, such as arc lamps, Nernst lamps and chandeliers, applicable in show-window lighting?

7. To what extent should lights be exposed in a show window, and under what circumstances are border lights permissible in show windows?

8. Is it ever advisable to mix different colors and kinds of illuminants in store lighting?

9. What color of light is best suited to jewelry-store lighting?

10. Is the usual angle of 45 degrees, at which the majority of electric chandelier sockets are placed, the best for the majority of locations?

N. R. Stansel, inspector of mechanical and electrical engineering, Federal Building, opened the discussion on question No. 1, and said that there is a marked difference between reflectors to distribute and globes to diffuse light. With high-intensity units the problem of distribution and diffusion is greater than with incandescent lights, with which almost any desired distribution may be made.

J. R. Cravath gave some figures showing the amount of light thrown down by an ordinary conical tin reflector lined with mirrors. The reflector in this case was 4½ inches deep and 10 inches in diameter. At 15 degrees from the vertical there was 136 candlepower per square inch; at 30 degrees, 42 candlepower; at 45 degrees, 22 candlepower, and at 60 degrees, 18 candlepower. A 16-candlepower lamp was used, and the measurement was taken with a five-foot photometer bar.

Question No. 2 caused an interesting discussion. Albert Scheible said that most lamps require special screens, and that the ideal in lighting is to have lamps screened from the eye in halls, churches, etc. An example of good lighting was referred to by E. W. Lloyd of the Chicago Edison Company in the Theodore Thomas Orchestra Building.

Mr. Caldwell, of the Welsbach Company, spoke on the third question, saying that as a question of light for the money spent a high-grade gas mantle is better because the low-grade mantles, even while undamaged, lose a great deal of their efficiency in a very short time. He preferred the use of a mantle supported by a ring at the top, leaving an unobstructed passageway for the products of combustion.

The general opinion on question 4 seemed to be that the ideal interior lighting is accomplished by concealing the light and diffusing it by reflection from ceiling and walls, but at present the loss of light on account of the poor reflection obtained makes the expense practically prohibitive. Means of keeping the source of light from the range of vision by shielding it by architectural devices, such as beams, wall recesses, etc., were advocated, and it was urged that the illuminating engineer put himself as closely in touch with the architect as possible so that each might assist the other.

It was generally agreed that arc and Nernst lamps were not very suitable for show-window lighting and also that chandeliers should not be used for that purpose.

The question of cone or trough reflectors for show-window lighting (No. 6) occupied a considerable portion of the time of the meeting, different opinions being held as to their relative value in window lighting. The majority of those entering the discussion were of the opinion that while the trough or "poke-bonnet" reflector lost more light than the cone reflector, as manufactured today, a better distribution could be obtained by use of the former. This trough or "poke-bonnet" reflector should be placed in the lower front part of the window and arranged so that the angle of light reflection may be altered easily.

The discussion of the earlier questions occupied so much of the time that the last two questions were voted to be left over until the December meeting. It was also decided that the papers presented at the New York meeting of November 9th should be discussed at that time. These papers are: "Fixture Location in Residence Lighting," by F. N. Olcott; "Fixture Design and Location," by Major E. L. Zalinski; "Location of Lamps and Illuminating Efficiency," by Preston S. Millar.

Besides those mentioned above, George C. Keech, F. J. Pearson, Mr. Curtis, J. J. Schayer, C. Wiler, A. J. Morgan, C. C. Spurling, Herman V. Von Holst, Frank McMaster, Homer E. Niesz, R. H. Chappell, J. G. Learned and others took part in the discussion.

Kansas Gas, Water and Electric Association.

The Kansas Gas, Water and Electric Association held its annual meeting in Lawrence, Kan., on October 16th and 17th, 56 members of the association being present. The following-named officers were elected for the ensuing year: President, E. S. Springer, Leavenworth; first vice-president, C. L. Brown, Abilene; second vice-president, F. L. Williamson, Clay Center; third vice-president, H. F. Jackman, Minneapolis, Kan.; secretary and treasurer, James D. Nicholson, Newton; executive committee, John C. Nicholson, Newton; M. A. Patten, Topeka, and F. D. Aley, Wichita.

Papers read and discussed were as follows: President's address, W. E. Sweezy; "Kansas Water Survey," Prof. F. O. Marvin; "A Problem of the Country Light Plant," H. V. Forest; "Composition of Natural Gas," Prof. E. H. S. Bailey; "Developing a Day Load for Small Central Stations," C. L. Brown; "Relation of Kansas University to the Electrical Industry of Kansas," Prof. R. M. Freeman; "The Future—What Shall It Be?" F. L. Williamson; "Profitable Co-operation," J. Robert Crouse.

Topeka will be the place of next meeting, the date being October 16, 1907. Several new members, central-station managers, were added to the list. The president and the assistant secretary expect to do some energetic work in the "Wrinkle" department and have a good Question Box at the next meeting.

Northwestern Electrical Association.

The next annual meeting of the Northwestern Electrical Association will be held at the Coliseum in Chicago on January 16, 17 and 18, 1907. The meeting will be held at the time of the electrical show with the belief that this arrangement will be to the mutual advantage of the show interests and the association. An excellent programme has been prepared for the meeting and a large attendance is expected. Harold Almert of Chicago is president and B. C. Adams of Madison, Wis., secretary of the association.

Electric Pumps for Fire Protection.

Automatic sprinkler systems furnished with water from gravity tanks on the roof form a valuable means of fire protection for large buildings. To keep the roof tanks filled under normal conditions and to enable the automatic sprinklers to continue in operation after the roof tanks have become emptied, during a fire, has usually been accomplished by a steam pump. The advantages of electricity in this work, however, are apparent, and an inclosed electric motor, direct-connected to a centrifugal pump, is far superior to steam for the purpose. In case of fire, the current supply from central-station mains entering the building through well-insulated underground wires, is far less likely to be interrupted by fire or water than is the supply of steam for running a pump. Moreover, the electric system does away with the need of a steam boiler with its accompanying disadvantages, steam under pressure, presence of fire and necessity of attendance.

A typical electric equipment for fire protection

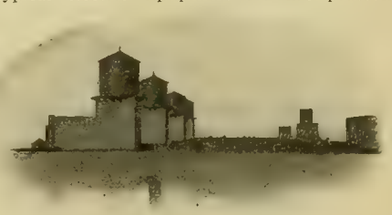


FIG. 1. RIVER FRONT OF CHICAGO WAREHOUSE PROTECTED BY ELECTRIC PUMPING SET.

has recently been installed in one of the largest warehouses in Chicago, built and owned by the Chicago Dock and Canal Company and leased to the Furniture Exhibition Company. The Chicago River side of this structure is shown in Fig. 1. The building is constructed of brick, 450 feet long and 120 feet deep and rises five stories above the basement, containing about 378,000 square feet of floor space.

The fire protection system comprises 3,360 sprinkler heads with one fire-boat connection and 12 fire-steamer connections. A constant pressure is maintained on the system from four 18,000-gallon tanks, one set on top of each fire wall. The tanks are supplied from an electric pumping set which forms the unique feature of the installation. This set, shown in Fig. 2, consists of a six-pole, 180-horsepower, 800-revolution, 220-volt, direct-current General Electric motor, direct connected to a six-inch, four-stage centrifugal pump. This pumping set has a capacity of 1,000 gallons a minute against a pressure of 150 pounds to the square inch when running at 800 revolutions per minute. The impellers of the pump are so arranged that artificial means of balancing the end thrust are entirely unnecessary.

Special provisions are made to insure the continuous operation of the motor should it become submerged in water and debris in case of fire. The motor is completely inclosed, the joints in the protecting end plates being ground to make them water-tight. At the commutator end of the

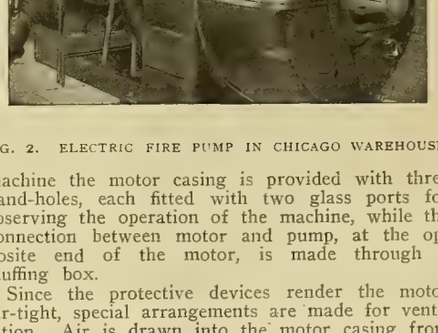


FIG. 2. ELECTRIC FIRE PUMP IN CHICAGO WAREHOUSE.

machine the motor casing is provided with three hand-holes, each fitted with two glass ports for observing the operation of the machine, while the connection between motor and pump, at the opposite end of the motor, is made through a stuffing box.

Since the protective devices render the motor air-tight, special arrangements are made for ventilation. Air is drawn into the motor casing from outside the building by a fan on the armature shaft. The inlet opening is shown in the illustration at the commutator end of the machine. The outlet pipe, seen at the back of the motor, is made in a special involute form in order to establish a steady flow of air through all parts of the motor by keeping the air in motion in the exhaust pipe. With tight piping connections to the outer air, the motor and pump are perfectly water-tight and will operate when entirely submerged.

THE SMALL CENTRAL STATION.

Practical Hints on Its Construction and Operation.

CHAPTER XVI. (*Concluded.*)

General Data.

Transformer Work.

45. In placing transformers and making connection for same, you will always leave the line connection where you branched off to be made after all other work is completed. The primary fuses at the transformer must be left out until the final line connection is complete.

46. In making connections to constant-potential (alternating or 500-volt) circuits always finish one connection before breaking the insulation on the other line. Remember this: That you must have but one wire or joint bare at the same time when working on the lines.

47. After completing a transformer connection and before closing line connection, carefully paint the entire outfit (except glass insulators) with insulating paint.

48. See that all wires leading out of transformers and out of fuse boxes are well taped and painted where they leave the transformers, and all transformers must be placed so far from doors, balconies, windows and other openings, and sufficiently high above ground and roof, as to prevent accidental contact; in other words, out of reach.

49. All secondary wires from transformer to house should be as well insulated and protected from ground as if carrying high-pressure currents.

50. In plugging brick or stone buildings, paint the plugs with insulating compound before driving them.

51. All supports for transformers and fuse boxes placed on buildings must be well painted with insulating paint.

Inspectors' Special Instructions.

1. At all times when on duty your carts must be supplied with rubber gloves, boots, coat and hat; also, pliers, connectors, climbers, jack straps and vise, safety belt, hand ax, insulated stool, magneto, two or three brackets and glass, tape, carbons, line wire, jumpers and hand line.

2. Inspectors away from their carts, or those not provided with carts, are requested to have and to use their necessary safety devices and clothing where handling lamps or lines.

3. In working on lamps or lines, always regard the line as grounded and alive, whether it is or not. Observe this rule in hunting trouble on "dead" circuits. They may be "O. K.'d" at any time by others and the current put on without a report from you. They may also cross up elsewhere with live circuits.

4. Report to their headquarters, as soon as you can, any trouble discovered on the lines of other companies, and report dangerous conditions existing to the city lighting department if you are in doubt as to the ownership.

5. Avoid interference with foreign wires where possible, but if you find the lines of other companies so situated as to be dangerous to the public, do what you think is right, and report to the owners and to this company by nearest telephone and make written report as well.

6. In the event of injury to persons or property by the wires or appliances of this or any other company, where the electric current could possibly be the cause, investigate fully and make full written report to this company only. If trouble was the result of cross or dead or broken wires, find out how the cross was made, how the wire was broken, to whom the wires belong, the names of witnesses and parties damaged in any way; in fact, report all you can find out and find out all you can.

7. Report by telephone, day or night, to the general manager any serious or unusual trouble as soon as practicable.

8. All repair work where material is used must be reported on a separate slip.

9. In putting on jumpers be careful that the loop of jumper does not lie on wire below, to make a cross possible if the insulation does not hold.

10. All inspectors when away from the plant are requested to report by telephone as often as practicable. All inspectors must report as often as once an hour during their entire watch, especially if on trouble.

11. Inspectors must report by telephone to plant any repair work to be done by linemen which has been occasioned by temporary work while on watch.

12. Mounted commercial inspectors must remain at the office when not out with their horses on regular duty.

13. All mounted inspectors must keep their carts as near their work as possible when out; at other times, at the station or office, and remain there themselves.

14. In addition to reporting by telephone when out, report to station at the time you go off duty, notifying the one in charge that you are off and that you will be off after that time.

15. Record on telephone sheet any call for extra service, and report same to office on properly signed blank form.

16. No extra service will be furnished except by instructions from chief of dynamo department or the office.

17. In clearing trouble of any kind, where temporary work only can be done by you, make a full report on separate trouble slip, so that it can be properly repaired later. Unsoldered joints, broken insulation, bracket work on poles or similar troubles, as well as defective pins, cross-arms, poles, windlass boxes, etc., should be reported separately.

18. Maps of alternating circuits, showing locations of branch cut-outs, must be carried by all inspectors.

19. Inspectors can find separate maps at station or office, which they can take with them if necessary.

20. All items of interest relating to the condition or operation of the plant in any manner you are requested to report.

21. Always be gentlemanly to customers and to the public.

22. Always wear your uniform and badges when on duty.

23. Always leave memorandum at station where you are gone.

Incandescent Work.

24. You must at all times be supplied with a complete supply of fuses. Exchange your wallet once a week or oftener, if necessary, for a full one.

25. In renewing fuses, be sure that the binding-post screws which hold the line wires are firmly set. Fuses are frequently blown by loose line connections.

26. When primary fuses are blown, examine transformer for short-circuit or leakage before replacing them.

27. When main-line secondary fuses have blown, test with the current for ground, if circuit is being used; if not, test with magneto bells, first removing both fuses on main block and testing wires to lamps only.

28. In fusing primary circuits only, observe the following. Never fuse transformer with larger fuses than given below:

Ten-light, ½-ampere; 20-light, one-ampere; 25-light, one-ampere; 40-light, two-ampere; 50-light, three-ampere; 100-light, five-ampere.

Never fuse transformers until all the work is completed on the outside lines and you know the inside work is ready.

29. For fusing on secondary circuits only, be governed by the following:

For 50-volt lamps.—One lamp, use one-ampere; three lamps, use three-ampere; five lamps, use five-ampere; six to eight lamps, use 10-ampere; 10 to 12 lamps, use 15-ampere; 15 to 18 lamps, use 20-ampere; 20 to 30 lamps, use 30-ampere; 40 to 45 lamps, use 50-ampere; 50 to 60 lamps, use 60-ampere; 70 to 80 lamps, use 80-ampere; 80 to 90 lamps, use 100-ampere.

For 100-volt lamps.—One to two lamps, use one-ampere; three to five lamps, use three-ampere; five to 10 lamps, use eight-ampere; 10 to 15 lamps, use 10-ampere; 20 to 25 lamps, use 15-ampere; 30 to 35 lamps, use 20-ampere; 40 to 50 lamps, use 30-ampere; 60 to 70 lamps, use 40-ampere; 80 lamps, use 50-ampere; 100 lamps, use 60-ampere; 120 lamps, use 80-ampere; 150 lamps, use 100-ampere; 200 lamps, use 130-ampere.

30. In placing fuses on secondary circuits, always open the switch on the branch being fused, or turn the lamps "off" at sockets before replacing fuse.

31. When replacing fuses, always test for grounds or short-circuits on lines where fuses are blown.

32. Use your fused testing wire for all tests on secondaries, if testing with current. When grounds are found, unless cleared by you, the branch grounded must be left cut out and the office notified.

33. If grounds or short-circuits develop on house wires, inform the owner and ascertain if he wants the company to correct the fault at his expense. Report to the office by telephone, if necessary, what trouble is found, and the owner's name, unless you locate and correct the fault. The usual report in writing will be necessary.

34. Always cut out entirely any faulty transformer and report by telephone at earliest moment in the daytime, so as to allow as much time as possible to change it.

Fire Rules.

35. Record all fire alarms on telephone blank, and when location is discovered, examine the maps, so that you may be familiar with the locations of the circuits in the vicinity should a second alarm call you out.

36. When out, if you discover a serious fire, go at once and see if our lines are likely to be in the way.

37. In answering second alarms, always report to the police captain and the fire chief on your arrival, and inform them where you will likely be found about the fire.

38. If the supervisor of city lighting is on the ground, render him any assistance you can.

39. Don't neglect the company's interest at any time for that of others.

40. Save any property of the company in or near burning buildings only when you can do so without risk to yourselves.

41. Be of such service to the fire chief as you can, so far as it relates to your business.

42. Avoid cutting wires when possible, and arrange to renew the service as soon as possible, if you do cut them.

A thorough knowledge of the circuits will enable you to do your work easier and in a more satisfactory manner to yourselves and the company than if you fail to acquire this. Study the maps.

Dynamo Department.

1. The number of lamps on each circuit must be recorded on the circuit board each day.

2. All new city lamps and circuit changes will be made on map board and must be noted in this department.

3. All station employes are requested to study the circuit maps and become familiar with the locations of the different circuits.

4. On receipt of telephone or other message to cut out any circuit for the protection of life and property, do so promptly. On an arc circuit, always run the brushes up before pulling plugs on switchboard. On incandescent by cutting in resistance at switchboard to kill the dynamo, then open the switch.

5. When a live circuit opens during a run, the dynamo must be cut out at once and left out until the trouble is located and O. K.'d by lineman or inspector.

6. Circuits ordered open must be marked on board with colored chalk. All other circuits must be marked "O. K." with white chalk. This must be done only by those authorized so to do, and must be reported to man in charge in dynamo room.

7. Never "try" a circuit with dynamo that opens during a run, until the trouble is located, no matter if it "rings" closed.

8. Never connect dynamo to a circuit on which men are at work, without instructions from the men to do so.

9. When an arc light or motor circuit is reported "O. K." after it has been open, build up current very slowly at dynamo by hand, and take about five minutes to put full current on, because it frequently happens that linemen will leave their work and start out on a circuit looking for trouble, without first notifying the station. By starting the circuit in this manner, should they be in a position where they might feel the current, they would likely have warning before current reached a dangerous intensity.

10. Never run two machines in series. Doing this will be sufficient cause for dismissal. No excuse will be accepted for disobedience of this rule.

11. Rubber mats and gloves must be used when working the switchboard. The same rule applies to work on dynamos when running.

12. An arc made by electricity can frequently be blown or whipped out with a towel, on continuous-current circuits, and should be extinguished in that manner, if the connections which occasion the arc cannot be easily separated.

13. In the event of a short-circuit on alternating lines or switches in station, the current can be safely shut off by cutting in resistance on exciter at switchboard.

14. Water will not extinguish an electric arc or fire when produced only by the current.

15. Large canvas covers are available, which should be quickly spread over the dynamos if water is used to extinguish fire on the floor above.

16. Fire buckets must be kept filled with both sand and water on each floor in machine building above engine room. In many cases sand will prove more useful than water in extinguishing a fire. The hose on each floor must be kept connected and ready for use.

17. In using sand or water, remember that a little well directed is better than quantities thrown wildly. Use no more of either than is absolutely necessary, as it is easy to do more damage with them than would be likely by fire.

18. Any faulty lamps, wires, belts or anything else reported to this department must have immediate attention from the man in charge.

19. Always report to the general manager by telephone, at his office or residence, anything whatever which he should know. Do this promptly.

20. None but employes are permitted in the building without a pass. Men in charge are requested respectfully to enforce this rule.

21. Smoking is absolutely forbidden.

22. Always record all telephone messages.

23. Read all other rules, part of which apply particularly to this department, and a knowledge of them is required of you.

Engine Room.

1. No one, except employes whose business requires it, is permitted in this room without permission of the chief engineer, or a pass from the office; then only at his own risk.

2. No one must be permitted about the machinery whose business does not require it.

3. All are cautioned to use the greatest care when about the engines, to avoid accident. Loose or flapping clothing must not be worn, and jumpers or jackets must be worn buttoned.

4. Anything unusual must be reported to the chief engineer at once, or the engineer in charge.

5. In the boiler or engine room, or anywhere else, avoid contact in any manner with wires or lamps.

6. Faulty lamps or other electrical apparatus must

be reported at once to the one in charge of dynamo floor.

7. Dynamos or wires on engine floor must not be handled by others than the engineer in charge or the man in charge of dynamo floor, and then only in the manner indicated in the rules for the dynamo department.

8. Should it be necessary, in case of accident, you can instantly stop the alternating current from any machine by throwing the small exciter belt, or by cutting or pulling loose one of the wires from the small exciter which is driven by the machine from which the current should stop. This can be done without danger.

[To be continued.]

Relative Economy of Steam Turbines and Engines.[1]

By Walter Goodenough.

It has become evident to most of us, from time to time, that what is needed in the power station is not so much more economical prime movers, but rather more intensive operation of the particular type of machinery which we now have. This paper has, therefore, been made with the idea that it might bring interesting discussion from many and be of assistance to some of the companies.

The assumption that fixed charges are spread over the whole 24 hours, and that the machine operates during the full 24 hours, is, of course, not correct; but in the present instance, where it is desired to bring out rather the effect of the combination of fuel and fixed-charge costs than actual operating costs, this assumption is considered to be well taken. On this basis characteristic curves for engine-driven and turbine-driven units are produced.

It is assumed for purpose of this paper that each plant is of one unit running 24 hours per day, and on this basis fuel costs and fixed charges per kilowatt-hour are plotted individually and then combined. No other costs have been taken into consideration, as the addition or subtraction of such constant costs as labor, heat losses, etc., make little or no difference in the characteristics of the curves until these increases or decreases have assumed a very large size. It is further assumed that the labor costs for a single engine-driven unit will be fully as low as for a turbine, and this assumption has also been made for the maintenance of the respective machines. It is taken also that the extra heat turned into the feed water by turbine auxiliaries over those of engine auxiliaries will offset the greater amount of heat used in the work of driving the larger turbine auxiliaries.

In making the curve of fuel cost, the price of coal is assumed at $2 a ton, and the evaporation per pound of coal as 7½ pounds of water. On this basis 1,000 pounds of water evaporated will cost 13½ cents.

In determining the fixed charges, the following percentages have been taken for engine-driven units:

	Per Cent.
Interest	5
Depreciation	12
Maintenance	1
Taxes	1
Total	19

For the same charges for turbine-driven units the percentages have been taken:

	Per Cent.
Interest	5
Depreciation	10
Maintenance	1
Taxes	1
Total	17

In the above tabulation interest remains standard at five per cent.; the maintenance remains the same for both turbine and engine, as any good engine unit will not have a higher maintenance of itself and its auxiliaries than a turbine with its much more numerous auxiliaries. In considering depreciation amortization has been neglected, and the depreciation deliberately placed high.

In the present state of the art we can expect to see developed in the near future prime movers and fluids generators (including the pieces of apparatus now known as boilers and gas producers) of such an increased efficiency that it will become necessary, for many reasons, to abandon our present units within a few years. We are assured by the makers of turbines that they are still exploring the field, and most of us have visions of high-economy gas-driven machinery at no distant date. So unsettled are the conceptions for the future of commercial economy in power generation that it cannot be but wise to place a high depreciation on our present machinery. Competition, local disturbances through municipal-ownership agitation and other commercial reasons will demand more than ever the supersedence of present-day designs for new ones of higher efficiency. The exact form in which "depreciation" is applied does not matter; the basic fact remains that machinery does depreciate, and the fact is not less true that the genus "stockholder" pays the depreciation. He may do it by default of dividends, held in a sinking fund by a careful administration, or by means of assessments, of interest on mortgages or bonds.

In regard to the first cost of the machinery under discussion it has been assumed that with the 500-kilowatt units the system in use will be 500 volts direct current. It is also assumed that the engine units will have direct-current generators and the turbine units alternating-current generators, requiring converting apparatus. It is further assumed that the engine will work with saturated steam and that the turbine will use superheated steam. We, therefore, assume the following costs for the engine unit:

	Per K. W.
Engine and generator	$45.00
Condensing apparatus	4.00
Foundations	3.00
Total	$52.00

On the same basis we assume that the turbine with saturated steam would cost as follows:

	Per K. W.
Turbine and generator	$36.00
Condensing apparatus	6.00
Foundation	1.00
Motor-generator apparatus and switchboard	22.00
Total	$65.00

In order, however, that full operating value from the standpoint of steam economy may be obtained from the turbine, it is necessary to install with our boilers some superheaters, and for this additional cost we should apply $4.25 per kilowatt, making a grand total for the turbine of $69.25.

In order to show the effect upon combined kilowatt-hour cost of having to add converting apparatus, curve (D) in Fig. 1 has been made, based on a total first cost of $69.25, less $22.

For 1,500-kilowatt units it has been assumed that both the engine-driven and the turbine-driven unit will generate alternating current, and on this basis there have been assumed the following costs:

	Per K. W.
Engine and generator	$35.00
Condensing apparatus	2.25
Foundations	2.25
Total	$39.50

On the same basis as the above we have:

	Per K. W.
Turbine and generator	$28.00
Condensing apparatus	5.00
Foundations	.50
Superheater and piping	4.00
Total	$37.50

In the case of curves for 1,500-kilowatt units it has been assumed, without question, that the engine will run with saturated steam and the turbine with superheated steam.

On the basis of all sized units, operating alternating current, the 500-kilowatt turbine makes quite a little better showing of rated load efficiency against the engine unit than the 1,500-kilowatt size of turbine. The author would, however, suggest that the 1,500-kilowatt unit is probably the one size where conditions of total cost per kilowatt, fuel and fixed charges come nearest those of the engine. For all sizes above 1,500 kilowatts the combined cost of the turbine unit draws rapidly away from the engine unit in the direction of lower cost, and it might be suggested here that if there were any one spot where engine builders desired particularly to apply refinements to their designs in the way of larger cylinder ratios, rejacketing, reheating and superheating, the 1,500 kilowatt size would undoubtedly prove the most fruitful for them. There is some question, however, as to whether the increased economies in steam consumption they might obtain would overcome the increased fixed-charge cost due to greater expenditure to obtain these results.

As stated in the first part of this paper, it is of considerably greater importance in the immediate present to the station manager to consider how he may obtain the greatest economy from the units which he has rather than where he can buy units having half a pound better steam consumption than what he has.

If we look at Fig. 1, it will be noted that the fuel cost for the 500-kilowatt engine unit is at its lowest point at 90 per cent. rating, while with the turbine unit this best fuel cost comes near to the 120 per cent. rating, both with and without superheat. Now, if we add to this the fixed charges per kilowatt-hour, we see in our engine unit that the point of maximum economy is moved from 90 per cent. rating to 125 per cent. rating. Also, in our turbine units the point of maximum economy, when converting apparatus is included, is moved up to about 145 per cent. rating from 120 per cent. When the converting apparatus fixed charge is not included, we find the high point of total economy has dropped back to around 140 per cent.

From these characteristic curves, therefore, it becomes quite apparent that we cannot carry our steady loads per unit any too near 100 per cent. rating. It would not, of course, appeal to the average careful station manager to operate his individual units at continuous loads above 100 per cent. Consideration has to be taken of the ability of the generator to stand continuous overload, and a margin has also to be provided for suddenly applied overloads or swings. It would seem, however, that there should be no valid excuse in a well-managed plant for not maintaining the loads as near as possible to 100 per cent. rating of each individual machine. It is well known that engine builders have, for quite a number of years, built their machinery, for point of maximum economy, nearer to 75 per cent. rating than 100 per cent. rating; they assuming that the loads in a station would always be under rather than up to or over 100 per cent; and therefore they have put their machinery where it would show up the best under loads which the average engineer feels he can run.

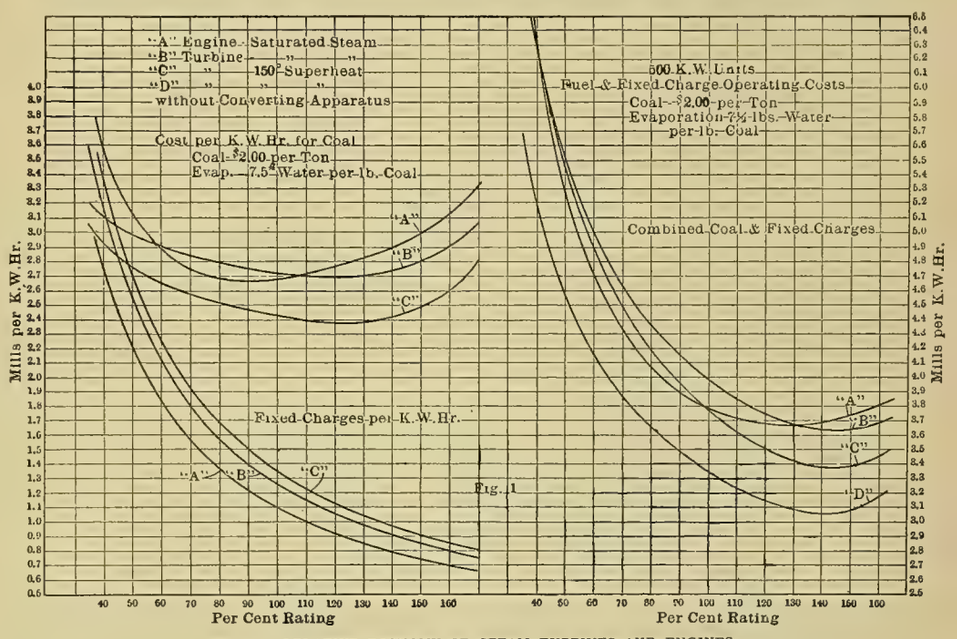


FIG. 1. RELATIVE ECONOMY OF STEAM TURBINES AND ENGINES.

It is apparent, however, from these curves that the true economy of the plant is by no means the steam economy of the plant, and it is also seen that the engine builder, on the basis of steam economy alone, did not shove his point of best economy far enough back, after all. On the other hand, it appears that the turbine builder has not yet reached consideration of this point, and he is building his turbine for a rating which carries the point of combined economy to considerably over 100 per cent. rating and close up to the point where the total economy begins to fall off sharply, and the capacity of the machine is being rapidly absorbed. In the particular instance of the 500-kilowatt units, it would seem that the engine overload capacity was not too far in excess of its generator capacity; but in the case of turbine it is apparent that the size of the turbine for the same size generator should be considerably decreased and means taken to insure, after such decrease, that overloads can be readily carried by the machine. Such changes as those would then bring the point of maximum total economy back to the place where it is actually possible to operate the machines under steady loads in the average power station furnishing current for a street railway.

However, the turbine builder has not supplied us with this very desirable machine, and it therefore becomes necessary for us to make the best of what we have. It would seem wise to fix as high as possible the loads at which each individual machine in the station should operate, and then maintain these loads as continuously as possible. When variations have to be taken they should naturally be taken by increasing the load on the machines already in service, rather than to put in another unit and underload it or all

1. A paper read before the American Street and Interurban Railway Engineering Association at Columbus, Ohio, October 16, 1906.

of the units in service. There is a question of reliability and safety of service which comes in here, and which the station manager will, of course, have to settle according to the character of his load and the number and size of his units.

The foregoing naturally brings up the question of selection of the size of units in new developments or renewals. The end of all construction should be the minimum combined cost per kilowatt-hour of operation, and therefore it behooves us in selecting our new units that we study carefully not only the immediate loads to be applied but also the expected future loads. It is to be suggested that many managers can, with good success, chart their daily load and fix almost precisely, from day to day, the time when each unit shall enter upon its work and the load which it shall carry. The average station engineer has too limited a view, from reasons of training, to take any initiative of this sort. He will often require considerable persuasion to get him over the fear of running his machinery too hard. It is the author's general experience, however, that with someone to start such a man authoritatively along the lines of better economy, he becomes not only anxious to make a better showing, but his pride in such showing is very marked.

The general statement which has been made that

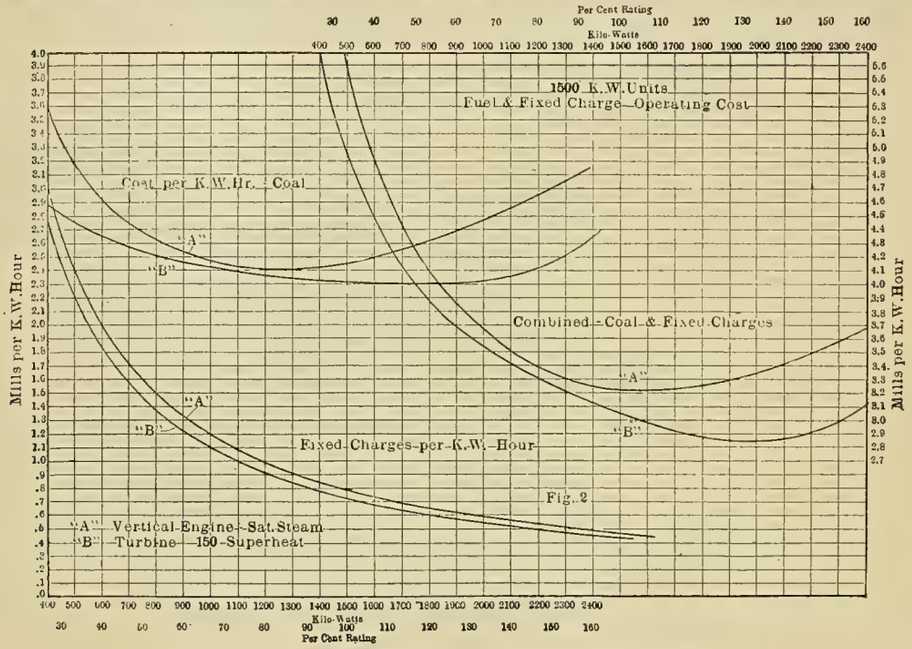


FIG. 2. RELATIVE ECONOMY OF STEAM TURBINES AND ENGINES.

the relation of the individual fuel and fixed-charge curves to the combined curve.

The point has been raised that after a plant is once installed the fixed charges do not enter into the economy of operation, and that, therefore, the plant should be run at its lowest steam consumption. If, however, it is legitimate and necessary to figure fixed charges per kilowatt-hour in preliminary estimates, it appears to the author that they should be considered when the plant is in operation, for two reasons:

First—The operating reason; that is, with the load usually carried by operating engineer, full value is not being obtained from the investment. A monthly report, which shows fixed charges per kilowatt-hour generated, should be of immense value to the operating superintendent in determining whether his plant is receiving the particular and discriminating attention which such a large investment warrants.

Second—The investment reason; that is, a machine which has the lowest combined cost per kilowatt-hour at the individual loading that is carried is the most desirable to continue in the installation. Manifestly a machine which has a combined kilowatt-hour cost lowest at 100 per cent. rating is better than one having its lowest cost at 140 per cent. rating. The turbines have a flatter load curve than engines is decidedly misleading when considered from the standpoint of total cost per kilowatt-hour. Inspection of the combined curves on both Figs. 1 and 2 shows that at 100 per cent. rating the rate of change in cost per kilowatt-hour of operating the turbine is decidedly greater than for the engine. It is seen from this curve that the engine, with its point of steam economy at 85 per cent. or 90 per cent. rating, has at 100 per cent. rating a much flatter curve of total economy. If we will inspect curve (D), Fig. 1, we will see that for an increase in load, from 75 per cent. rating to 100 per cent. rating, the increase in economy on the basis of which this curve is made, will be 11 per cent. Of this 11 per cent. gain in total cost the steam economy gain is only 4.7 per cent., while the fixed-charge gain is 23 per cent., or four times as much gain as in steam cost. These percentages, of course, will bear quite some changing under different conditions, but it must be borne in mind that the characteristics of the curves will remain very generally the same.

Again, as stated in the first part of the paper, it is not strictly correct to assume that the unit is to run 24 hours a day at a certain load. However, it should be noted that applying the fixed charges to the unit for the actual number of hours run each day will increase these fixed charges per kilowatt-hour, and more than ever increase its effect on the total combined economy, shoving the point of maximum economy still further up into the overloads. The decreasing of the fixed charges per kilowatt-hour means, however, an increasing of the steepness of the fixed-charge curve below 100 per cent. rating, thereby accentuating from the other standpoint the marked effect upon total costs which fixed charges have at all ratings below 100 per cent. or thereabouts.

The effect of the increase in the cost of coal, while not affecting the strict character of the curve of cost per kilowatt-hour, does somewhat flatten out the inclined portions of the curve.

Thus it may be truthfully said that the curves (A), (B), (C) and (D) will at all times retain their characteristic forms, and that being the case, whatever has been shown in this paper as to relative costs for different percentages of full load is very closely true, the increase or decrease of either fuel cost or fixed-charged cost changing but very slightly first machine will probably have smaller steam end for the same generator than the second unit. By adding automatic overload devices, costing little money, to the first machine it can be made to operate up to the full overload capacity of the generator in taking care of peaks of short duration.

The author would point out that this is not a consideration of station load-factors, but rather a consideration of the economy in operation of individual units, and also economy in their selection as affected by type and design.

In conclusion, the author would additionally point out that the gains indicated herein for turbine and engines are to a greater or less extent true for all other station apparatus, and perhaps no more true than in the case of boilers, whose load and operation seem buried under as much misapprehension as in the case of the generating units.

Possible Transfer of Chicago Edison Properties to Subway Interests.

It is said that the terms of the leasing of the Chicago Edison Company, Commonwealth Electric Company and North Shore Electric Company to Chicago Subway interests are practically agreed upon. It is reported that the terms will provide for the guarantee for three years of a dividend of eight per cent. on Chicago Edison stock, and for the succeeding two years 8½ per cent., and for the remaining period of the lease nine per cent. The lease is to be made for a period of 99 years. However, an obstacle has arisen in the attitude of the Chicago City Council. At the meeting of that body on November 12th Alderman Snow presented a resolution in which it was contended that the city should not permit the Edison company to enter into a 99-year lease contract with the Subway company, as its franchise expires in 1912. It was also declared that no public-service utility should be permitted to earn more than six per cent. on the actual investment, and set up the police power delegated to the city by the Legislature by which the city can fix the price of electricity. The resolution, which stated that the Edison company is guaranteed an earning of not less than eight per cent. after the consolidation with the Subway interests, and calling for an investigation, was sent to the committee on gas, oil and electric lights.

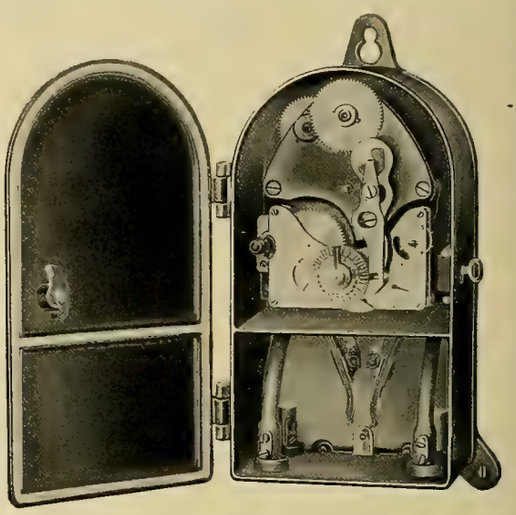
A Commercial Type of Automatic Time Switch.

There is a growing demand, particularly in the electric-lighting field, for an automatic time switch for opening and closing electrical circuits. The time switch shown in the accompanying illustration was designed by the General Electric Company to meet the definite requirements of this class of service, being adapted for both alternating and direct current.

This automatic time switch consists of an electrical circuit-breaker operated and controlled by a single clock movement of heavy and rigid design. The parts are mounted compactly in an iron case with two distinct compartments. The upper portion contains the clock protected against dust and moisture, and the lower part holds the circuit-breaker mounted on a porcelain terminal board. Clock and circuit-breaker, being operated by the same mainspring, require a minimum number of parts.

The clock movement is of simple and rugged construction. The lever escapement will withstand hard usage and vibration. Extra long bushings and pivots are provided, and the gear teeth and pinions are very heavy.

The circuit-breaker has a number of interesting



AUTOMATIC TIME SWITCH.

constructive features. The brushes are built up of spring leaf copper and the outside leaf is provided with an arc burning tip, so that the main contact surface does not become roughened, but presents always a smooth rubbing surface.

Clock and circuit-breaker are connected by a simple release mechanism. The clock movement rotates a dial once every 24-hours. The dial is graduated in quarter hours, and for convenience in distinguishing night and day one-half of the dial is blackened. At the edge of the dial are two cams which revolve with a dial, and, acting through levers, control the operation of the circuit-breaker.

In addition to this compact and durable operating mechanism, a small lamp within the clock case increases the reliability of the switch when it is exposed to low temperatures. If the time switch is installed in an obscure position, the light from the lamp is also of service in examining the apparatus.

This time switch is independent of failure of current, being entirely mechanical in action. The principal mechanism is visible when the door is open, and when the door is closed the apparatus is made dust-tight and water-tight by a rubber gasket and sealing clamp, which darws the door tightly closed as the handle is turned. The door can then be locked and sealed if necessary. This time switch is rated at 25 amperes and 250 volts.

A Home-made Wiring Job.

A young lady bookkeeper in an electrical store in a small town near St. Louis gives her experience as a "wireman" in the Ewing-Merkle Electric Company's magazine. With the assistance of a boy she wired her two-story home in 18 hours, working evenings. Seven rooms were wired for 15 lights, seven single-pole switches and two three-ways. In only one instance was she unable to fish down a partition, and here molding was resorted to. Every joint was soldered and taped, first with rubber and then with hard tape. When tested the circuits were found to be correct.

The stockholders of the Citizens' Railway Company of Lincoln, Neb., have voted to increase the capital stock from $100,000 to $200,000 for the purpose of extending and improving the lines.

Accuracy in Wiring Calculations.[1]

By Albert Scheible.

It is my belief that, in certain lines of figuring, electrical men do not strike the common-sense mean between the crude approximation that allows for wide variations of practice and the exactness which can correspond only to the far greater precision of laboratory conditions. At first glance it might seem as if overexactness could do no harm, but, if other factors are so indefinite as to nullify the apparent precision, then the excess of exactness not only means a waste of time in figuring (with the temptation to save the time by guessing), but may also give out a misleading impression as to the closeness of the calculated result.

For instance, if one factor in a formula is known to the one-hundredth of one per cent. and calculated to that degree of precision, the natural assumption is that the result will be accurate to the same degree. But what if another factor in the same formula is determinable only to an accuracy of one or two per cent.?

Take, for example, the first of the formulas published by the General Electric Company for calculations on any system of electrical distribution, due, I believe, to Mr. E. J. Berg:

$$C.M. = \frac{D \times W}{P \times E^2} \times K,$$

where D = Distance (one way) in feet
W = Watts delivered
P = Per cent. loss in line of W
E = Voltage at delivering end
and K = 2,160 is a constant for continuous current
= 2,400 for single-phase, all lights
= 1,200 for three-wire three-phase, all lights
= 1,500 for three-wire three-phase, motors and lights.

Here the result of K for continuous current is 2,160, and would have been 1,080 if the total length of the wire had been taken instead of the one-way distance, this general formula being an enlargement of the more limited formula used in direct-current figuring for nearly a score of years:

$$C.M. = \frac{\text{Feet} \times 2 \times \text{amperes} \times K}{\text{Volts lost}},$$

where K is still the mil-foot resistance of copper.

Or, better still, let us take an inverted form of the continuous-current formula:

$$\text{Volts lost} = \frac{\text{Feet} \times 2 \times \text{amperes} \times K}{\text{Circular mils}}.$$

Here the delivered amperes may be assumed to any desired closeness, leaving the exactness of the result to depend on the other three factors. Of these the circular mils are given by the commonly used table to an average exactness of one-hundredth of one per cent., and I have usually found the circular-mil figures used to the last place, instead of being approximated. Such an accuracy in the commercial sizes of wire is out of the question, it being more reasonable to expect variations of one per cent. in the same. Abbott, in his proposed standard specifications for hard-drawn copper telephone wires, provides that the weight of the same shall not vary by more than two per cent. from the specified figure, and, allowing for variations in the specific gravity, this would still imply their coming within two per cent. of the desired circular-mil cross-section, or 200 times the error allowed in using circular-mil figures to the last place.

As for the length of the wire, the common methods of estimating line distances on streets, allowing for variations in sag and in the tilting of corner poles, would make a difference of two feet in a thousand a negligible error; and, in estimating lengths from a building plan, who would claim to come closer than within 2½ inches on a hundred feet of wiring? Either of these means a possible error of one-fifth of one per cent. Some of you practical men would probably want to double or treble this allowable error.

The third factor is the mil-foot resistance of copper. On this we should expect to find a general unanimity, but a glance through various formulas and tables shows that this is not the case. When Dr. Matthiessen made his memorable tests on the conductivity of copper, he did not attempt to average the same, so, instead of establishing one standard of resistance for pure copper, he repeated several slightly different ones. To overcome this uncertainty, the American Institute of Electrical Engineers appointed a committee whose report, as accepted in 1893, fixed a definite standard, corresponding to a value of 10.35 ohms for the mil-foot resistance of pure copper at 20° C. (or about 68° F.).

While the work of Dr. Matthiessen, as thus interpreted by the American Institute committee, has since then formed the accepted basis for calculations, it was soon shown that copper of even greater purity and higher density than that used by Matthiessen could be obtained, so that a conductivity of 102 per cent. and even 105 per cent. of the standard has been reached,

1. A paper read before the Electrical Section of the Western Society of Engineers, Chicago, April 20, 1906.

However, commercial copper does not usually reach Matthiessen's standard of conductivity, hence safe calculations demand the use of a higher figure than 10.35 for the commercial mil-foot resistance. The figure actually used varies with different writers both here and abroad. Thus in England Fowler's "Electrical Engineer's Year Book for 1906" gives it as 10.41, while Crapper's "Electric and Magnetic Circuits" uses 10.81, and Dawson, in "The Engineering Electric Traction Pocket Book," gives 10.8. In this country Professor Crocker, in the second volume of his work on Electric Lighting, implies a value of 10.56, while Abbott's specifications for copper telephone wire imply a value of 10.63. Other American writers differ as follows:

D. C. and J. P. Jackson: "Elementary Book on Electricity and Magnetism" 10.50
Thomas G. Grier: "Notebook of Wiring Tables" 10.60
H. A. Foster: "Electrical Engineers' Pocket Book" 10.81
International Correspondence Schools 10.80
Cecil P. Poole: "The Wiring Handbook" 11.00
E. J. Berg (In tables published by the General Electric Company, October 26, 1896) 10.80
"Modern Engineering Practice" (American School of Correspondence) 10.80

The values given by different authorities, therefore, range from 10.41 to 11, the more common figures being 10.5, as used by Perrine and the Jacksons, 10.8, used by Berg and the International Correspondence Schools, and 11, used by Bell and Poole. The reasons given for adopting these figures vary somewhat, and some of the most prominent writers even suggest more than one figure. Thus Professor Crocker on pages 5 and 9 of his second volume on "Electric Lighting" makes the statement that the resistance of any copper wire at 20° C. (or 68° F.), according to Matthiessen's standard, may be calculated by the following simple formula:

$$R = \frac{10.35\ l}{d^2}.$$

It is customary to specify in plans and contracts that copper for electrical purposes shall have a conductivity not less than 98 per cent. of Matthiessen's standard. Assuming a conductivity of only 98 per cent., this would mean a value of 10.56 for the mil-foot resistance, yet on page 233 of the same volume we find Berg's formulas based on a value of 10.8, a figure 2.23 per cent. higher than that previously given.

Louis Bell in the 1906 edition of his "Electric Transmission of Power" (page 486) says: "At present the best grades of copper wire have a conductivity of fully 98 per cent. of that of the chemically pure metal, and even this figure is not infrequently exceeded;" and again (p. 509): "The actual value of the mil-foot constant at ordinary temperature is approximately 10.8, but is here taken as 11 ohms, to take account of the ordinary contingencies of irregular diameter, slight variation in conductivity, and the effect of hard drawing." So also in his earlier volume on "Power Distribution for Electric Railroads" (p. 25) Dr. Bell uses 11 as "the desirable value of the mil-foot resistance, allowing for the ordinary contingencies of temperature, joints, etc."

On the other hand, Perrine apparently thinks that 10.5 allows for commercial impurities, since he says in his work on "Conductors for Electrical Distribution" (p. 132): "For the purpose of transmitting large amounts of electrical energy, use is made of heavy conductors of copper having a specific resistance at a temperature of 75° F., expressed in terms of the resistance per mil-foot as 10.5 ohms." So also the statement of the two Professors Jackson in the book already mentioned (p. 383): "The resistance of a commercial wire which has a cross-section of one circular mil and a length of one foot (that is, one mil-foot) is about 10.5 ohms at ordinary temperatures."

Mershon in the ohmic-resistance table accompanying his chart for alternating-current calculations (Query: To what degree of accuracy can such charts be used?) makes no mention of the temperature or degree of purity, but the resistance figures given by him approximate those for Matthiessen's standard conductivity at 68° F., corresponding to a mil-foot value of about 10.4. This table of Mershon is reprinted by Foster in his "Electrical Engineers' Pocket Book" (p. 137), yet the same work uses 10.81 in a number of formulas, saying (p. 99), "The resistance of one mil-foot of 96 per cent. conductivity copper wire at 70° F. is 10.81 ohms."

Poole in "The Wiring Handbook" admits it as a common custom to use values of 10.5 or 10.75, but thinks that the actual length of wire used will be several per cent. greater than that estimated, since, he says (p. 33): "The resistance per mil-foot of copper wire at about 70° F. is 10.6 to 10.8 ohms; the slightly larger value of 11 is used here in order to make a little allowance for the discrepancy between the actual and the calculated length of a stretch of wire." Just why this discrepancy in length should always be an additive one is not stated.

Several textbooks of the International Correspondence Schools use 10.8 on the ground of its being the mil-foot resistance of pure copper at 75° F., and quite consistently quote Berg's alternating-current formulas based on the same figure.

Over in England, Ellis H. Crapper, who is at the head of the electrical engineering department in the University College at Sheffield, interprets the work of the British committee on copper conductors as fixing the mil-foot resistance of annealed, high-conductivity, commercial copper (at 60° F.) at 10.2044 standard ohms, which would correspond to about 10.41 ohms at 70°. However, in the same work ("Electric and Magnetic Circuits," pages 355 and 135) he says: "The resistance of one foot of wire, one mil in diameter, is 10.81 ohms at 70° F."

Here again there seems to be a discrepancy in one and the same textbook, though not as great as that between the values taken by prominent American writers, which differ by fully 4½ per cent. Probably every work that I have mentioned has a large number of followers who swear by it without stopping to check up the basis of the formulas or tables. Many, and perhaps most, of the calculations for which such formulas and tables are used may be of such a nature that an error of one or two per cent. is not serious; but does that warrant the wide discrepancies just mentioned or the waste of time implied by using circular-mil or resistance tables to their last point? Are we not justified in expecting prominent writers to agree closely on the value assigned for constants in widely applicable formulas? And if the conductivity, owing to differences in purity and hardness, may vary (say) one per cent., while the estimable lengths may vary from one-fifth to one-half of one per cent., why should we attempt to go beyond an accuracy of (say) one-tenth of one per cent. in the other factors used with the same? Would it not be more common sense for all practical work to supplement our circular-mil and ohmic resistance tables with columns of approximations for ordinary use?

Wire Size B. & S. Gauge.	Circular Mils. Exact.	Circular Mils. Proximate.	Ohmic Resistance per 1,000 Feet Pure Annealed Copper at 68° F. Exact.	Ohmic Resistance per 1,000 Feet Pure Annealed Copper at 68° F. Proximate.
4/0	211,600	212,000	0.04893	0.049
3/0	167,805	168,000	0.06170	0.062
2/0	133,079	133,100	0.07780	0.078
0	105,535	105,500	0.09811	0.098
1	83,694	83,700	0.12370	0.124
2	66,373	66,400	0.15600	0.156
3	52,634	52,600	0.19670	0.197
4	41,743	41,700	0.24800	0.248
5	33,102	33,100	0.31280	0.313
6	26,251	26,250	0.39440	0.394
7	20,871	20,900	0.49730	0.497
8	16,510	16,500	0.62710	0.627
10	10,382	10,400	0.99720	0.997
12	6,530	6,530	1.58600	1.590
14	4,107	4,100	2.52100	2.520

Or, in the formulas where commercial figures are concerned, ought we not to waive the laboratory refinements and content ourselves with a more reasonable degree of accuracy? Take, for example, Abbott's specification of copper telephone wire[1] that the weight per mile should be determined by carefully weighing two per cent. of the number of coils called for in the contract, and that the weight thus obtained shall correspond within two per cent. on either side of the result given in the following formula:

$$\text{Weight per mile} = \frac{\text{Circular mils}}{62.567}.$$

Changing this to $\frac{C.M.}{62.6}$ introduces an error of less than one-twentieth of one per cent., and expedites its use for work involving an admitted variation of two per cent. Of course, I am a believer in exactness, but not in the overexactness which may be nullified by the variations of practice, nor in the wasting of time, which often leads to the substitution of mere guesswork for the calculating; hence my raising this point.

Many of you will know of other formulas where the same arguments may apply, so my question-topic resolves itself into these three, which seem to me timely questions for discussion:

(1) Why should there be any discrepancy in the values of constants used for common calculations?

(2) To what degree of accuracy can wiring be figured?

(3) Ought not approximate constants and tables to be used more freely for such calculations?

Discussion.

P. Junkersfeld, Chicago: Mr. Scheible has raised a number of questions well worth a good deal of attention. Overexactness is something that undoubtedly is the cause of much waste of time in a great many respects, but is something about which we must not get careless. We must determine when and where. We must remember that conditions vary widely. These various conditions frequently offset, a great many times, the refinements which might be dispensed with in particular cases.

George A. Damon, Chicago: It is always interesting to meet our old friend, Ohm's law, in any of its many forms. Every young electrical engineer should, of course, be intimately acquainted with this law in all of its forms, and for that reason I believe it good policy for a young man in starting out in making calculations involving Ohm's law to go to the extreme of refinement, rather than to begin to guess too early in his career. The faculty of reaching an engineering conclusion by guess, or by an approximation, is something

1. Quoted in Miller's "American Telephone Practice," fourth edition, p. 764.

which should be approached with a great deal of caution.

In connection with wiring calculations, I do believe that the best results are sometimes obtained by what might be called engineering "finesse," rather than by means of careful calculations. For instance, take the feeder system for an electric railroad. Here is a situation in which you can make exact engineering assumptions and figure out the answer to a nicety, and get just the diameter and the length of the feeder which should be provided to run the railroad, and when you get through it may be possible to put in half as much feeder, and the road will still be able to operate. The fact is that the amount of feeder is often determined, not so much from the calculations of losses and by Ohm's law, as it is by how much money there is available to build the road. Therefore, when an engineer starts out to get a result of this kind, he should be posted as to the financial conditions, as well as to the physical ones; then he will be in the best position to make the proper assumptions.

In calculating a feeder system, it is necessary to assume a percentage of loss. A percentage of loss upon what? Upon the maximum current that is going to pass over the feeder, or upon the average current? If you have a variable load, and figure average current, you may be surprised to see what a small feeder will answer the purpose. If you figure upon the maximum current, the size may be prohibitive, from a financial standpoint. Again, what is the allowable per cent. of loss? This assumption, of course, will have a very material influence on the answer. The young engineer is liable to figure that he will allow a five per cent. loss upon the maximum current. If he does, the requirements of his feeder system will probably bankrupt the promoter. On the other hand, an assumption of 20 per cent. loss on the average current would result in such a small feeder that the lights in the cars at the end of the feeder would be dim, and the passengers would be unable to read. Between these two extremes a balance must be found. In handling such a problem, it would be well to figure it out in several ways, and get the limitations, and thus be in a position to use good judgment as to the amount of feeder to recommend.

In the approximate table of wire sizes which Mr. Scheible has shown, it strikes me that his table does not get far enough away from the standard table to be of any particular use. We have all noticed, of course, that the cross-section area in circular mils of a wire is about double every third size. For instance, a No. 0000 wire is about twice the size of a single 0 wire. It seems to me that we might take advantage of this fact and make our table read in round numbers, for instance, No. 0000 wire, 200,000 circular mils; No. 0 wire, 100,000 circular mils, etc.

There is one thing in connection with the use of the formula which Mr. Scheible has not brought out; that is, the purity of the wire. The value of the resistance of a mil-foot as ordinarily specified is for wire composed of 98 per cent. pure metal. Personally, I have actually never had the purity of copper measured but once, although we have bought a great deal of copper. We have always assumed that we could get it as pure as specified. We did, however, measure it once, and the reports showed that it was not quite 98 per cent. pure. Now, if you will calculate the difference in the energy loss in the course of a year between conductors of 96 per cent. and 98 per cent. purity, it will be quite an item. There seem to be difficulties, however, in making exact tests for purity, and there is also a hesitancy on the part of laboratories in making reports as to whether the conductor is 97 per cent. or 98 per cent. pure. I would like to hear the experience of those who have made tests as to just what accuracy might be expected.

Morgan Brooks, Urbana, Ill.: It is very difficult to say whether a wire is 97½ per cent. pure because of the impossibility of measuring wire diameters exactly. It was my business, when with the American Bell Telephone Company, a number of years ago, to make wire tests, and at that time there were no specifications for hard-drawn copper that were recognized as efficient. I found it easy enough to determine the gauge of a wire in terms of B. & S gauge numbers, but with the more accurate method, using the micrometer gauge, it is more difficult. The wire has some spring, and if not accurately straightened it is difficult to get the diameter right within 0.0001 of an inch.

When I was with the American Bell Telephone Company we used wires of moderate size. The largest was No. 6 or 8, as is used between New York and Chicago. The smallest was No. 12. An error of measurement of two per cent. of the diameter means an error of four per cent. in the area and weight.

A micrometer with a spring arrangement makes wire measurement much easier, as it equalizes the pressure each time. I found it convenient to measure off 100 feet of wire and weigh it. I found a specific gravity of 8.9 to be more nearly correct than 8.8, as ordinarily given.

I found the conductivity of certain wire tested at that time to be over 100 per cent. Fearing that to report it at that, I would lose my job, I simply said the wire came up to specifications; I do not yet know what the trouble was.

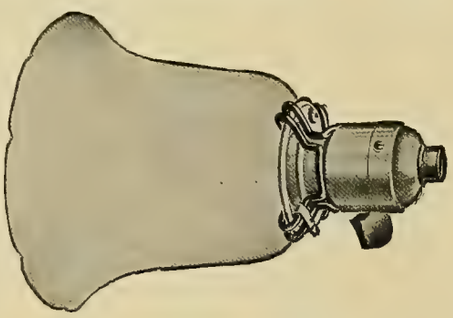
It should not be overlooked that in the larger sizes of wire, made up into cables, it takes about 1,020 feet of wire to make a conductor in 1,000 feet of cable. Another difficulty in figuring wire sizes, especially in lamp wiring, is that in the American gauge only even numbers of sizes are available in the market, and the differences between successive sizes thus available is about 60 per cent. We introduce errors by choosing the nearest size to the calculated one.

Rochester-Syracuse Electric Railway.

What will be, when completed, one of the largest interurban electric railways in this country, the Rochester, Syracuse and Eastern Railway, connecting the cities of Rochester and Syracuse, N. Y., has now opened up 37 miles of the entire length of 83 miles, the initial portion being from Rochester to Lyons. The undertaking, which is controlled mainly by Syracuse capitalists, Lyman C. Smith being the president, has been conducted in the most up-to-date manner. It is expected that it will cost $6,000,000 to complete the road. The roadbed, which in many instances traverses private right-of-way, is of the most substantial construction, all the material used being of the best. The power-house equipment consists of Westinghouse-Parsons steam turbines, Westinghouse turbo-generators, as well as switchboard and auxiliary machinery. The cars are solidly built, weighing approximately 50 tons and measuring 54 feet in length by 8½ feet in width. Each car is equipped with four 125-horsepower Westinghouse motors, Westinghouse multiple-unit control and air brakes. The company will operate express trains and accommodation trains, the former running at a regular schedule speed of from 50 to 60 miles an hour. On a recent trial trip a few days ago, one of the cars attained a speed of 70 miles an hour. It is expected that the entire road from Rochester to Syracuse will be completed and in full operation by January 1, 1908.

J-E-M Shade Holder.

Practical men are displaying great interest in the new shade-holder known as the J-E-M, an illustration of which is here represented showing it attached to a shade. This device is made of a single piece of wire ingeniously bent so as to grip the shade at four points and the socket at eight. These points of support are all in the same line and make the shade center exactly on the socket. This rigidity makes the new shade-holder particularly suitable for shades on fixtures that are set at an angle from the horizontal. There are no screws to loosen if the fixture is used in a place where it is subjected to jarring, while no screwdriver or other tool is needed for the installation. This shade-holder also has the advantage of allowing the shade to be easily removed for washing, and it does not deteriorate with repeated use. The J-E-M Shade Holder Company, 13 East Thirtieth Street, New York city, which manufactures this excellent little article, will be glad to mail free samples of the three sizes, 1⅝ inch, 2¼ inch and 3¼ inch.



J-E-M SHADE HOLDER.

An Historic Street Railway.

An electric railway is being built by the Fayetteville Street Railway Company of Fayetteville, N. C., which will be of historical interest. The roadbed used is said to be the first street-railway route ever surveyed in the entire country, having been mapped out and the tracks laid for a horse-car system many years ago, when steamboats were first operated on the historic Cape Fear River. Parts of the old road are unearthed occasionally even at the present time. The new line follows the old one for quite a distance, and will convey freight and passengers from the river wharves through the city.

Recent Mexican Installations.

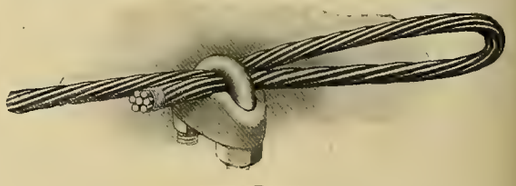
The Mexican Engineering and Construction Company is now pushing the work on the "Porfirio Diaz" tunnel in Guanajuato. This tunnel, which will be seven meters in diameter, is to pass under the city and will, when completed, receive the flood waters from the valleys above the city, thereby preventing any repetition of the recent catastrophe, the tunnel being large enough to prevent any possibility of a like occurrence. The order for the machinery was given to G. & O. Braniff & Co., who, as agents for the Westinghouse Electric and Manufacturing Company of Pittsburg, Pa., have supplied that make of electrical apparatus. Ten air drills receiving air from two motor-driven Ingersoll air compressors are to be used. The compressors are each 18¼ by 12¼ by 12 inches and the motors will each be of 50-horsepower capacity. Two motor-driven exhaust fans are to keep the tunnel ventilated as work progresses. A 30-horsepower electrically operated hoist will be used to haul the loaded cars out of the tunnel on an incline to the dumping ground at the upper end. The electric power will be taken from the circuits of the Guanajuato Power and Electric Company.

Through G. & O. Braniff & Co. a large and modern electrical plant for lighting and power is being installed by the Oaxaca Smelting and Refining Company, of which Mr. O. F. Westlund is manager. There is hardly a smelter in the Republic of Mexico which has not its electrical installation. The advantages resulting from the greater economy and efficiency with an electrically equipped smelter being fully appreciated by this company, it is installing a 110-kilowatt alternating-current Westinghouse generator, 440 volts, 60 cycles, steam engine driven, with exciter, switchboards, etc., at the generating station. Transformers will be used to supply the arc and incandescent lights, the many motors, up to 50-horsepower capacity, being operated direct from the generator. The motor-driven centrifugal pumps are of the Byron-Jackson make, and the triplex are made by the Allentown company.

The Negociacion Minera "Santa Maria de la Paz y Anexas" of Matehuala has ordered material for a modern steam-driven electric plant to be installed at its mines. This plant is of a particularly new and interesting nature. The electric power will be used to drive a multi-stage Byron-Jackson centrifugal pump. This one pump will deliver 150 gallons per minute against a total head of 1,640 feet. It is safe to say that this is the greatest head against which a single centrifugal has ever been operated in Mexico, and indicates the rapid advancement which is taking place in this type of pump manufacture, which is proving so well adapted to mining work. This pump is driven by and direct coupled to a Westinghouse 150-horsepower alternating-current motor making 1,700 revolutions.

Cook's Clip.

Herewith is illustrated the Cook U-bolt clip manufactured by Frank B. Cook of Chicago. The feature of this clip is its great holding power.



COOK'S CLIP.

The device is made of the best grade material, and each clamp is assembled by hand after it has been galvanized. This careful assembling prevents the nuts from sticking and lightens the lineman's labor considerably. It is said that the clip will not injure the strand in any way and will stand the weather for an indefinite period. Mr. Cook says that although the clip has been on the market but a short time, it is already extensively used.

Electrolysis in Roubaix.

According to the United States consul in that city, an interesting question resulting from damage due to electrolysis has arisen in the city of Roubaix, France. About two years ago the administration of postoffice and telegraphs caused the telephone lines to be placed underground in lead pipes. Recently the telephone system has been much interrupted, and the present excavating was begun to ascertain the cause of the trouble. When the trenches were opened it was found that the lead cables had become practically unserviceable, apparently on account of electrolysis, due to the action of the current from the tramways above. The condition is such the cables will have to be replaced, and this will be done by iron-covered cables. Meanwhile the department of postoffice and telegraphs and the tramway company are having a discussion as to who shall pay the cost, which will of course be large.

Inspection from the Contractor's Point of View.[1]

By A. M. Sanborn.

I certainly cannot plead that the subject does not offer ample opportunity for remark. I am afraid that if I undertook to tell you all about electrical inspection from the contractor's point of view, I should be talking here for the next week.

The point of view from which one approaches an object or subject necessarily has a great deal to do with his decisions and conclusions; and, as the contractor and inspector approach from entirely different directions, it appears to me but natural that they do not always agree, as there is no disputing the statement that their point of view is entirely different.

From the inspector's point of view, if the work is not perfect, and does not come up to his ideas of standard, he very naturally points out wherein the work is defective. The contractor (I want to start on the premise that we are talking about the honest and conscientious contractor) desires, and is striving for, just as high a standard as is the inspector; but you must realize that it is much easier to criticize and find fault than it is to attain the standard of perfection that we all so much desire. Very naturally and rightly, the electrical inspector considers the position as it affects the fire hazard only.

The contractor has many more interests to consider. He has first the owner or customer, who is all-powerful in fixing the limitations of the class of work that is to be done by means of the price that he will pay. The always-present methods of competition play their part in determining the class of work to be installed. Therefore, it is apparent that the contractor does not always have the opportunity to select the highest type of construction and equipment, much as he would desire.

Again, the architect approaches the situation from an entirely different point of view from either of us. The appearance of the work appeals to him; he requires conduits, wires and equipment to be concealed and out of sight; he is very naturally influenced by his esthetic tendencies and practical ideas of construction and many other considerations of the building. The condition that might be very desirable from the inspector's point of view is frequently extremely unsightly and objectionable from the architect's point of view; and the condition that would be ideal to the inspector often cause inconvenience to the building operation that is very objectionable to the architect.

Further, the consulting and operating engineer's point of view is different from either the inspector's, contractor's or architect's. He must consider the efficiency, cost of operation, cost of installation, convenience and many other points which may conflict with the inspector's point of view.

Finally, the stockholders of the contracting company want to know if everybody's point of view is to be considered at the sacrifice of the profit on the job. They are apt to insist with a vengeance that the contractor should observe this point of view to some reasonable extent.

And now, gentlemen, I have pointed out these different points of view for the purpose of calling your attention to the fact that the way of the contractor is not all strewn with roses and that the obligations of equalizing and neutralizing all of these various points of view rest with the contractor. On his shoulders rests the burden of satisfying all these various interests; consequently, his position as it applies to the inspector does not always represent his individual ideas; and therefore I say, bear and forbear, and remember that the contractor is made out of the same kind of clay that you are, and that he cannot perform miracles or attain a state of absolute perfection in his work any more than other human beings can attain perfection in any work that they attempt.

You do not need me to tell you that the workmen who actually perform this work are not at all what they should be; and if I say that in many cases they are inefficient, and without the proper understanding of their trade, do not understand that I wish to reflect any discredit on them; there must be a reason for this condition.

Has it ever occurred to you what a really new and undeveloped business we are in? You know that it has been scarcely 15 years that we have been installing practical electric lighting and power work, and that in that short space of time we have gone through a process of evolution, that our workmen have taken up their trade at a time in life when other craftsmen have completed their apprenticeship. We have had masons, carpenters and joiners and many other trades since King Solomon's time, and therefore it is not to be wondered at that our workmen are not as much experienced in the short space of time that they have had opportunity to learn their trade as those workmen whose fathers have been masters before them.

My suggestion, therefore, is co-operation. Let the inspector help the contractor and workmen to develop the art; let the contractor help the inspector; let us get together and understand each other better to the end that we may improve ourselves and our work until we are able to come nearer the standard of perfection that we should all like to attain.

And to the inspectors, I want to say that I think you should carry in mind the object for which you are inspecting. This object I understand to be the prevention of fire. I do not believe that the companies who employ you directly or indirectly (and by companies I mean the men who pay the losses) desire that you seek any particular ideals or that you attempt to attain a complete state of perfection, but they want to be sure that the work is done in a safe and practical manner, so that it will not contribute to the fire hazard of the risks. This being the case, some judgment must be exercised by the inspector, and he must have some latitude. If he has not this all-important qualification of good judgment, and if he is not allowed reasonable latitude by his chief, he will not make a success at fire prevention. He should not spend his time and energy in nagging, discussing and reporting trifling variations from the standard; he should make the inspection from a broad point of view and with the sole idea of fire prevention. I believe that such should be his only purpose. I do not believe that to be successful he has to make unfavorable reports to his chief of every risk, simply to show that he has made an inspection.

I believe that large sums of money can be saved for the people who pay the losses by the several inspection departments co-operating with the contracting fraternity; and such co-operation cannot be obtained if the inspectors by virtue of their position seek to cause contractors to spend needless money to follow out their individual ideas or to vindicate their positions. But if the inspector and the contractor each accept the other on the broad platform of co-operation, and work together, we will be able to bring about the much-desired results, and preserve harmony among all.

I believe in inspectors, and I believe in the Code; and I am free to say that if it was not for the inspection system we would be in a state of chaos, everybody going his own way, and practicing his own ideas, whether good or bad. The entire business would be without foundation. Let us accept the Code as the foundation for proper regulation, bearing in mind, however, that the necessity for inspection does not justify its abuse. We should always remember the "other fellow" has interests that must be considered and protected. Try to attain your ends and conserve your own interests without stepping on the other fellow's toes. And, after all, this whole matter is a purely business proposition, and I do not believe that the insurance interests can any more demand unreasonable things from their customers and contractors, and retain their confidence and respect, than can the contractor shirk his job and expect the continued patronage of his customer.

Now as to the Code. I have the most sincere and profound respect for the Code and the various organizations that contribute to its formation. Of course, you all know of the method used in formulating the Code; you are aware that various organizations—namely, the American Institute of Architects, American Institute of Electrical Engineers, American Society of Mechanical Engineers, American Institute of Mining Engineers, American Street Railway Association, Associated Factory Mutual Fire Insurance Companies, Association of Edison Illuminating Companies, International Association of Municipal Electricians, National Board of Fire Underwriters, National Electric Light Association, National Electrical Contractors' Association and Underwriters' National Electric Association—send committees to meet with the electrical committee of the Underwriters' National Electric Association in December of each year. All associations and individuals have the privilege of sending their ideas as to changes and additions to the Code, and enjoy the right of the floor. All questions are given careful and full consideration and much discussion, and in the end a vote taken, the result of such vote being the rule. Consequently, I say that I have respect for the Code, knowing that it is not founded on theories or snap judgment, but rather on the result of mature and careful consideration and the experiences of the various interests, together with the requirements and necessities of existing conditions. I think, therefore, that all inspectors should accept the Code as it is written, and so practice it, and not make changes or additional rules. I think we should have one uniform code, understood by the inspector, contractors and workmen, and practiced alike all over the United States.

At the National Electrical Contractors' convention, held in Philadelphia and Atlantic City in 1902, an underwriters' rules committee was appointed, of which I had the honor to be chairman. About the first thing this committee did was to let the electrical committee of the National Board of Fire Underwriters know of its existence and its desire to meet with them. In November of the same year I had the pleasure of acknowledging an invitation for our committee to meet in New York with the electrical committee and other interests represented. I have good reason to believe that the gentlemen present at that meeting expected that the contractors' committee was going to jump in with a lot of suggestions as to changes along the line of modification of the rules. If my assumption is correct, they were mistaken, as that was not the purpose of that committee, nor has it been the purpose of any subsequent committee attending these meetings.

We did, however, set up a battle cry at that meeting, which was uniform interpretation of the Code and uniform application of the Code. That has been the slogan of every contractors' committee attending these meetings, and will be the slogan of the committees to come, and we much hope for the co-operation of this Western Inspectors' Association along these lines. The National Electrical Contractors' Association stands for the Code, and stands for good workmanship and honest contractors; and I assume that the Western Association of Electrical Inspectors stands for equally high principles. Therefore, I say again, let us have co-operation, uniform interpretation and uniform application.

Organization is the order of the day. Individual effort has proven too weak. Organization is necessary, and organization can do unlimited amount of good, providing their objects are high and the membership of the right character. It is the duty of each member of your association to see that the other members live up to the objects and principles of it, and if you find in your ranks a "grafter," let it be the duty of your organization to stamp him out. He will do more to prevent the attainment of the standard in one month than the entire membership of this organization or any contracting association can do in one year.

And now, gentlemen, I feel that I have rambled somewhat from the subject given me, but I hope what I have said will be accepted as a heart-to-heart talk, and that we may understand each other better after this meeting, and that we will all carry as our banner—"Uniform interpretation and application of the Code, and co-operation with one another."

1. An address delivered before the Western Association of Electrical Inspectors at Indianapolis, October 18, 1906. Mr. Sanborn is an electrical contractor of Indianapolis.

Chicago Telephone Company Submits a Proposition.

The mayor and council of Chicago are busy considering propositions from various sources for the right to furnish telephone service in the city. Among them are the proposals of the Illinois Manufacturers' Association, one from St. Paul and Kansas City interests represented by Arnold Kalman, and a later one, which has attracted a great deal of attention, from Independent interests represented by J. D. Powers and Ed. L. Barber, who have secured the telephone rights of the Illinois Tunnel Company, and propose to develop the automatic system and give long-distance connections to Independent systems throughout the country.

The Chicago Telephone Company, whose franchise expires in something over two years, has presented a proposed ordinance in which it offers reduced rates and other concessions for a 20-year extension of its franchise. The whole question is now before the City Council committee on gas, oil and electric light. Under the proposed ordinance the company will pay the city three per cent. of the gross receipts on exchange business done within the city and will make improvements and maintain the highest efficiency.

Provision is made for the purchase of the plant by the city at the end of 20 years, by a two-thirds vote of the council in two consecutive years, ratified by a three-fifths vote at any city election. Other restrictions are cast about municipal ownership.

Some of the prices offered in the proposed ordinance are as follows: One-party line, including up to 100 messages each month, $5 a month; additional messages during the month, up to 300, three cents each; all additional messages during the month, two cents each; one-party line, for private residences only, including unlimited messages, $6 a month; two-party line, for private residences only, including unlimited messages, $5 a month.

The 10-party-line residence service is abolished and without any advance in rates will be changed from 10-party to four-party, the guaranteed rate of five cents per day remaining the same. The 10-party business telephones at a guaranteed rate of 10 cents per day will be changed to two-party lines at a guaranteed rate of 10 cents per day with one message, or a guaranteed rate of 15 cents per day with three messages. The four-party residence telephones, with a guarantee of 10 cents per day, will be reduced to five cents per day.

The two-party guaranteed rate of 20 cents per day is reduced to 15 cents per day.

A new two-party rate of 10 cents per day with one message is established. The single-line nickel guarantee of 30 cents per day is reduced to 20 cents per day. The guaranteed rate of 20 cents per day with two calls for single lines is reduced to 15 cents per day.

At the last meeting of the council the city electrician was instructed to ascertain the exact number of telephones in operation by the tunnel company. Under its ordinance it should have 10,000 in use at this time.

Telephone News from the Northwest.

H. F. Mann, manager of the Minnesota Telephone Company, has started work for the extension of a telephone line from Cove, Minn., to Eastwood.

The Tri-State Telephone Company secured a verdict in the suit brought against it by C. R. Parmalee in St. Paul, for $20,000 damages for injuries alleged to have been sustained from coming in contact with a live wire, made so by coming in contact with the street-railway trolley wire. The company set up that its wires were struck by lightning during a heavy thunder shower and that it received no notice of trouble with its lines until the following morning and could not be held negligent.

Two telephone linemen in Sioux Falls, S. D., working for the Citizens' Telephone Company, were instantly killed by receiving a shock from an electric-light wire. They had thrown a telephone wire over the electric-light wires, while working on a pole, but took hold of the wire at the time when the electric company turned power on its lines for making the daily test of the wire. Both men fell to the ground, dead.

Jay Turner of Owatonna, Minn., has been made wire chief for the Northwestern Telephone Exchange Company, at Albert Lea, Minn.

The Mutual Telephone Company of Red Lodge, Mont., has sought an injunction against certain labor unions to prevent them from placing the company on the "unfair" list. In the meantime, the subscribers of the company are hearing from the unions, which are very strong in that state, and of the 113 business and home connections, 58 have been ordered out.

After a prolonged contest over the matter, the City Council of Fargo, N. D., has refused a franchise for long-distance connections to the North Dakota Independent Telephone Company. There are threats against the council of political revenge at the spring election.

The Northwestern Telephone Exchange Company furnished free service to the different cities and towns on its line for the dissemination of the election returns.

Thomas Peebles and others have incorporated the Gate Telephone Company at Burlington, Iowa, with a capital of $10,000. William H. Taylor is president and Mr. Peebles secretary-treasurer. The company is supposed to be connected with the Mississippi Valley Telephone Company.

E. H. Moulton, president of the Tri-State Telephone Company, says that, if a satisfactory franchise can be obtained at Chicago, the company will build a line from the Twin Cities to that city.

The Mississippi Valley Telephone Company will lay the foundation this fall at Keokuk, Iowa, for its new telephone exchange building. R.

Ohio Telephone Notes.

Frederick S. Dickson, former president of the Federal and Cuyahoga Telephone companies and other companies owned by Cleveland men, has brought suit in the Common Pleas Court against the Everett-Moore syndicate, consisting of Henry A. Everett, E. W. Moore, C. W. Wason, B. Mahler, J. B. Hoge and James Hanna, for the recovery of $100,000, claimed to be due him for services performed in taking care of their affairs when the syndicate became involved in trouble some years ago.

Owing to the vigorous objections made by the people at large, the directors of the Columbus Citizens' Telephone Company have reconsidered their decision to advance the rates for service, and the matter is now indefinite. This action was taken after discussion on the streets and in the newspapers had become rather heated. It is not known what the intentions for the future are.

The capital stock of the Mt. Vernon Telephone Company has been increased from $150,000 to $250,000. The money from the additional stock will be used for the extension of the lines and making improvements required by the rapid growth of the town.

The election returns were handled in an admirable manner by both the Cleveland Telephone Company and the Cuyahoga Telephone Company at Cleveland. Returns were secured from all the states and from all points in Ohio and sent to the hotels and other centers in the city and then to all points of the state. It is estimated that 150,000 inquiries were answered that night by the companies. C.

Indiana Telephone Items.

The Citizens' Telephone Company of Evansville has renewed its application for permission to construct and operate an Independent telephone system in Evansville and the campaign for and against a dual system has been renewed with vigor.

A bill of complaint alleging patent infringement on a telephone desk standard has been filed in the Federal Court by the Western Electric Company of Chicago against the Sterling Electric Company of Lafayette, Ind.

The Lake Erie and Western Railroad Company has taken a step toward the installation of a telephone-telegraph system on its road. The first installation of the new system will begin in Indianapolis and continue to Tipton. The other divisions will be equipped immediately after the completion of the Indianapolis and Tipton division.

The telephone and telegraph companies in Indiana employed a large extra force to transmit election returns during the recent election. It was no uncommon thing to send and receive telephone and telegraph news over the same wire.

Arrangements have been made to connect the Independent toll lines of Indiana with Chicago through the plant of the Home Telephone Company at South Bend. This arrangement will enable the Independents throughout the entire state to secure toll-line service with Chicago and other northern points.

The large number of fatal accidents occasioned recently by coming in contact with live wires has occasioned a number of suits for damages. Two suits were filed during the last week against the Central Union Telephone Company to recover damages for the loss of life while engaged in performing the duties of linemen.

The managers of the principal telephone companies in Indiana are somewhat alarmed over the threat among farmers to ask the Legislature for a law which will compel companies to give service to anyone living upon the line, simply by connecting therewith by any kind of a telephone the farmers may choose to purchase. The companies have endeavored to bring about a standardization of telephone equipment, and to permit the connection of any kind of telephone would not only weaken the service but prove annoying in many ways. S.

Poulsen's Wireless Telephone.

The inventor of the telegraphone, Valdemar Poulsen, is said to have achieved the transmission of the human voice by a process resembling the methods used in space telegraphy. He uses a wave detector arranged at the receiving station in series with a telephone and battery in a manner analogous to what is done in radio telegraphy.

According to the Berlin correspondent of the London Times Engineering Supplement, the sending apparatus comprises a "singing arc" placed in an atmosphere of hydrogen and fed by a 220-volt direct current. The vibratory circuit comprises a condenser, consisting of seven Leyden jars, an adjustable induction coil and the primary coil of a Tesla transformer. A high-tension flaming arc, several centimeters in length, is maintained between the secondary terminals of the transformer.

If the secondary winding of the induction coil is connected to a battery and transmitter, on speaking into the transmitter it is said that the flaming arc fed by the high-frequency current will distinctly reproduce any words spoken into the microphone with an intensity superior even to that of ordinary direct-current "speaking" arcs.

A similar arrangement, with an electrolytic cell serving as wave detector, was used to transmit the human voice in the inventor's laboratory, and the results obtained over distances of about 30 yards with the aid of an aerial wire, about two yards in length, were considered so satisfactory that it is hoped shortly to transmit conversation over a distance of several miles.

GENERAL TELEPHONE NEWS.

The Snyder Telephone Company of Snyder, Okla., has sold its business to the Pioneer Telephone and Telegraph Company.

The question of granting a franchise to an Independent telephone company was submitted to vote of the people at the recent election in Omaha, Neb., and was carried by an overwhelming vote.

The Twin City Telephone Company of St. Joseph has been taken over recently by the Michigan State Telephone Company, and now another company is applying for a franchise in the cities of Benton Harbor and St. Joseph.

Among the recently incorporated telephone companies are the following: Gate Telephone Company, Burlington, Iowa; Paola Telephone Exchange, Paola, Kan.; Western Union Telephone Company, Burkeville, Texas; Olustee Telephone Company, Olustee, Okla.; Cleveland Telephone Company, Cleveland, Texas; Deer Creek Telephone Company, Deer Creek, Minn.

The Porto Rico General Telephone Company of Stamford, Conn., has filed a certificate of incorporation. It has an authorized capital of $130,000, and its charter empowers it to build and operate telephone and telegraph systems in Porto Rico. Frederic Culver of Hadlyme, Conn., Granville Whittlesey of Greenwich, Conn., and Generoso Candina of San Juan, Porto Rico, are the incorporators.

The special committee of the City Council of Niagara Falls, Ont., which has been considering the offers of telephone companies for a franchise in that city, has recommended that the offer of Stark & Co. be accepted. This company does not ask for an exclusive franchise; its rates are considerably lower than those of the other companies competing, and the city can take over the plant at any time.

CORRESPONDENCE.

Continental Europe.

Paris, October 30.—A hydro-electric plant of some size is in erection at Moosberg, Germany, which will send current to the city of Munich. The Aar River supplies the power. Using a water-head of 26 feet, it is expected to secure about 5,200 horsepower, and this will be furnished by three turbine groups, using wheels of the Voith pattern and 5,000-volt alternators of the Siemens-Schuckert make. Generated at 5,000 volts, the current is raised at the station to 30,000 volts, and a double overhead line runs to Munich. In the city a sub-station lowers the voltage to 5,000 volts, and this current will be used upon the city mains in addition to what is already in use.

The Compagnie pour la Fabrication des Compteurs, of Paris, has recently brought out a new apparatus for sterilizing water by means of ozone. In a metal box is placed a set of condenser plates formed of glass with tin-foil coating, and an induction coil which may be connected upon the lighting circuit gives a discharge between the plates. Connected with the box is a water piping, and this is arranged so that when the water flows it draws out the ozonized air with it, and by passing through a mixing chamber the ozone is brought into intimate contact with the water. Upon leaving the apparatus the water is found to be sterilized, and the process is a very simple one.

A combination lamp made by a Paris firm consists of a mercury vapor lamp with a set of ordinary incandescent lamps added to it so as to modify the light. Seeing that the mercury vapor lamp is lacking in red rays, it is intended to supply the deficiency by using the incandescent lamps with their filaments run somewhat below candlepower so as give a red glow. This, added to the light of the mercury vapor tube, gives a great improvement in the light. For 380 candlepower the current is stated to be 3.2 amperes at 75 volts, or 0.87 watt per candle.

Experiments have been carried out at the port of Antibes, on the Mediterranean, with a new system of operating submarine torpedo boats at a distance by means of electric waves. The submarine boat contains a storage battery supplying current to a number of motors so as to carry out the propulsion, steering and various maneuvers. The motor circuits run to a circular switch having 15 points. By sending the electric waves from a distance, the arm is made to travel over the switch, but it does not send current until it comes over the desired point for operating a certain motor, in which case the current is sent into that particular circuit so as to effect the propulsion, for instance, and this occurs only when the arm is stopped. The torpedo is launched from the boat by a similar maneuver, and in the same manner signal lights are thrown on, etc. The apparatus can be operated at a distance of one mile or more, as was shown by the tests.

In Germany experiments have been made to show the expense of different kinds of traction, including tramways running on rails, an electric omnibus upon an ordinary road with overhead trolley, and an automobile omnibus with battery. Estimates were made as to first cost and running expenses, and it was found that the first system is the best when the cars are run at intervals below 20 minutes, the second at intervals between 20 minutes and two hours, and the third above two hours.

In order to give a better test of line insulators by running them in the open air and as nearly as possible under the actual conditions, the Pankow firm of Berlin has installed a testing plant on its premises, and can furnish a current of 100,000 volts from a special transformer of the Westinghouse pattern. The first set of experiments is made upon the new "ambroine" insulators, of German make.

A novel form of electric railway has been proposed for running to the summit of Mt. Blanc. Instead of running upon rails, the cars will be suspended between two stretched cables, one at the top and one at the bottom, and the car will be supported by rollers upon the cables. At the same time it will be drawn by a traction cable which works upon a drum driven by an electric motor. The two supporting cables will be fixed in a suitable metallic construction and held on a masonry viaduct. It is estimated that the project would cost about $1,000,000, and can be carried out within three or four years.

Motor plants operated by producer gas are used in many of the tramway generating stations on the Continent, and it is found that they give considerable economy. Specially-designed gas motors are used in such cases. The producer uses coal, coke, peat, or even refuse, such as sawdust or shavings, in which case a combustion chamber of appropriate form is adapted to the producer. By the use of the gas engine a much higher efficiency is obtained from the combustible. In some cases the cost is only one cent per kilowatt-hour. Among the tramway plants which are using such apparatus, I may mention the Orleans station in France, which gives 500 horsepower, and the Lausanne plant, of about the same size. Other plants are in use elsewhere. A de C.

Great Britain.

London, October 31.—A good idea of the intentions of the London County Council regarding the electric-power-supply question is afforded by a report which has just been presented by the highways committee. The area to be covered is 450 square miles, and there is to be one generating station. This points to the fact that the use of the tramway generating station at Greenwich has been abandoned, and presumably, also, the relatively low voltage, viz., 6,600 volts, which was so much commented upon by the opponents of the bill a session ago. One cannot resist the reflection that whereas municipalists throughout the country are continually declaiming against monopolies, yet every municipal commercial undertaking constitutes a monopoly in its broadest sense. So keen is the London County Council not to have anything in the nature of competition that it is now intended to seek power enabling the acquisition of all the supply undertakings in the area, on terms, either compulsorily or by agreement.

All this is completely revolutionizing the terms of the electric-light acts, and although a special act of Parliament overrides the general law, yet such drastic changes usually come from a government department. The area outside London amounts to 334 square miles, while the County of London measures 117 square miles. The total cost of the power house, which it is proposed to build in sections, is put at $7,000,000, and the total cost of the distributing system $13,250,000. The capital of the companies in the London area amounts to $70,000,000, and the expenditure upon electrical undertakings by local authorities $26,000,000.

A statement has just been published concerning the proposal of the Midland Railway Company to equip, experimentally, a short length of its line in the northwest of England, on the single-phase system. The piece of track in question is eight miles, double, the line voltage being 6,600 volts single-phase, with step-down transformers on the trains. The motor coach in the contract just placed will be equipped with two single-phase motors of the compensated, series type, with special commutation poles, each having a rated output of 180 horsepower. There will be a main transformer on the motor coach delivering 320 volts to the motor terminals. The primary side of this transformer will be controlled by an electrically operated main switch, opened by the master controller when in the off position. For starting, the voltage on the motors will be varied by connecting them to various taps on the transformer by means of electrically operated contactors placed under the cars and controlled by the driver. The motors will be connected to the car axles through single reduction gearing, the ratio being 40:118. The driving wheel on the car axle will be 43½ inches diameter. Current for auxiliary purposes, such as lighting, heating, etc., will be furnished by a special transformer, permanently connected to the line. Catenary suspension, with single trolley wires for each track, will be employed.

After several years' haggling and quarreling, the Electrical Contractors' Association is to conduct a test case in the law courts against the Sheffield Corporation carrying on a municipal wiring department. The Sheffield case is a peculiar one. Quite a number of corporations throughout the country carry on electric-wiring business, under a special act of Parliament, but Sheffield bought out a company, which already carried on such a department, and it has continued the work without parliamentary sanction.

Vickers Sons & Maxim are installing in their Sheffield works a 2,000-kilowatt Parsons turbine and a 1,000-kilowatt Willans & Robinson turbine, solely for driving their works. This must constitute one of the largest installations of its kind, at any rate in Great Britain. G.

Dominion of Canada.

Ottawa, Ont., November 10.—Shareholders in the Dominion DeForest Wireless Telegraph Company are being notified that the Northern Commercial Telegraph Company has purchased 200,000 shares, and consequently the controlling interest, in the former company, paying for it with an equal number of shares in the purchasing company. The shareholders of the DeForest company are invited to exchange their shares for those of the Northern company. The shares of both companies are of the same par value—$5.

John Knight of Renfrew, Ont., has disposed of his waterpower privileges at the Fourth Chute on the Bonnechere River to the owners of the Rednor Iron Mines. The site is capable of developing over 1,500 horsepower. The company contemplates extensive improvements, including an electric plant for light, power and smelting purposes.

The waterpower at Calumet Falls, Que., has been sold to an American company which intends to manufacture pulp, paper and cement and supply electricity to the towns within a radius of 40 miles. The existing power at Calumet Falls is estimated at 64,000 horsepower. A number of prospectors for the company are now engaged in surveying the country, which is believed to be rich in mica, graphite, galena and phosphate.

The Saraguay Electric Light and Power Company of Cartierville, Que., has offered to supply light to the citizens of Montreal at a lower rate than the Montreal Light, Heat and Power Company. This company has been in operation since March last. It has taken over the property of the Cartierville Electric Light and Power Company.

To provide for the extraordinary increase in the sale of electricity the Montreal Light, Heat and Power Company has found it necessary to augment its power equipment, and it has recently contracted with the Canadian Westinghouse Company for apparatus for the power station on the Soulanges Canal, about 40 miles west of Montreal, on the St. Lawrence River. The equipment consists of three 3,750-kilowatt revolving-field alternating-current two-bearing generators, connected with water turbines. An important part of the apparatus is 13 2,500-kilowatt oil-insulated water-cooled transformers. Seven of these transformers will be used for raising the voltage at the generating station from 4,000 to 44,000 volts, the remaining six being used at the lowering end of the transmission line, stepping down the voltage from 44,000 to 12,000. Generators and exciters will be controlled by motor-operated rheostats, and the complete switchboard apparatus, which the Westinghouse company is furnishing for both main and sub-stations, embody the latest type of electrical control, representing the highest development of switchboard apparatus. W.

New England.

Boston, November 10.—The building containing the Alton, N. H., electric-light plant was burned on the night of November 3d.

The Ansonia Electrical Company, manufacturer of insulated wire, is planning a brick addition to its plant in Ansonia, Conn., which will be four stories high, 80 feet long and 50 feet wide. It will add about 32,000 square feet to the company's floor space and increase the plant's capacity over 50 per cent. The contract will involve the expenditure of $50,000.

The full bench of the Massachusetts Supreme Court has reversed the lower court's decision in favor of Orlando Mason and other Winchendon, Mass., mill owners, in their suit against Baxter D. Whitney. Mr. Whitney has mills along Miller's River above those belonging to the plaintiffs, and since 1899 he has been running one of his mills at night for the purpose of furnishing electricity for the Winchendon electric lights. The running of the mill night and day lowered the level of the river at the plaintiffs' mills so that their power was affected. They brought suit to compel Mr. Whitney to stop using the water at night, and to have him store the water at night so that it would be released in sufficient volume to work their mills during the day.

The Consolidated Railway Company now has a direct electric railway between Worcester, Mass., and New London, Conn., via Jewett City and Plainfield, Conn. The steam-railroad tracks of the Norwich and Worcester Railroad form part of this line.

Waterbury, Conn., capitalists will ask for a charter for a company to build and operate an electric railway between that city and Milldale, connecting at the latter place with the electric railway between Springfield, Mass., and New Haven, Conn.

The Consolidated Railway Company is extending the Berkshire street railway from Great Barrington, Mass., to Canaan, Conn. The company will electrically equip its road between Meriden and Middletown, Conn., next spring.

The Massachusetts gas and electric light commissioners have been asked to approve an issue of capital stock amounting to $75,000 by the Webster Electric Company, the proceeds to be used to pay floating indebtedness and the cost of additions to the company's plant.

The Worcester Polytechnic Institute has received two 150-kilowatt 2,200-200-volt step-down transformers, a 1,000-ampere five-volt direct-current generator, a 10-ton traveling crane, and a conduit for the new wiring system for the new electrical-engineering laboratory. A trunk line of steam piping to the laboratory has just been completed. Two flaming arc electric lamps have been installed in the power laboratory and two 220-volt, 60-cycle, compensator-type arc lamps have been ordered for the foundry. Several modern high-grade galvanometers of French construction, with universal shunts, have been received by the department of physics.

The recently incorporated York and Oxford Railway Company proposes to build a standard-gauge railroad between Springvale, Me., and Bridgton Junction, Me., via Sanford, Limerick and Baldwin, a distance of 40 miles, the motive power to be electricity, compressed air, or animals.

The following securities were sold at auction in this city yesterday: West End Street Railway Company's four per cent. bonds of 1915, amounting to $4,000, at 100¾; New England Telephone and Telegraph Company's five per cent. bonds of 1915, amounting to $4,000, at 104 and 104¼; seven shares of Charleston Gas and Electric Company's stock at 130.

The Northern Connecticut Power Company is building a brick power station 52 by 125 feet, near the present Windsor Locks, Conn., plant. The new plant is to furnish electric light and power for Windsor Locks, Enfield and Thompsonville, Conn. The company recently obtained control of the Windsor Locks Electric Light, the Enfield Electric Light and Power and the Enfield Gas companies. B

New York.

New York, November 10.—William H. Tolman, who was the vice-president of the jury on political economy at the Milan Exposition last summer, on his return to this city yesterday said that the gold medal for "social economy" had been awarded to the Brooklyn Rapid Transit for its arrangements for the comfort of its employes in the way of reading rooms and clubhouses at the various carbarns.

As a result of complaints, an order was issued in Albany Thursday by the State Railroad Commission directing the officers of the Brooklyn Rapid Transit Company to operate no more open cars after today.

A high-speed, elevated, mono-rail rapid-transit road may be built in this city within a comparatively short time. At a hearing held by the committee on plans of the Rapid Transit Commission, advocates of the Behr mono-rail system made a strong showing, and the members of the committee not only displayed interest in the proposal, but gave evidence of being inclined to favor the building of the road. Should the plan be adopted, New York will have the first mono-rail railroad to be built and operated in the United States. It will cost approximately $170,000 a mile to construct the road, and the cars are to cost $45,000 each. They are to be made of an alloy of aluminum and magnesium. The rail is to be six feet above the roadbed, and the car sides will extend below it on either side, so that, on curves, the center of gravity will be below the rail, and thus obviate the possibility of the car overturning. The committee, which held the hearing yesterday, will report to the full board at the next meeting in all probability.

The Appellate Division of the Supreme Court handed down its opinion in the case, decided last Monday, of the people ex rel. New York Electric Lines Company against William B. Ellison, commissioner of electricity. The court affirms Justice Bischoff's denial of a motion for a peremptory writ of mandamus to compel the commissioner to issue permits to the company for the opening of the streets to lay conduits. Justice Ingraham writes the opinion, and all the justices concur. The company lays claim to the right to lay the conduits and has expected to operate under a franchise granted by the Board of Aldermen on April 10, 1883.

The consent of the four grandchildren of Robert Fulton has been obtained to the removal of his body from Trinity Churchyard to the tomb and monument which the Robert Fulton Memorial Association intends to erect. The site has not yet been selected, but it will be on Manhattan Island. The cost of the memorial is estimated at $600,000. Plans are laid for the laying of the cornerstone on November 14th next year, the anniversary of Fulton's birth, in the hundredth year since he sailed the Claremont upon the Hudson River. President Roosevelt will be invited to be present.

The daily newspapers report that S. V. Granger of Newark, N. J., has perfected a wireless telephone which will transmit the human voice through earth and air without the use of wires for 20 miles. Already several prominent electric companies have offered him a handsome price for his invention, but he has refused to sell, and has filed his application for a patent, it is declared.

From the November Bulletin of the New York Edison Company these interesting announcements are taken:

The Milan papers announce that the New York Edison Company has been awarded a gold medal in connection with the Milan International Exposition. The exhibit consisted of illustrations of several of the company's stations and sub-stations, various works of engineering, building, and street illumination of New York city, welfare work, and bound copies of the Bulletin.

During the month of September 2,757 customers, requiring 226,941 equivalents, were contracted with for Edison service. These contracts include 5,232 horsepower in electric motors. Likewise in September no less than 40 separate pieces of electric heating and cooking apparatus were connected with the mains of the New York Edison Company. They include electric irons, stoves, plate-warmers, radiators, coffee percolators, chafing dishes, grid-irons, glue-pots, cereal cookers, foot-warmers and egg boilers. Two electric clothes-drying closets are now in course of installation, and it is expected they will be in service during the month of November. C. I. C.

Southeastern States.

Charlotte, N. C., November 10.—A three-year franchise has been granted to L. C. Wagner and associates at Statesville, N. C., to build a street railway.

The directors of the Blacksburg (Va.) Power and Supply Company have placed the order for their machinery installation with the Weber Gas

Engine Company of Kansas City, the work to be commenced at once. The company will furnish electric lights to the town by January, 1907, and will further engage in other lines, including the manufacture of ice.

The growth of transportation lines of all sorts in Virginia for the last 12 months is shown by the taxes on railroads and electric lines which increased from $652,695 a year ago to $732,469 the present year. Valuations are assessed by a commission.

The annual meeting of the stockholders of the Roanoke Rapids Power Company was held this month at Roanoke Rapids, N. C., and the condition of the company's interests was shown to be excellent. W. M. Habliston of Richmond, Va., was elected president and Winthrop Chauber treasurer. The directors at their meeting ordered the building of a dam across the river and the installation of a hydro-electric plant to develop 10,000 horsepower to be completed in the next half year. The power company will also furnish power for a new $500,000 cotton mill that will be built just as soon as the electric power is ready for distribution.

Ground has been broken for a new trolley system at St. Augustine, Fla., to girdle the old city and extend to South Beach, the trolley company having recently bought the South Beach Railway plant.

The Town Council of Argenta, Ala., has granted a franchise to the Argenta Light and Power Company. The company will furnish the town lights, not less than 60, at $10 per month. The franchise is for 35 years.

The Little River Power Company filed articles of incorporation at Gadsden, Ala., on November 6th, the stockholders being R. A. Mitchell of Alabama City, O. R. Goldman of Gadsden, and others. The paid-in capital is $100,000. Electric power will be developed on Little River at Blach, Ala., for lighting, heating and motive power purposes. The capital stock may be increased as the directors see fit. L.

Ohio.

Cleveland, November 10.—The hearing of the injunction case of the Cleveland Electric against the Forest City Railway Company relative to the use of East Ninth Street and Central and Quincy avenues has been postponed until Monday. Negotiations have been begun between the two companies regarding certain agreements that shall hold good in case a referendum vote is held, but they seem far apart as yet. There has been heavy buying in Cleveland Electric securities of late, and it is said that business men generally believe that the company has a good chance of winning its suit in the Supreme Court. Six new cars will shortly be in operation on the lines of the Forest City Railway Company. It is said that the receipts of the two cars now in operation are increasing daily.

Quo warranto proceedings have been filed in the Circuit Court at Dayton against the Dayton Citizens' Lighting Company to test the legality of its charter. It is claimed that the company was chartered to do two kinds of business, electric lighting and steam heating. Claims have been made that a company cannot be granted this privilege, and a test case will be made of this. Should the company be defeated the decision will affect many companies in the state.

At the instance of the village council of Plymouth an injunction has been secured against the Sandusky, Norwalk and Mansfield to prevent it operating cars on the streets and to compel it to tear up the tracks already laid and put the streets in their original condition. As a result the company has stopped work on the line between that point and Shelby. This line would connect the roads of the northern and central portions of the state. As the injunction was granted in Richland County, only the southern portion of the town is affected, but the company has now refused to allow its cars to enter the northern section, and passengers are compelled to walk a mile to get to the business houses.

The Eastern Ohio Traction Company and the village of Cleveland Heights have reached an agreement as to the location of the tracks on Mayfield Road and the cost of making improvements, and the receiver has asked the court to be allowed to incur the expense of moving them.

Mayor Robb of Lima has vetoed the ordinance giving the Indiana, Columbus and Eastern a franchise on Bellefontaine Avenue for the entrance of the Bellefontaine-Lima line, now under construction. The Council has also been enjoined from further action on the ground that it had acted illegally.

The first rails on the Youngstown and Ohio River road were laid a few days ago near West Point.

An ordinance giving the Mahoning and Shenango Railway and Light Company an extension of franchises in Youngstown was read at the last meeting of Council. It provides for an extension to 1931 and a new 10-year contract for electric lights. In return the company proposes to give 25 tickets for $1 or six for a quarter, with universal transfers.

The Citizens' Electric Light Company of West Manchester has been incorporated with a capital stock of $25,000 by John E. Leas, Bruce Rollman and others. O. M. C.

Michigan.

Grand Rapids, November 10.—Ten years ago there was scarcely an electric interurban railroad in Michigan. To-day, according to a statement made by Railroad Commissioner Atwood, there are 819 miles in operation. The Detroit United leads with 279 miles, and the Michigan United, with lines out of Lansing, Kalamazoo, Battle Creek and Jackson, comprise 151 miles. There are 83 miles of electric road around Grand Rapids, 87 in the Detroit, Ypsilanti and Ann Arbor line and 56 in the Detroit, Monroe and Toledo system.

The latest project which seems to have fallen by the wayside, or is at least delayed for a time, is the proposed line of the Northern Michigan Traction railway which was reported but a week ago to be making surveys for a line 225 miles in length from Manistee to Cheboygan. F. O. Olson was the promoter of the line and began operations at Traverse City setting surveyors of the Riggs-Sherman Company of Toledo and from Traverse City at work. He said that he had plenty of Cleveland capital back of the project. Last Saturday the Riggs-Sherman Company withdrew its men and paid them off.

Among the lines which stand a better show of being built is the extension of the McMichael road from Benton Harbor to Paw Paw Lake by way of Coloma. Surveyors are at work under the direction of General Manager Mason of the Benton Harbor lines. The line along the river to Eau Claire will be completed by the first of December, it is said.

The Grand Rapids Electric Railway Company, which has surveyed a line from Grand Rapids to Greenville, Mt. Pleasant and Alpena, passing through Six Lakes, Langston and Entrican in Montcalm County, has filed a trust deed to the Cleveland Trust Company for money for construction purposes.

The Washtenaw Light and Power Company has secured the water rights of the Ypsilanti Paper Company at Lowell and will put in a lighting and power plant. The machinery has been ordered. The Washtenaw company has secured a franchise for lighting the village of Saline.

Charles H. Baird, with Holly men, has secured an option from the banks which recently took over the plant of the Holly Milling Company and the electric-light plant on a mortgage. It is proposed to put the entire plant in operation as soon as a franchise is secured from the village. A 10-year contract to provide street lights at $60 per year and commercial lighting at 12 cents per kilowatt is asked. B.

Indiana.

Indianapolis, November 10.—Improvements that have been going on all summer on the Indianapolis and Martinsville traction line are now completed and new cars have been put in service, making this road as good as any in Indiana.

Work on the Indianapolis, Crawfordsville and Western line is to be pushed to a finish regardless of the weather conditions. The work of building the power house and car barns in Crawfordsville is going on steadily and will be completed about the time the track and overhead system is completed.

Officials of the Indianapolis and Cincinnati Traction Company announce that the Greensburg extension will be completed and in operation by December 1st. The electric power at Rushville is ready to be turned on at a moment's notice. The new cars have arrived.

Pulse & Porter of Greensburg were the successful bidders and will construct the big power plant of the Indianapolis, New Castle and Toledo electric line near New Castle. The contract was let by the Allis-Chalmers Company, and the Greensburg firm expects to begin work immediately. The contract price is $40,000, exclusive of the concrete smokestack. The foundation for the building is almost completed.

The big dam across White River, near Noblesville, which was begun two years ago by the Noblesville Hydraulic Company and then stopped by injunction because of back water, will be completed and the numerous towns and cities in this territory will be furnished with electricity for light and power purposes generated by water power. This fact has been definitely settled by the incorporation during the last week of the White River Light and Power Company, with headquarters in Indianapolis. The new company, capitalized at $750,000, proposes also to operate an electric railway for a distance of two miles connecting the lake that will be formed by the backwater with Noblesville. The men connected with the enterprise include Thomas Griffin, A. D. Booth and R. H. Sharpe.

The Ft. Wayne Electric Works of Ft. Wayne has secured the contract for all the electrical apparatus for the electric light and waterworks systems at Rushville. The Hoover-Owens-Van Rensselaer Company of Dayton, Ohio, received the contract for the engine.

The Indiana Ice and Dairy Company of Anderson has been incorporated for the purpose of erecting an ice and electric plant. The company will furnish electric light and power to the southwest portion of the city.

Reeves & Co. of Columbus, Ind., are preparing to put on the market a gang plow for use with their traction engine. The special features of the new plow are a flexible frame and ability to turn in a short space. The company's factory will be enlarged and the addition used to manufacture these plows.

According to report the next Legislature will enact a stringent law regulating automobile drivers who ignore the rights of the general public. Especially are the farmers demanding that a more effective safeguard be given to them while sharing the public highways with the automobilists. S. S.

Texas.

Austin, November 7.—The survey for the proposed interurban electric railway that is to be built between Dallas and Waxahachie has been completed, and it is announced by the promoters of the project that the contract will soon be let for the construction of the line. The engineer in charge of the work is J. W. Martin.

The Stone & Webster syndicate of Boston, which owns the three electric street-railway systems in Dallas, is endeavoring to get the consent of the City Council to the merger of the properties. The separate companies are known as the Consolidated, the Metropolitan and the Rapid Transit. Guy E. Tripp is in charge of the details of the proposed merger plan. It is stated that if the consolidation is effected important improvements to the amalgamated system will be made.

Frank R. Tobin of El Paso, who has the franchise for building an electric railway between El Paso and Ysleta, over the county roads, is making good progress towards the organization of the company to carry out the project. Considerable stock has been taken by the landowners along the route of the proposed railway.

Several surveys have been made of the proposed electric railway that is to be built between Houston and Galveston by the Stone & Webster syndicate, and those who are in charge of the preliminary work are now preparing their final report to the syndicate. As soon as this report is acted upon and the route selected the contract for the construction of the line will be let. David Daly, manager of the Houston Electric Company of Houston, which is also a Stone & Webster property, is looking after certain details of the interurban project.

An electric-light plant will be installed at Moody by J. B. Earl of Waco, manager of the Brazos Valley Telephone Company. H.

Pacific Slope.

San Francisco, November 8.—The gas-lighting situation in San Francisco has improved until the supply for commercial purposes is about equal to the demand. The resumption of street lighting in the downtown burned district is progressing very slowly for want of materials for installing gas lamps. The gas mains throughout the burned district have been repaired by working large groups of men steadily digging up the shattered mains and stopping the leaks. The San Francisco Coke and Gas Company has completed one of the largest gas holders on the coast at its works on Beach Street.

The Pacific Gas and Electric Company has just completed its second 4,000,000-cubic-foot gas generator at the Martin station, six miles from San Francisco. This plant, which was built primarily to supply the three 5,000-horsepower gas engines for driving dynamos, was of great value to the company in supplying the city after the disabling of its North Beach plant by the earthquake. This illuminating gas, of high quality, will be used to run the gas engines as well as for lighting purposes. The 4,000,000-cubic-foot gas generator, which was completed at the Potrero plant a few weeks before the disaster, was fortunately not injured. An additional 4,000,000-foot gas unit will be installed there, making the combined daily capacity of the two plants at the south end of the local system 16,000,000 cubic feet per day. It is hoped that the big gas engines will be ready to operate with a full load on the dynamos within a few weeks.

The electric-lighting situation in San Francisco has been far from satisfactory for several months past. There has been a great deal of trouble on the lines, and circuits have remained open for hours in districts where there seems no excuse for such a state of things. The city has never had an adequate supply of electric light and power, but it has had much better distribution in past years. The supply of current for operating the United Railroads cars, a part of which is supplied by the Pacific Gas and Electric Company, has also been subject to interruptions, causing great inconvenience to the public.

The owners of buildings in course of construction continue to arrange to install isolated electric plants in the basements, so as to be sure of a supply of light and power. The owners of the new Halleck Building at the corner of Sansome and Sacramento streets are in the market for a

75-kilowatt direct-current generator to furnish lighting and elevator power. A dozen of such plants have been ordered installed.

The Lakeside Realty Company has been granted the right to lay tracks and run electric cars along a number of streets in the Sunset district, including Nineteenth Avenue, which was formerly reserved as a boulevard.

The San Francisco Board of Supervisors has finally passed the proposed street-car ordinance, and it is now unlawful to ride on the steps, outside the guard rails, upon the bumpers and within the gangways of cars. If enforced, this will add greatly to the comfort of passengers, as at the rush hours every portion of the cars from fender to roof has been covered with struggling passengers.

The United Railroads of San Francisco has commenced lighting Sutter Street with arc lights suspended from its trolley poles, in compliance with its agreement to supply lights when the municipality granted the corporation the privilege of using overhead construction on that street.

The Cliff House line of the United Railroads has resumed operation, after being out of business six months as a result of the earthquake. The Valencia Street line, which has been undergoing reconstruction from a cable road to an overhead-trolley line for several months, has been placed in operation.

The City Council of Pasadena has accepted the $36,000 bid of Charles C. Moore & Co. of San Francisco and Los Angeles for installing a municipal electric-lighting plant. It is understood that Babcock & Wilcox boilers and a Crocker-Wheeler generator will be included in the equipment. Bids have been asked for on the necessary poles, lamps and wires. The power station will be completed in time for the reception of the machinery.

The telephone and telegraph companies have been asked to bury their wires in the business portion of the town of Riverside, Cal., before the proposed system of ornamental-cluster street lights, similar to those in use in Los Angeles, is installed.

The Gray's Harbor Electric Company has taken a contract for furnishing street lights for the city of Aberdeen, Wash., for a period of 10 years at $6.66 per lamp a month.

The North Kittitas Rural Electric Company has applied to the commissioners of Kittitas County, Washington, for a franchise to construct and maintain a pole line for the transmission of electricity along the county roads.

It is announced that government wireless-telegraph stations will soon be erected at North Head, Wash., and at Cape Blanco. W. N. Concannon of San Francisco, who recently completed a wireless station on Tatoosh Island, has secured the contract for the new buildings. A.

PERSONAL.

J. C. Steen, recently with the General Electric Company at Lynn, Mass., has gone to the University of Wisconsin as director of its mechanical engineering shops.

Professor Andrew Fleming West of Princeton University has decided to remain there and has, therefore, declined the office of president of the Massachusetts Institute of Technology.

N. C. Kingsbury, who has been with the Jeffrey Manufacturing Company of Columbus, Ohio, for the last 10 years, recently resigned his position to become vice-president of the Michigan Telephone Company, with headquarters in Detroit.

Mr. J. W. Duntley, president of the Chicago Pneumatic Tool Company, sailed for Europe on November 6th for a five-week trip in the interest of the company's business. During this time he will visit the important trades generally in England, Scotland, France and Germany.

G. L. Hunt, local freight agent of the Indiana, Columbus and Eastern electric railway at Columbus, Ohio, has tendered his resignation. N. A. Thompson will succeed him. W. D. Harris has resigned as passenger and freight agent of the same company at Newark, Ohio.

Robert R. Choate, for nine years manager of the Muskegon (Mich.) Traction and Lighting Company's commercial department in Muskegon, has accepted a similar position with the Henry L. Doherty Company in Knoxville, Tenn. He will be succeeded by Philip Buckley, an employe of the Muskegon company.

C. M. Dombrosky, after 16 years in the service of the Cleveland Telephone Company at Cleveland, Ohio, has resigned his position to go to Rio Janeiro, where he will superintend the inside telephone construction of the local tramway, light and power company. Recently Mr. Dombrosky has been in charge of the Main, Ridge and West exchanges of the Cleveland Telephone Company.

Robert L. Warner has resigned the position of New England manager for the Westinghouse Electric and Manufacturing Company to become a member of the brokerage firm of Warner, Tucker & Co., in Boston. Mr. Warner has been connected with the Westinghouse company for 15 years. The position of New England manager of the company will be abolished, the company's interests being placed in charge of D. Edgar Manson, the manager of the Boston office, a position which he has held for the last three years.

George A. Berry, until recently engineer of company forces of the New York Central and Hudson River Railroad Company, has severed his connection with that company and has been elected vice-president and general manager of the Hicks Locomotive and Car Works of Chicago. Mr. Berry, in his new capacity, will have sole charge of the plants and business of the company, and will make his headquarters in Chicago.

John E. Sewell has resigned the position of general manager of the Connecticut Railway and Lighting Company, the resignation to take effect December 1st. He will take a rest for the benefit of his health. A report that the company was to pass under the control of the Consolidated Railway Company has been denied by the president of the railway and lighting company, Mr. A. M. Young of New York.

ELECTRIC LIGHTING.

G. C. Athey will install an electric-light plant in Wauneta, Neb.

Tracy, Minn., contemplates putting in a municipal electric-light plant.

Paul Van Ackeren has decided to install an electric-light system at Lindsay, Neb.

An electric-light and power franchise was voted at Essex, Iowa, to Oscar Nelson.

It is reported that the Wabaska electric-light plant at Wymore, Neb., will be rebuilt.

The council of Franklin, La., proposes to establish an electric-light plant. John C. Lewis is mayor.

The Richfield (Utah) Electric Light and Power Company has been incorporated with a capital stock of $50,000.

The Carsons Light and Power Company of Texarkana, Tex., has been incorporated with a capital stock of $50,000.

The Joplin Light, Power and Water Company of Joplin, Mo., has been incorporated with a capital stock of $25,000.

Fire at Kenmare, N. D., destroyed the power station of the Kenmare Light and Power Company. The loss is $10,000.

The Chelsea Electric Light and Ice Company has been organized and will install an electric-light plant in Chelsea, I. T.

Wymore, Neb., has granted an electric-light franchise to H. T. Clarke, Jr., of Omaha, Neb. Mr. Clarke will install a plant.

The Council of Marble Rock, Iowa, has granted a franchise to Fred W. Smith of that place for the establishment of an electric-light plant.

George W. Burkitt and William Broyles will establish an electric-light plant in Palestine, Texas, to be equipped with all the latest machinery.

Reynolds & Tucker of Tulsa, Okla., have been granted a franchise to operate an electric-light plant in that city. It is proposed to expend $20,000 for the purpose.

The City Council of Vicksburg, Miss., has granted a franchise to Harry K. Johnson for the construction and operation of an electric-light plant, to cost $250,000.

The Citizens' Light and Power Company of Wichita Falls, Tex., has incorporated with a capital stock of $10,000, by R. P. Walsh, A. Kahn and J. D. Davis, all of this place.

The City Council of St. Paul, Minn., has decided to appoint an independent investigation into the subject of maximum lighting and power rates and has made a large appropriation for the purpose.

The Citizens' Light and Power Company of Texarkana, Ark., has been incorporated by C. C. Taylor, R. W. Rodgers, Claude L. Shepherd, all of Texarkana, and others, with a capital stock of $50,000.

The Perkins (Okla.) Electric Light and Power Company has been incorporated with a capital stock of 5,000, to establish an electric-light and power plant. Incorporators are J. A. Hert, John Wagner, J. M. Boone and others of Perkins.

W. A. Scott, Jr., and John S. Henson are at the head of the Thomasville Manufacturing, Electric Light and Power Company, which has been incorporated with a capital stock of $11,000 for the purpose of establishing an electric-light plant in Thomasville, Ala.

Bids will be received until November 23d by the commissioners of Indian affairs for furnishing material and constructing an electric-light plant at the Green Bay, Wis., school. Shephard Freeman, superintendent, Keshena, Wis., and C. F. Larrabee, acting commissioner, Washington, D. C., may be addressed.

ELECTRIC RAILWAYS.

The Akron and Youngstown City Railway Company has purchased a site of five acres in Diamond Ohio, for the erection of a power house.

F. M. Mills and associates have asked for a street-railway franchise at Sioux Falls, S. D., and agree to have five miles completed by July 1, 1908.

It is thought that an effort will be made to secure a right-of-way through Kenosha for the extension of the Milwaukee, Racine and Kenosha electric railway.

The Greenville, Leland and Rolling Forks Railway Company, W. R. Barkesdale of Memphis, Tenn., president, will build an electric railway from Greenville, Miss., to Leland and Rolling Forks, 61 miles.

The Omaha and Council Bluffs Street Railway Company is considering plans for new buildings and a new power plant which will be required for the increasing business of the company. The new plant, with sub-stations, will cost about $250,000.

The Champaign and Kankakee Electric Railroad Company has been incorporated to build a line to extend from Champaign, Ill., to Chicago Heights. Capital stock, $100,000. E. D. Risser and R. A. McCracken of Paxton, and others, incorporators.

The daily average traffic of the Chicago and Oak Park Elevated, with transfers, for the month of October was 49,759 passengers, an increase of 622, or 1.27 per cent., compared with October a year ago. Without transfers the average was 47,958, a gain of 689, or 1.46 per cent.

The Sioux Falls (S. D.) and Sioux City Electric Railway Company has been incorporated with a capital stock of $1,000,000 for the purpose of building an electric railway through the counties of Minnehaha, Lincoln, Clay and Union. O. N. Smith, Charles Fantle, Fred C. Whitehouse and others are the incorporators.

The North Shore and Western Electric Railway Company of Elgin, Ill., has been incorporated, with a capital stock of $50,000, for the purpose of building an electric railway between Elgin and Evanston. Incorporators are William C. McHenry, William A. Love, Ernest R. Fifer of Chicago and Harry P. Parsons of Evanston.

H. D. Smith of Appleton was elected president of the Wisconsin Electric and Interurban Railway Association at Milwaukee on November 5th. The vice-presidents are Thomas Higgins of Manitowoc, F. W. Montgomery of Madison and H. Warren of Superior. C. C. Smith of the Columbia Construction Company, Milwaukee, is secretary-treasurer.

Henry A. Everett and his associates have perfected a consolidation of the Toledo-Point Place Railway Company and the Ottawa Beach and Southern Railway Company with a capitalization of $15,000,000, under the name of the Toledo, Ottawa and Northern Railway Company. Articles of incorporation have been filed with the Michigan secretary of state.

The contract for the erection of five sub-stations for the Buffalo, Lockport and Rochester electric railroad has been let for stations at Brockport, South Greece, Albion, Medina and Gasport, N. Y. All must be completed before January 1st. Power will be supplied by the Niagara Falls Electrical Transmission Company. The building and equipment of each station will cost $14,500.

A new traction syndicate has been formed in Sharon, Pa., which purposes to build a long-distance fast-service line from Pittsburg down the Ohio River, one branch going up the Beaver Valley to Newcastle, a distance of 52 miles, and the other down the river to the new steel town of Midland. It will connect at Newcastle with the Sharon and Newcastle trolley and will form a part of a Cleveland-Pittsburg system. Grading for the Sharon-Cleveland line is under way and the building of the road will be started early next spring. The entire line will be 150 miles.

An agreement is said to have been reached between the Oerlikon and the Siemens-Schuckert works to commence immediately the plant for the electrification of the whole length of the St. Gothard railway. The section from Zurich to Lucerne is to be constructed first as an experiment. This first section is the only one at present approved of by the Federal Railway Department, but it is stated that a syndicate has offered to convert at its own cost the whole part of the line which is situated in Switzerland by 1909, and to transfer it to the Swiss government on terms yet to be agreed upon.

Near Louisville, Ky., a few days ago, 100 workmen were engaged in an attempt to lay the tracks of an electric railway across those of a steam road. The steam-road officials objected to the electric road crossing its tracks. However, the job was nearly completed when the steam-railroad men learned what was going on and they quickly sent 300 laborers to stop the electric fellows and tear up the tracks. A fight ensued, which was expected, and, knowing they would be outnumbered in case of trouble, the electric-road gang

had made preparations to charge the rails from the trolley wire, which was done. After 40 of the intruders were severely shocked the other 260 kept away, and thus electricity triumphed.

The Montgomery Traction Company of Christiansburg, Va., has incorporated with a capital of $10,000, for the purpose of building a line 2¼ miles long from Christiansburg to Cambria, Va. C. A. Johnston is president and M. H. Tompkins secretary.

POWER TRANSMISSION.

The Big Bend Water Power Company of Spokane, Wash., of which E. P. Spalding is manager, will shortly let the contract for the erection of a large power plant.

The Rapid River Light, Power and Transit Company will make a final survey at once for its proposed power plant near Rapid City, S. D. It is proposed to develop about 3,000 horsepower.

The Kettle Falls Power and Irrigation Company of Spokane, Wash., has been incorporated with a capital stock of $500,000. The company has purchased from J. W. Reynolds a power plant on the Colville River, near Kettle Falls, Wash., also a grist and lumber mill. These mills will be enlarged and an electric-light plant put in. This plant is to furnish towns in that vicinity with electric lights and to supply the mines with power. H. J. Cole, Charles V. Roberts and others of Spokane, Wash., are incorporators.

The Canadian Engineer says: The report of the engineer in charge of the Georgian Bay Canal survey will show the feasibility of a hydro-electric development of 1,250,000 horsepower along the route. It is now claimed that an expenditure of $100,000,000 would be justified by the increased facilities afforded transportation of the products of the West to the seaboard by this great waterway, and if so great an electric development can be realized, there would be a greater incentive to construct the works as a national undertaking.

PUBLICATIONS.

Queen & Co., Philadelphia, Pa., are distributing a neat little catalogue of their different types of testing sets, galvanometers, portable testing batteries, etc. The book contains illustrations of the different apparatus listed.

The Manhattan Electrical Supply Company, 17 Park Place and 14 Murray Street, New York, and 188 Fifth Avenue, Chicago, issues several leaflets describing some of its specialties, such as bells, dry batteries, telegraph outfits, time switches, etc.

A neat booklet has been sent out by the Fostoria Glass Specialty Company, Fostoria, Ohio, in which the advantages of the Noblac inner globe are set forth. These globes are made in many sizes and shapes, as shown by the illustrations in the booklet.

The De La Vergne Machine Company, foot of East One Hundred and Thirty-eighth Street, New York city, has just issued a circular describing its Klein water-cooling tower. These towers will cool the water to from five to 15 degrees below the temperature of the atmosphere.

The Westinghouse Electric and Manufacturing Company, Pittsburg, Pa., has issued circular No. 1139, describing starting and field rheostats. The circular contains detailed description and illustrations of the various parts of its standard rheostats and describes the methods of mounting the complete devices on the switchboard. A list of circulars in force on September 1, 1906, is given in the last pages.

Circular No. 798, issued by the Stanley-G. I. Electric Manufacturing Company, Pittsfield, Mass., discusses the advantages of Stanley-G. I. alternating-current motors for driving laundry machinery. An illustration is given of a laundry extractor driven by the company's two-horsepower alternating-current motor. The G. I. flush receptacle and attaching plug is listed and illustrated in Bulletin No. 615, issued for September, 1906, by the Stanley-G. I. Company.

SOCIETIES AND SCHOOLS.

The annual dinner of the Electrical Trades Association of Chicago was announced for Friday evening of this week in the breakfast room of the Grand Pacific Hotel. Mr. Frederic P. Vose, Marquette Building, is secretary of the association.

The Railway Signal Association has published in two volumes a "Digest of Proceedings" of the association from 1895 to 1905, inclusive. The books are attractively bound in green cloth and the contents is of such a nature and so arranged as to form a convenient railway-signal reference book. Papers, reports and discussions of the Railway Signal Club and the Railway Signal Association have been grouped for ready reference. For the purpose of record a brief outline of the origin and purpose of the association is given, together with a list of officers and members. The papers cover all branches of railway signaling and contain much valuable information. H. S. Balliet, engineer maintenance of way and connected with the electrical division of the New York Central and Hudson River Railroad, Grand Central Station, New York city, is secretary-treasurer of the association.

AUTOMOBILES.

Consul Albert Halstead of Birmingham, England, says that it is reported that the British Postoffice Department proposes to use motor mail wagons where at present horse mail wagons are used, and that it is so well satisfied with experiments made with motor mail wagons as to intend to introduce them on all the long-distance horse-coach routes, and later to carry not a little of the mail now dispatched by train. This proposed larger use of motors for mail purposes, taken in connection with the experiment that is now being made in North Staffordshire to carry pottery to Liverpool and grain from Liverpool by large motor freight wagons, is one of the significant developments of the use of automobiles in the United Kingdom.

MISCELLANEOUS.

The new Gamewell police-alarm system in Memphis, Tenn., has been placed in commission and is highly satisfactory. Forty-four boxes are placed about the city. Besides the patrolmen some of the responsible citizens will carry keys and have the right to turn in fire alarms and police calls. The patrol-wagon stations are connected with the alarm boxes also by telephone.

A new naval-auxiliary vessel of 11,000 tons, with a length of 450 feet, has been built to accompany a squadron of British warships as a floating machine shop. It contains an electric generating plant of large size, and all of the machines and cranes are to be worked by electric motors. It will carry a crew of about 300 men, mostly artificers, and is provided with space-telegraph apparatus.

A United States patent, No. 834,476, for an elastic-fluid turbine nas been granted to Oscar Junggren of Schenectady, N. Y., who has assigned it to the General Electric Company. Mr. Junggren calls the machine a multistage turbine. Within the casing are rows of wheel buckets mounted on a shaft, and inlet nozzles, in combination with wheel webs for carrying the buckets. Means are provided for dividing the casing into compartments or stages in such manner that a high-pressure compartment or stage contains more rows of wheel buckets than does a low-pressure compartment or stage. There are intermediate buckets for the high-pressure stage only, and nozzles for discharging fluid under a predetermined condition as to pressure and velocity against the wheel buckets.

TRADE NEWS.

The Chicago Mica Company of Valparaiso, Ind., of which E. H. Heilstedt is secretary, intends to build a factory in Canada for the manufacture of mica. The location has not been finally decided upon, but plans are in process which show that almost as large a plant will be erected in Canada as is now located in Valparaiso. When the Canadian plant is completed, it is the intention of the company to manufacture, in addition to mica, oilcloths, varnish and tapes. An interesting feature will be that the plant is designed to be absolutely fireproof, and its construction is to be almost entirely of steel and cement.

Among recent shipments by the International Telephone Manufacturing Company, Chicago, were orders of apparatus for the public-service system of the municipality of Neepawa, Man.; the St. Catharine and St. Basile telephone companies of St. Catharine and St. Basile, Que.; the Compania Telefonica Do Estado De Sao Paulo, Sao Paulo, Brazil; Rosalia Telephone Company, Rosalia, Mexico, and the telephone company in Athens, Greece. This company also has practically ready for shipment a 4,800-line capacity, 1,200 installed, central-energy lamp-signal multiple switchboard equipment, with additional telephones, for the municipal public-service system at Port Arthur, Ont., and a similar equipment for Fort William, Ont., and a 500-line equipment for West Fort, Ont.

Mr. W. W. Merrill, secretary of the Chicago Fuse Wire and Manufacturing Company, announces that Mr. G. A. Knoche will represent that company as agent in the southwestern states. Mr. Knoche was with the Wesco Supply Company for a number of years in the capacity of purchasing agent. His headquarters are at 539 Frisco Building, St. Louis, where he conducts his business under the name of the Mutual Sales Company. His intimate knowledge of the requirements of the electrical trade will unquestionably result in increasing the sales of the well-known products of the Chicago Fuse Wire and Manufacturing Company, particularly "Union" enclosed fuses and blocks, which are approved by the Underwriters' National Electric Association; also, by the Factory Mutual Laboratory of Boston, "Union" switch outlet boxes, conduit boxes and covers, fuse wire and fuse links.

BUSINESS.

M. W. Dunton & Co. of Providence, R. I., announce that they are making a "special drive" on their regular cotton sleevings for electrical purposes, and have made a reduction in price, in spite of a stiff cotton market.

Harvey Hubbell (Inc.) of Bridgeport, Conn., is sending to the trade a new catalogue in which attention is directed to the many new specialties shown therein, original in design, practical and said to be unequaled in their class. The high reputation and A1 quality that have characterized the Hubbell lines in the past will, it is promised, be maintained in the future.

Eighty-five per cent. of the floor space in the main building of the Coliseum is already sold for the Chicago electrical show in January. Managing Director Niesz is just now giving much of his attention to the matter of reduced railway rates from points in the Middle West, and for this purpose it is probable that the contemplated organization of the Allied Electrical Trades Association will be revived.

The Central Electric Company of Chicago is sending to the trade circulars descriptive of its Duplex lamp guard. One of the features of the Duplex is that it does not require removal from socket to insert or withdraw the lamp. It is strongly made of carefully tinned wire, and the attachments are made of clamping springs which effectually prevent guard slipping from the socket or opening and exposing lamp to injury. This guard will inclose either a 16 or 32-candlepower incandescent lamp.

ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued (United States Patent Office) November 6, 1906.

834,899. Dental Handpiece. Wallace W. Freeman, Norfolk, Va. Application filed August 22, 1905.

An electric motor drives a shaft which has an armature on it, the shaft passing through the hand piece. A shell with a number of exterior pockets covers the motor and has a number of removable field coils and a notched V-shaped ring core or pole piece for each coil. The cores form a part of a ring. A resistance coil is placed in each shell and means carried by the hand piece are provided for controlling the resistance.

834,912. Electric Igniter. Joseph N. Kelly, Dayton, Ohio, assignor of one-half to G. H. Geiger, Dayton, Ohio. Application filed October 29, 1903.

A rotary member forms one terminal of a circuit. There is a stationary terminal and a member between the terminals and normally independent of the circuit. The rotary member has a cam-face which engages the member to force it into contact with the stationary terminal and complete the circuit.

834,948. Electrical Furnace. Frank J. Tone, Niagara Falls, N. Y. Application filed September 14, 1905. Renewed April 6, 1906.

An electric furnace has a side wall or walls of refractory material held together so as to be movable away from the charge; a refractory base; electrodes and interposed conducting material adapted to remain unfused at the working temperature of the furnace, the base being provided with a space for a cooling medium sufficient to prevent substantial diversion of the current through the base.

834,952. Thermostatic Circuit-closer. Charles L. Walker, Harrow, England. Application filed March 25, 1904.

The circuit is made or broken by the movement of a thermometric liquid when it is actuated by a sudden rise in temperature.

834,953. Rheostat. Orville T. Weiser, Philadelphia, Pa., assignor to Siegmund Lubin, Philadelphia, Pa. Application filed February 7, 1906.

Conducting members connecting resistance coils in series are supported by and insulated from a frame. The frame has a ventilating fireproof cover through which terminal plugs are adapted to pass into sockets of certain of the conducting members.

834,989. Electric Fuse. John J. Miley, Boston, Mass. Application filed March 5, 1906.

It is adapted to be connected with the more or less widely separated terminals of different fuse-blocks, having terminal plates, one of which has a longitudinally-slotted portion corresponding in length to the difference between the closely disposed and the widely separated terminals of the different fuse-blocks.

834,990. Incandescent Electric Lamp. George P. McDonnell, St. Louis, Mo., assignor to the American Electric Company, East Orange, N. J. Application filed September 1, 1905.

The extremities of the carbon filament are embedded in a glass mount. Inlead wires sealed in the glass connect to the filament some distance from the ends of the filament.

834,995. Electric Clock. Arthur F. Poole, Wheeling, W. Va. Application filed December 6, 1900.

A master-clock has an equalizing mechanism. There

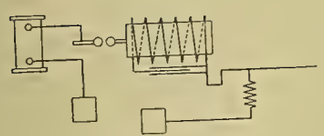
is mechanism operated by the motive power actuating secondary clocks, and arranged to operate the equalizing mechanism of the master-clock in one direction. A clock mechanism is arranged to actuate the equalizing mechanism in the opposite direction and to return the equalizing mechanism to its normal position once in twelve hours, or a multiple thereof.

834,998. Electric Wave-form Tracer. Harris J. Ryan, Ithaca, N. Y. Application filed July 3, 1905.

In combination with a vacuum tube and means for producing a pencil of rays therein, there is a fixed screen which intercepts the pencil of rays, thereby causing a luminous spot to appear upon the screen; and electro-magnetic means are provided for moving the pencil of rays to cause the spot of light to trace a curve upon the screen.

835,003. Electric Terminal Fixture. Arvid H. Svensson, Buffalo, N. Y. Application filed January 8, 1906.

The terminal fixture has a screw threaded opening into which is screwed a compressible insulating-cord containing a number of conducting-wires. The threads of the opening confine the cord against longitudinal displacement and fastenings are provided for securing the ends of the conducting-wires in place in the fixture, whereby the cord is prevented from unscrewing.



NO. 835,023.—TRANSFORMER.

835,006. Means for Operating the Switches, Frogs and Signals of Electric Tramways. Leonard Atkinson, Christchurch, New Zealand. Application filed April 18, 1906.

The signals, switches and frogs are operated simultaneously by means of a mechanical device.

835,013. Telegraphic Tape Perforator. Patrick B. Delany, South Orange, N. J., assignor to the Telepost Company of South Dakota. Application filed November 1, 1904.

A polarized relay and two magnets are so connected that the magnets are controlled by the armature of the relay and the relay is controlled by the armatures of the magnets. The relay is also controlled by an independently operated key.

835,023. Transformer. Hermann Heinicke, Steglitz, near Berlin, Germany. Application filed January 17, 1905.

A transformer for high-tension electric currents for the production of electric waves for wireless telegraphy, therapeutic and other purposes comprises an insulated metallic core, a coil wound round the latter and sliding on it in axial direction, and a condenser connected directly with the ends of the coil. (See cut.)

835,025. Circuit Protective Device. Dugald C. Jackson, Madison, Wis. Application filed September 24, 1904.

A resistance placed in a circuit is normally short circuited by a knife switch. A solenoid connected in series with the circuit attracts an armature which is attached to the knife switch by a slotted link which allows it to exert a pull on the switch only after an interval. The pull opens the switch and cuts the resistance into the circuit.

835,037. Telephone Repeater ircuit and Apparatus. Herbert E. Shreeve, Newton, Mass., assignor to the American Telephone and Telegraph Company, Boston, Mass. Application filed January 24, 1906.

A transmitting induction coil is placed at the juncture of telephonic current-transmitting circuit-sections. A relay or reinforcing apparatus is associated with the induction coil and means independent of the induction coil are provided for adjusting the relative resistance and capacity of the circuit sections.

835,039. Adjustable Switch Box. Silas D. Slocum, Alexandria, Va., assignor to Leon W. Bossert, Utica, N. Y. Application filed September 18, 1905.

An adjusting mechanism for switch and outlet boxes comprises, in combination with a box having apertured lugs therein, bracket members adapted to be fixed to a wall and having sliding connection with the box and clamping-screws mounted in slots in the box and adapted to hold the latter in adjusted positions in relation to the bracket members.

835,046. Telephone System. Alfred Stromberg, Chicago, Ill., assignor to the Stromberg-Carlson Telephone Manufacturing Company, Rochester, N. Y. Application filed November 24, 1902.

A central-energy system with line and cut-off relays and supervisory signal. A circuit in shunt of line relay is provided by the cord-connecting apparatus and this circuit controls the supervisory signal. (See cut.)

835,047. Telephone-exchange System. Harry G. Webster, Chicago, Ill., assignor to the Stromberg-Carlson Telephone Manufacturing Company, Rochester, N. Y. Application filed May 7, 1903.

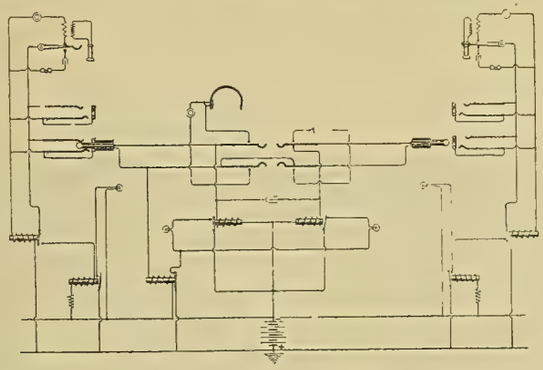
A feature of this telephone system is a double wound cut-off relay one winding of which has a normally closed low resistance path in shunt with it and the other winding connected with the cord circuit so that the connection of the cord circuit with the line destroys the sub-station control of the line signal.

835,074. Controlling Means for Electric Circuits. Julius K. Lux, St. Louis, Mo. Application filed October 11, 1904.

A rotary lamp switch has a rotary contact. A handle operating this contact is normally movable in one direction without operating the contact. Means are provided for indicating the position of the movable contact and there is a ratchet connection for positioning the indicating means relatively to the movable contact.

835,082. Self Electric Massage Apparatus. Sven R. E. Schmidt, St. George, N. Y., assignor to John O. Peterson, Brooklyn, N. Y. Application filed February 8, 1905.

Hollow fluted massage rollers are mounted on a handle in parallel relation to each other and at a distance apart. They are electrically insulated from each other and are charged with a filling fluid substance. There is an absorbent covering on the rollers and electrial applianees for transmitting current to portions of the body of the patient when closing the gap between the rollers.



NO. 835,046.—TELEPHONE SYSTEM.

835,097. Torpedo-setting Mechanism. Chester L. Chamberlain, Los Angeles, Cal. Application filed April 19, 1906.

An electromagnet controls the movements of a magazine to delivery position. The electromagnet is connected to a main-line circuit. A second electromagnet controls a torpedo-delivery means and is connected to a train-closed local circuit.

835,103. Device for Reversing and Automatically Blocking Trains on Electro-dynamic Traction Railways. Julien Dulait and Leon Rosenfeld, Charleroi, Belgium. Application filed February 8, 1905.

A switch on the train controls a motor which operates a single reversing switch placed in each section of a railroad track.

835,113. Insulating Compound. Samuel G. Penney, Allegheny, Pa. Application filed June 19, 1906.

This is composed of maltha twenty per cent., byerite thirty per cent., benzine twelve per cent., and carbon tetrachloride thirty-eight per cent.

835,119. Telephone Attachment. Bradley L. Stone and George M. Dressel, Belpre, Ohio. Application filed March 12, 1906.

A drop slidaby mounted in a casing is provided with a laterally extending pin. A vibrating lever is pivotally mounted on the casing and has one end bifurcated and its opposite end formed with a cam-face defining a number of locking-recesses for the reception of the pin. The drop is positively moved to operative position when the lever is vibrated.

835,138. Automatic-lighting Burner. Howard Lyon, Oneonta, N. Y. Application filed May 2, 1905.

An insulating sleeve surrounds a pilot burner and an incandescent filament is in metallic connection with the sleeve and the burner.

835,142. Insulating Composition. Wilson H. Strickler, Columbus, Ohio. Application filed February 16, 1906.

The insulation is composed of a coating of silicate of soda, created a double silicate by the addition and incorporation of a solution of lime, to which is added by incorporation a solution of soap, pulverized asbestos and mica.

835,158. Terminal Tip for Electric Conducting Wires. Gustave L. Herz, New York, N. Y. Application filed August 15, 1904.

Two end plates are riveted together to form a spool around which the wire may be wound and a shank is formed integral with one of the end plates to which the wire may be secured, the shank having a hole in it through which the end of the wire may be passed to more securely lock the wire in position.

835,181. Telephone. Robert A. Davidson, Santa Cruz, Cal. Application filed May 14, 1906.

It has a normally open talking-circuit, a receiver-hook to automatically close the circuit when the receiver is removed, and means independent of the hook and operated from the central office for opening the circuit, the hook controlling the circuit-opening means to restore the sytem to normal.

835,183. Electric Bell. Harold W. Eden, Detroit, Mich., assignor to the P. R. Manufacturing Company, Detroit, Mich. Application filed December 26, 1905.

There is a gong and an electromagnet, a vibratory armature, an independently pivoted hammer and a connection between the armature and hammer adjacent to the pivot of the hammer whereby a compound lever of the third class is formed which is actuated by the magnet in a direction to strike the gong.

835,199. Electric Bell. Charles M. Proctor, Detroit, Mich., assignor to the P. R. Manufacturing Company, Detroit, Mich. Application filed December 26, 1905.

The contact for the circuit breaker is secured in an insulator clamped in the channels of a bifurcated post which is in metallic connection with the base-plate.

835,211. Coupling Device. Charles E. Atkinson, Richmond, Ind., assignor of one-third to John M. Lontz, and one-third to Alexander Gordon, Richmond, Ind. Application filed October 20, 1905.

In the coupling of wires, particularly for electric circuits, two wedge-shaped members have at the larger end of each a wire socket and engaging longitudinal dove-tailed parts, which parts are wider at one end than at the other, whereby increased strain on the wires increases the force of engagement between the parts.

835,227. Dynamo-electric Machine. Robert Pohl, Bradford, England, and Felix Pohl, Cologne, Germany, assignors of one-half to the Phœnix Dynamo Manufacturing Company, Bradford, England. Application filed January 28, 1905.

There is an armature, field-poles and yoke. Intermediate pole pieces are placed between the main field poles and have their effective faces so shaped as to increase in breadth toward the main poles whose polarity is contrary to that of the respective intermediate poles.

835,229. Plate for Secondary Batteries. James H. Robertson, New York, N. Y., assignor to William D. Elger, Brooklyn, N. Y. Application filed February 1, 1904. Renewed March 3, 1905.

Formed in each side of the plate are registering and oppositely communicating recesses, each being formed in the arc of a circle, whereby finely tapering parts are formed between the ends of the recesses and at each side of a central aperture, the bottom surface of each recess being longitudinally grooved.

835,258. Plug Socket for Electric Lamps, etc. Frank J. Russell, New York, N. Y. Application filed February 23, 1906.

A shell terminal is formed with an inturned flange. There is a supporting base of insulating material. A washer of insulating material bears on the inturned flange of the shell terminal and interlocks with the base and shell terminal. A central screw extends through and locks the parts rigidly together.

835,268. Distributing Board. Charles E. White, Chicago, Ill., assignor to Frank B. Cook, Chicago, Ill. Application filed March 24, 1906.

The line side and switchboard side of a telephone exchange distributing board extend in the same direction and lie in planes at an angle to each other. The board has wire-guiding means on it.

835,269. Selective System. William R. Whitehorne, Bethlehem, Pa., assignor of one-half to Barry MacNutt, Bethlehem, Pa. Application filed March 15, 1906.

A number of telephone instruments are connected on the same line each instrument having an electromagnetic signaling device provided with a plurality of paths for the magnetic flux, and having an operating member included in but one of the paths. Means are provided for causing at will the operation of the member on any one of the instruments without operating the members of the other instruments.

835,278. Handle for Electric Snap Switches. Gilbert W. Goodridge, Bridgeport, Conn., assignor to the Perkins Electric Switch Manufacturing Company, Bridgeport, Conn. Application filed November 21, 1905.

The insulating body of a switch handle has a threaded plunger and spring in it and has a bottom projection with shoulders. A retaining cup is fitted over the projection and flanged over its shoulders.

835,279. Telegraph Pole. Broderick Haskell, Franklin, Pa. Application filed May 7, 1906.

A number of uprights of U-shape in cross section are held together by clips.

835,280. Pole for Telegraphs, etc. Broderick Haskell, Franklin, Pa. Application filed May 7, 1906.

This is similar to the preceding patent and consists of three U-shaped uprights held rigidly together.

835,281. Telegraph Pole. Broderick Haskell, Franklin, Pa. Application filed May 31, 1906.

Similar to the two foregoing and defines means of fastening a number of uprights together to form one piece.

835,282. Incandescent-lamp Cluster. Harvey Hubbell, Bridgeport, Conn. Application filed October 15, 1904.

An insulating casing is adapted to hold a body carrying contacts, and in connection with a shade holder it is adapted to carry a shade which is removable over the body. The casing is provided with slots through which contact plates may be passed to engage the contacts on the body.

835,292. Toll Collector. Harold D. Stroud, Chicago, Ill., assignor to the Stroud International Measured Service Company, St. Louis, Mo. Application filed February 8, 1904.

This invention relates to pre-payment telephone service. The coin chute has branch ducts, and a tilting platform is located at their junction and adapted to support a coin or toll piece in such a position that it will be struck by another passing down the chute and directed into one branch duct. Means are provided for tilting the platform to pass the coin into the other duct.

835,321. Electric Meter. William H. Pratt, Lynn, Mass., assignor to the General Electric Company, Schenectady, N. Y. Application filed April 20, 1904.

A magnetic core comprising three parallel members joined at one end has a potential-coil mounted on the central member. A rotatable disk is mounted opposite the central member and a second core extends into close proximity to the members and forms therewith

a nearly closed magnetic circuit for the potential-coil independent of the disk. A series winding is arranged opposite the central member on the other side of the disk.

835,322. Electric Measuring Instrument. William H. Pratt, Lynn, Mass., assignor to the General Electric Company, Schenectady, N. Y. Application filed May 24, 1904.

A frame of non-magnetic material is mounted on a base. Permanent magnets are supported by the frame and extensions on the frame form jaws against which pole pieces for the magnets are clamped in position by the action of the magnet. (See cut.)

835,327. Process of Insulating Electrical Conductors. George H. Rupley, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed January 13, 1906.

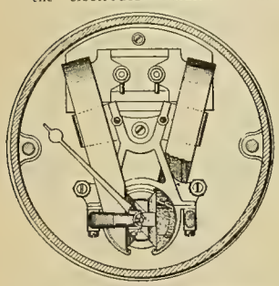
The process consists in mixing a quantity of powdered material with a vegetable oil substantially free from glycerin, applying a film of the compound to the conductor, and hardening the film by heat.

835,329. Means for Precipitating Gold and Silver. James Snodgrass, Johannesburg, Transvaal. Application filed January 3, 1906.

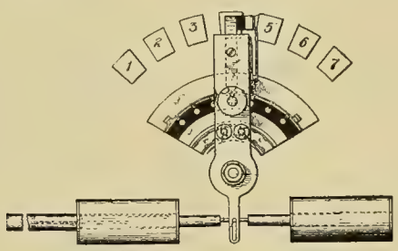
The cathode comprises a metallic frame and a fabric having a conductive coating and a metallic screen of fine mesh secured to the frame.

835,344. Current Rectifier. William S. Andrews, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed August 13, 1904.

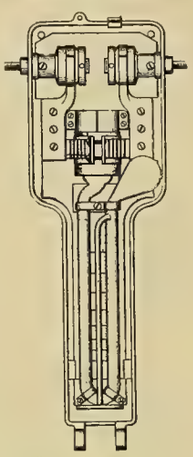
Reactance-coils are connected respectively with the three line conductors and meet at a common point. Three electrodes are connected respectively with the line conductors and an electrolyte is in contact with the electrodes. Additional electrodes are provided in the electrolyte, and there are means for connecting the additional electrodes to the common point.



NO. 835,322.—MEASURING INSTRUMENT.



NO. 835,416.—REGULATOR FOR ELECTRIC CIRCUITS.



NO. 835,484.—DEMAND INDICATOR.

835,353. Cut-out. Richard Fleming, Lynn, Mass., assignor to the General Electric Company, Schenectady, N. Y. Application filed April 30, 1903.

A pair of line-contacts are normally in engagement with a contact-strip mounted on a base, and a switch-plug having contact-plates secured to two of its faces is adapted to be inserted between the respective members of both pairs of contacts.

835,354. System of Electrical Distribution. Richard Fleming, Lynn, Mass., assignor to the General Electric Company, Schenectady, N. Y. Application filed October 13, 1905.

An alternating-current circuit has means for maintaining the constancy of the current in the circuit and has four vapor rectifiers connected in pairs across it. A work-circuit has one terminal connected between two of the rectifiers of one pair and the other terminal between the two rectifiers of the other pair. There are arc-maintaining circuits for each rectifier and means are provided for supplying all of the arc-maintaining circuits with current from the same source as that supplying the rectifiers.

835,361. Telephone Receiver. Charles T. Mason, Sumter, S. C., assignor to the Sumter Telephone Manufacturing Company, Sumter, S. C. Application filed March 7, 1906.

The pole-pieces of a magnet project through a cup placed at the front end of the magnet and have coils on them within the cup. The rim of the cup rests on the front end of a casing. A diaphragm is placed on the cup and is clamped under a perforated cap which is screwed on the rim of the cup. An earpiece is screwed into the casing over the cup and cap.

835,363. Constant-current Generator. Maurice Milch, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed April 3, 1905.

In this generator means are provided for cross-magnetization in the field coils which increases with increase in the armature current. Auxiliary commutator brushes lead off the current induced in armature by the cross-magnetization and are arranged to cause the current to oppose the main field magnetization.

835,367. Insulation for Electric Circuits and Method of Producing the Same. Harris J. Ryan, Ithaca, N. Y., assignor to the Westinghouse Electric and Manufacturing Company, Pittsburg, Pa. Application filed September 24, 1903.

A transformer is placed in a dielectric in an air-tight container and is subjected to a pressure of many atmospheres.

835,377. Machine for Basing Incandescent Lamps. Alfred Swan, New York, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed March 17, 1905.

The main features are devices for pressing the bulb and base for a lamp together, a heater to heat a cementing compound in a base, and means for transferring the base with the cementing compound therein from the heater to the pressing devices.

835,381. Means for Controlling Electric Motors from a Distant Point. Frederick A. Willard, Lynn, Mass., assignor to the General Electric Company, Schenectady, N. Y. Application filed June 7, 1905.

A solenoid having three coils and a core common to all the coils has insulated contacts on each end of the core and fixed contacts co-operate with the core contacts and form the armature terminals of a reversible electric motor. Leads are connected with the contacts on the core and with the end leads and a pole changer at a distant station controls the polarity of the central coil of the three coils.

835,382. System of Valve Control. Frederick A. Willard, Rochester, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed February 23, 1906.

The several motors each have a separate circuit controlling device which altogether have a common control circuit. Several master-controllers are connected to the control circuit. A relay governs the operation of each circuit controlling device and means are associated with each of the master-controllers for controlling one of the relays.

835,388. Thermal Cut-out. Ernst J. Berg, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed June 1, 1903.

An inductance is combined with one of the two fuses.

835,401. Protective Device for Automobile Motors. Alexander Churchward, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed June 12, 1905.

A resistance is connected in parallel with the field winding of a motor run by current from a storage battery and means are provided for interrupting the circuit from the battery when the circuit through the field is interrupted without a corresponding interruption of the circuit through the resistance.

835,406. Wire Connector. William F. Dawson, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed March 13, 1902.

A single piece of sheet metal is formed into two cylindrical receptacles with a wall of metal separating them and integrally connected thereto on opposite sides of the plane of their axes.

835,407. Alternating-current Machine. Max Déri, Vienna, Austria-Hungary, assignor to the Stanley Electric Manufacturing Company, Pittsfield, Mass. Application filed April 12, 1905.

A transformer winding of a different number of poles from the winding in the stator-slots is placed in the stator-slots with the usual winding and connected in series with it.

835,410. Signal. Charles R. Dowler, Lamar, Colo., assignor to the Colorado Railway Signal Company, Lamar, Colo. Application filed January 12, 1906.

A closed circuit operates a device normally holding a shaft with a signal on it at safety. Means are provided to cause shaft to move to give danger signal if the circuit is broken and to readjust the shaft again with devices to cause the action to be positive.

835,411. Circuit-breaking Device. Charles R. Dowler, Lamar, Colo., assignor to the Colorado Railway Signal Company, Lamar, Colo. Application filed February 9, 1906.

This device placed in a railroad embankment closes a circuit operating a signal upon undermining of the track embankment.

835,415. Switch. Edgar W. Gough, Great Barrington, Mass. Application filed May 3, 1905.

Means are provided for closing the circuit of electromagnetic means for releasing the switch arm. The circuit closing means consist of a magnetically released clock mechanism.

835,416. Regulator for Electric Circuits. Edgar W. Gough, Great Barrington, Mass. Application filed July 6, 1905.

A switch arm controlled by electromagnetic means is adapted to engage a series of contacts. A locking member controls the circuit through an electromagnetic device carried by the arm which actuates the locking member. (See cut.)

835,419. Alternating-current Block-signal System. Max R. Hanna, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed April 26, 1906.

Transformers are connected to a number of sets of signal current supply conductors and supply the track circuits of the blocks. The transformers of adjacent blocks supplied from the same supply conductors are oppositely connected, and a short rail-section interposed betwen two adjacent blocks supplied from different conductors.

835,422. Lamp-shade Holder. Henry A. C. Hellyer, Tenafly, N. J. Application filed April 26, 1906.

A body has a neck and is provided with two downwardly and outwardly inclined annular flanges at its lower end between which the shade is clamped, the outer flange being narrower than the inner one.

835,427. Receptacle. Charles H. Hill, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed February 11, 1905.

A holder is secured to one side of a panel and both holder and panel have openings which are in line with each other. A plug is adapted to be placed in the holder and a lamp passes through the holder into the panel. A transparent device covers the opposite side of the panel opening.

835,441. Signaling System. Wesley E. Laird, Pittsfield, Mass., assignor to the Stanley Electric Manufacturing Company, Pittsfield, Mass. Application filed July 22, 1904.

Means controllable from a distance are adapted to set a step-by-step device which, in one position, operates a switch controlling an electroresponsive signal device. Means are provided for resetting step-by-step device and a switch is provided for opening the circuit of the signal device while resetting the step-by-step device.

835,444. Induction-motor Control. Marius C. A. Latour, Paris, France, assignor to the General Electric Company, Schenectady, N. Y. Application filed March 27, 1905.

The motor is controlled by varying the distance between the poles without varying their number.

835,461. Electrical Measuring Instrument. Edwin F. Northrup, Philadelphia, Pa., assignor to the Leeds & Northrup Company, Philadelphia, Pa. Application filed May 26, 1906.

A number of current-carrying coils are mechanically free to move in the field of a magnet in such a manner that as one of the coils moves more into the field the other coil will move more out of the field, and vice versa, circuit connections are provided for connecting the coils each in a separate branch of a divided circuit, the movements of the coils due to the current in the circuit being independent of the strength of the current but a function of the ratio in which it divides in the branches.

835,475. Combined Reflector and Guard for Electric Lamps. George A. Russell, Worcester, Mass., deceased. Application filed March 21, 1904.

A protecting-frame incloses the lamp-bulb and is rotatably mounted with respect to it. A hinged part is adapted to engage the neck of the lamp-bulb, centering-fingers extending from the base-ring of the protector-frame to engage near the other end of the lamp-bulb, and a reflector is mounted inside the protector-frame and held in place by the centering-fingers.

835,484. Demand Indicator. Leonard Wilson, Pittsfield, Mass., assignor to the Stanley-G. I. Electric Manufacturing Company, Pittsfield, Mass. Application filed September 18, 1905.

A vessel contains a liquid and an expansible fluid which, by its expansion, displaces the liquid to effect an indication. A receptacle receives and measures the liquid displaced. A heating-strip is mounted in proximity to but separated from the vessel and means are provided for connecting the heating-strip in circuit. (See cut.)

835,487. System of Electrical Regulation. John L. Creveling, Cronly, N. C. Original application filed February 12, 1902. Divided and this application filed December 19, 1903.

The current from a generator supplying a storage battery is made to vary according to the voltage of the battery and current of the translating circuit.

PATENTS THAT HAVE EXPIRED.

Following is a list of the electrical patents (issued by the United States Patent Office) that expired on November 12, 1906:

414,686. Electric-light Post. P. J. Dinn, Boston, Mass.
414,695. Electromechanical Tripping Machine. T. F. Gaynor, Louisville, Ky.
414,714. Electric Heater. M. B. Leonard, Richmond, Va.
414,741 and 414,742. Incandescent-electric Lamp. G. W. Wilson, Boston, Mass.
414,757 and 414,758. Electric-fan Motor. P. Diehl, Elizabeth, N. J.
414,763. Automatic Circuit Making and Breaking Mechanism for Gas Lighting. W. W. Estabrook, Boston, Mass.
414,773. Electric-railway Signal. W. P. Kookogey, Brooklyn, N. Y.
414,792. Cut Out for Incandescent Lamps. T. D. Bottome, New York, N. Y.
414,798. Electric-light Support. A. Dawes, Chelsea, Mass.
414,866. Electric-current Indicator. J. F. Mehren, Chicago, Ill.
414,868. Electric Indicator. F. E. Morgan, New Haven, Conn.
414,879. Electric Indicator. D. W. Edgecomb, New York, and C. A. Terry, Whitestone, N. Y.
414,900. Dynamo-electric Machine. H. Geisenhoner, Schenectady, N. Y.
414,922. Incandescent-lamp Socket. S. Rodman, Jr., United States Army.
414,933. Street Lamp Post for Electric Lamps. F. U. Adams, Chicago, Ill.
414,943. Method of Utilizing Natural Electric Energy. M. W. Dewey, Syracuse, N. Y.
414,953. Secondary Battery. W. Roberts, Toronto, Ontario, Canada.
414,961. Telephone-receiver Holder. H. M. Wilson, Cambridge, Mass.
414,996. Combined Electromagnetic Brake or Traction-increasing Device. E. E. Ries, Baltimore, Md.
415,024. Apparatus for Obtaining Sheets of Metal by Electrodeposition. C. C. Coffin, Boston, Mass.
415,070. Electric-motor Support. S. H. Short, Columbus Ohio.
415,165. Electric Locomotor. J. R. Finney, National City, Cal.
415,182. Annunciator. A. T. Hess, Des Moines, Iowa.

WESTERN ELECTRICIAN

EVERY SATURDAY

Vol. XXXIX. CHICAGO, NOVEMBER 24, 1906 No. 21

Electric Power in Denver and Other American Mints.

By Frank C. Perkins.

The new Denver mint, as well as those at Washington, Philadelphia, New Orleans and San Francisco, is equipped with the latest labor-saving devices, and electricity is utilized very largely, most of the machines having individual motors for supplying the necessary power.

In this mint, which is just completed, are to be found electrically driven coining, stamping and rolling machines as well as electrically operated Planchette annealing furnaces, strip annealing furnaces and other furnaces requiring power for feed purposes. Fuel oil is used for heating, and electric motors drive the feed by chain through a speed box of gears, the rolled silver strips being passed in this way through the annealing furnaces. The accompanying illustrations (Figs. 1, 2, 3 and 4) show the arrangement of the electrical equipment of the furnaces and other machines in the Denver mint.

Electric power is also used for driving the vacuum pumps, the ventilating apparatus, the machine shop tools and a 200-ton hydraulic press, while an electric motor-driven pump supplies the necessary water for pressing the copper and silver residue into compact masses for easy handling. The machine shop at the Denver mint is quite elaborately equipped with electrically driven lathes, planers, drills and other machine tools, all direct motor-driven, no belting being used in this shop, which covers an area of 2,000 square feet. There are about 40 electrically driven machines in this shop supplied by well-known machne-tool builders, both eastern and western concerns being represented by the most modern productions in this line.

On the second floor of the Denver mint are the refining rooms, assay department, machine shop, drafting rooms and adjusting rooms. The building has two stories below the street level and three above.

The fuel economizer, air compressors, pumps, boilers and blowing apparatus for the induced draft are located in the lower basement, electric power being employed for driving this apparatus as well as the telescopic ash hoist.

Water-tube boilers are used, and they are arranged with furnaces of the Hawley down-draft type. While coal is used for the boiler, crude oil is used for the furnaces on the upper floors, storage tanks being provided holding thousands of gallons of oil. There are also storage water tanks of large capacity, which are filled from artesian wells.

The engine and dynamo room is provided with 75, 150 and 250-kilowatt dynamos operated respectively by high-speed Rice & Sargent engines, having cylinder dimensions of 12 by 30, 16 by 30 and 16 by 26 by 36 inches. The electrical generators supply a continuous current for light and power service of 230 volts, a blue Vermont marble switchboard nearly 40 feet in length being provided for the feeder and generator switches, as well as the controlling apparatus and measuring instruments.

An electrically operated overhead traveling crane is provided in the engine room of the Denver mint, this being of the three-motor type, used for installing and repairing the electrical generators and engines. The current is conducted throughout the building on the two-wire system for power service and lighting service of 230 volts. In the refinery rooms there is a 7½-horsepower motor of the Bullock type, driving a Sturtevant blower for supplying air to the furnaces, about 650 cubic feet at 12-ounce pressure being provided per minute.

Another blower of larger capacity, driven by a 15-horsepower motor, supplies air to the ingot melting room, while for the deposit melting room a 10-horsepower motor is connected to a similar blower of a capacity of 700 cubic feet per minute, working under an 11-ounce pressure at the burners. There are eight furnaces in the ingot melting room, also an electrically driven cutting machine for finishing the ingots and a large Troemner make-up room scale.

In the rolling room there are three electrically operated mills having 10-inch rolls. A 50-horsepower direct-current electric motor has been installed in this room for operating the grinding machines for punches and dies, for the three cutting presses, the proof press and a multiple shear. The annealing room is located near the cutting and rolling room, and the strip annealing furnaces are of the oil-burning type with motor-driven feed. Electric power is employed for carrying the rolled silver strips through the annealing furnaces, after which they pass on to the coining room. In this room electric motors are employed to drive several edge-rounding or upsetting machines, for blanks, also a number of electrically driven coining presses, together with weighing apparatus for the heavy drafts of coins, counting boards and bagging apparatus, used in addition to the scale apparatus.

There are many novel and interesting operative methods employed at this new mint which differ considerably from those of the older United States mints, and it is maintained that the Denver mint will undoubtedly be found to be one of the most successfully operated institutions of the kind in the world.

Fig. 5 (on the next page) illustrates an electrically operated coining press, driven by a direct-current motor, while Fig. 6 shows several stamping machines, each of which is geared to a four-pole direct-current machine. The euipment shown in Fig. 6 is in operation at the Philadelphia mint.

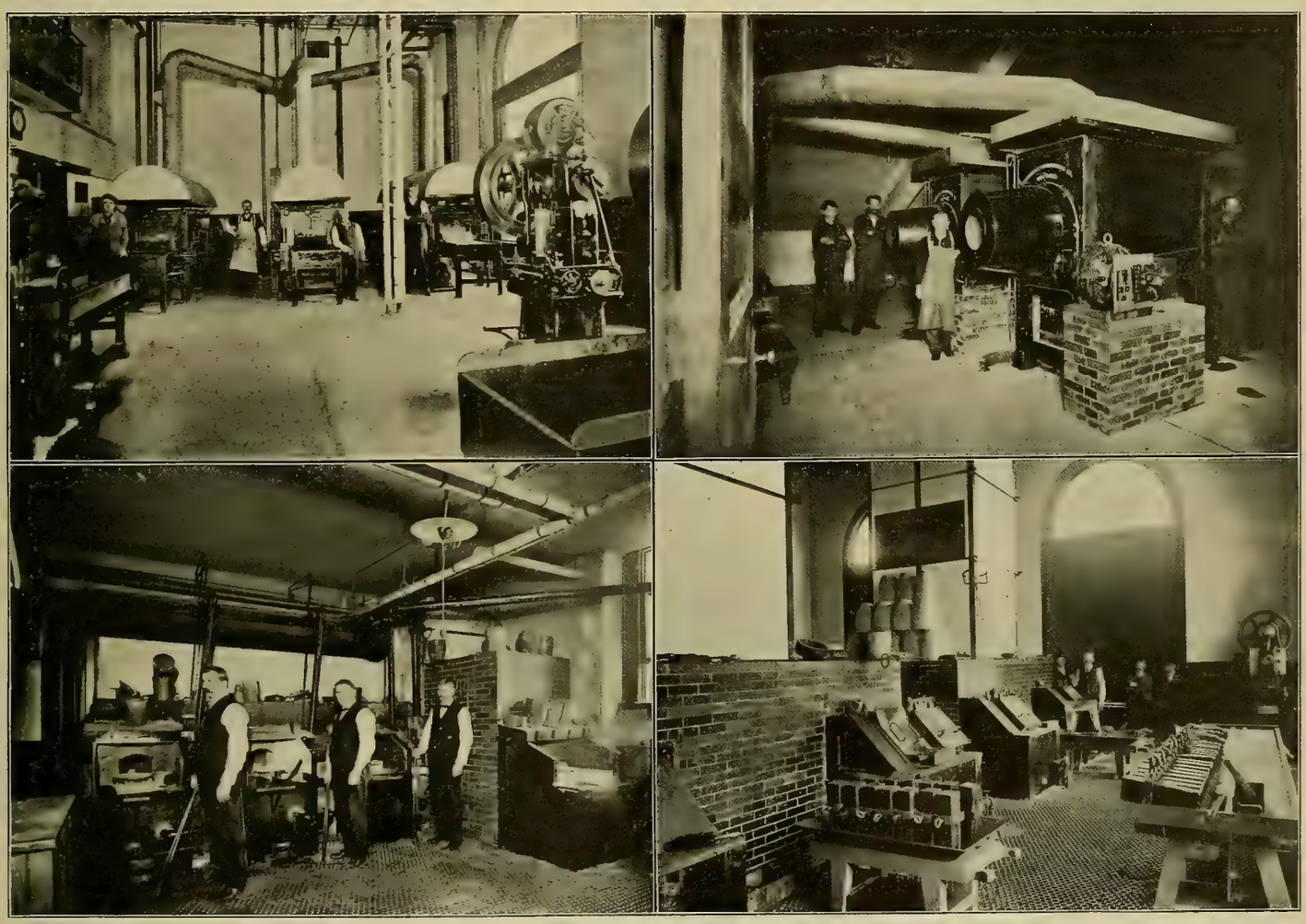


Fig. 1. Strip Annealing Furnaces. Fig. 2. Planchette Annealing Furnaces.
Fig. 3. Crucible Melting Furnaces in Deposit Melting Room. Fig. 4. Crucible Melting Furnaces in Ingot Melting Room.
VIEWS IN NEW DENVER MINT, IN WHICH AN EXTENSIVE USE OF ELECTRIC POWER IS MADE.

Protection Against Overload Without Rupturing the Circuit.

Sometimes, in the operation of electrical apparatus, it is of advantage to reduce the current in a circuit after it has been flowing a short time. Especially is this the case with circuits containing apparatus which is designed to be operated only for a short time on an overload and which will be injured or destroyed by the continued flow of the excessive current.

When machinery driven by motors is suddenly

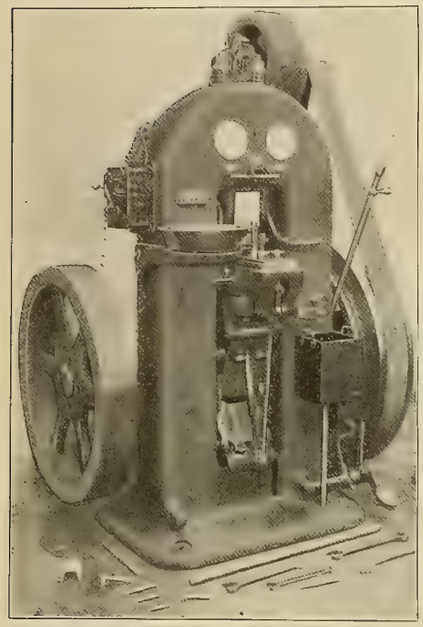


FIG. 5. TYPE OF ELECTRICALLY DRIVEN COINING PRESS USED IN UNITED STATES MINTS. (PAGE 413.)

blocked, or prevented from working, so that the motor is stalled, it is sometimes desirable to maintain a reduced current flowing through the motor to assist in releasing the machine. With the usual protective devices the overload would result in the motor being disconnected from the circuit altogether by the opening of circuit-breakers or blowing of fuses.

To avoid the entire disconnection of current supply in case of overload is the object of a patent which has recently been granted to Dugald C. Jackson of Boston, late of Madison, Wis. The device described in the patent operates to protect the apparatus and at the same time maintain the circuit at a working efficiency.

As an example, the case of a rock drill may be taken. When the drill becomes jammed it is better that the motor should not be cut from the circuit, even though it be stalled, for it could assist in freeing the drill point if it still continued to exert its torque.

The new circuit protective device included in the circuit will have the effect, it is claimed, upon the occurrence of an excessive current flow, of introducing automatically a resistance into the circuit which will maintain the torque of the motor and at the same time protect it from destructive current flow.

An electromagnet in the form of a solenoid with a movable core is connected directly or by means of a shunt in the circuit to be controlled. The core or armature is arranged so that it will act on a switch which operates to cut a resistance into the circuit. The movement of the armature is retarded by some such a means as a dash-pot mechanism and is connected with the switch by a slotted link, so that when the electromagnet begins to actuate the armature an interval of time elapses before the resistance is cut into the circuit. A by-pass is included in the dash-pot mechanism so that when the armature rises slowly upon excessive flow of the current there will be a point in its movement, just as it opens the switch, when the retardation effect ceases, and the switch will be opened with a rapid movement. The armature will be held up and will hold the switch open as long as the current strength is dangerous, and upon its reduction the armature and switch will return to a normal position, cutting the resistance out of the circuit and restoring the current to its normal state. The action can be better understood by referring to the accompanying diagrams.

Fig. 1 is a longitudinal vertical sectional view showing the construction, and Fig. 2 shows the application for protecting a motor. A solenoid winding (1) is adapted to receive a core (2). A magnetic shroud (3) encloses the winding and offers a magnetic path for the lines of force created by the winding. Dash-pot mechanism (4) is mounted at the top of the solenoid casing and consists of a dash-pot cylinder (5), in which the plunger (6) is adapted to reciprocate, the plunger being connected with the upper end of the solenoid core by means of a rod (7). Openings (8) and (9) through the piston (6) are covered by a disk-valve (10), which is loosely held in position by a headed pin (11). An adjustable valve (12) is mounted over an opening (13) in the disk-valve registering with the opening (9) through the piston, and by adjusting the size of the opening (13) the amount of retardation upon upward stroke of the piston may be adjusted. Upon downward stroke of the piston the disk-valve is released from the openings through the piston, allowing free passage of air therethrough and quick return of the piston. A link (14) connects with the lower end of the solenoid core, and at its other end is provided with a slot (15), engaging a pin (16), secured near one end of the switch-blade (17), which switch-blade when closed serves to connect circuit terminals (18) and (19), between which resistance (20) is bridged. The solenoid winding (1) is preferably connected serially in the circuit to be protected, while the switch-blade and resistance are normally connected in multiple series with it.

Upon sufficient current flow through the solenoid winding the core (2) will be attracted upwardly, and the switch-blade (17) will not move until the lower end of the slot (15) engages the pin (16). Owing to the dash-pot connection with the core (2), this upward motion will be retarded, and about the time that the pin (16) engages the lower end of the slot (15) means are provided for removing the retardation and allowing the attraction of the core to cause the switch to be quickly withdrawn from the terminal (19). This means consists in a by-pass (21) so adjusted as to allow immediate escape of the air above the piston in the dash-pot when the pin (16) is reached by the end of the slot (15). Upon the opening of the switch the resistance (20) is included in the circuit and the excessive current reduced to a safe value. The core when in its upper position comes into contact or nearly into contact with an iron cap or fixed portion of core (22), which covers the upper part of the shroud (3) and extends a distance into the solenoid core opening.

On account of the introduction of the resistance (20) into the circuit reduced current flow will necessarily result through the winding (1); but by means of the increased strength of attraction, due to the cap (22), the current strength through the solenoid winding, although decreased, will still be sufficient to maintain the attraction of the core, and consequently to maintain the resistance in circuit during the time that an excessive current tends to flow through the main circuit. Upon the current approaching its normal flow, however, the strength of attraction of the solenoid will be reduced and the core released, and, due to the weight of the core, which is not impeded by the dash-pot upon downward travel, the switch will be quickly closed and the resistance cut from circuit. The magnet winding is in the main circuit, and is therefore energized whenever current flows through it; but the core is adjusted by means of its weight or the effect of a spring, so that it is not lifted until the current becomes abnormal.

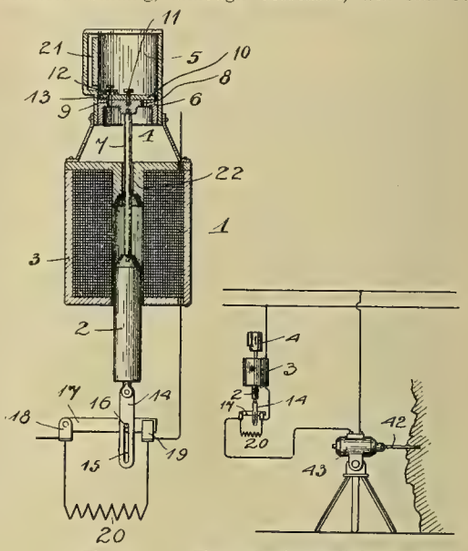


Fig. 1. Fig. 2. Device Applied to Rock Drill.

PROTECTION AGAINST OVERLOAD WITHOUT RUPTURING THE CIRCUIT.

In Fig. 2 a rock drill is shown and the protective device is included in the circuit. Drills of this kind often become jammed in rock, for instance, and it is desirable that the torque be maintained in the drill to assist in its release. The motor, however, being unable to rotate, is traversed by excessive current flowing through its windings unless protective means are provided. In case this new protecting device is included in the circuit, if the motor becomes stalled the resistance (20) is introduced in circuit and the current is reduced to a safe value. At the same time the circuit is maintained intact and the motor continues to exert its torque on the drill. Upon release of the drill the current may assume its normal flow and the solenoid will release the armature, shunting the resistance out of the circuit again.

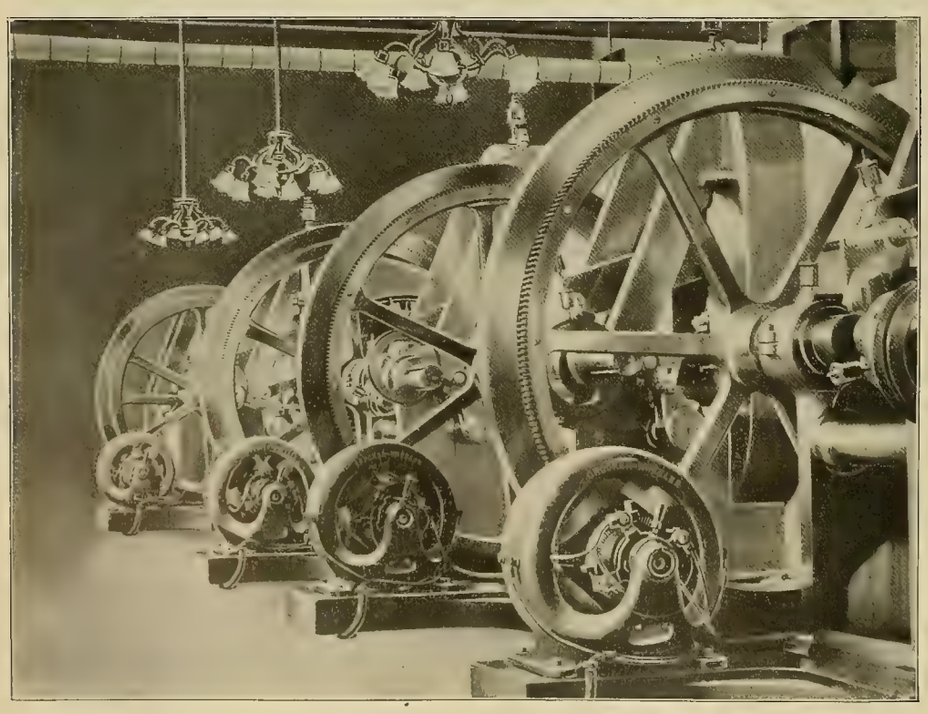


FIG. 6. A GROUP OF STAMPING MACHINES IN PHILADELPHIA MINT DRIVEN BY DIRECT-CURRENT MOTORS. (PAGE 413.)

Encouraging Report from St. Petersburg.

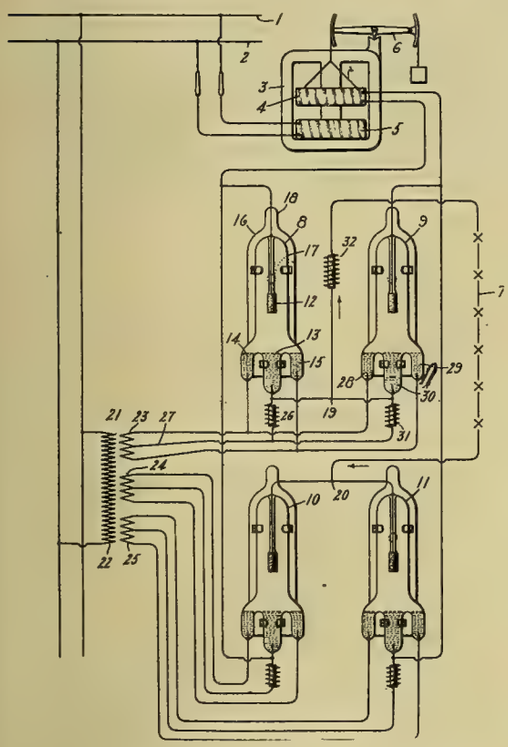
At the last general meeting of the St. Petersburg Electric Lighting Company the reports showed that in spite of the troubled period in that country and the expense caused by the strikes, which amounted to over $7,000, the results for the last year show a slight increase in profits, and there are 1,866 new customers, making an increase of 34,811 lamps. The receipts for the year were $847,613, and the profits $457,000. Two steam-turbine sets of 750 horsepower each have been lately placed in the plants. Keeping pace with the increased demand for current, the company expects to put in a new turbine-alternator of the same make (Brown-Boveri), but this will be a much larger one, giving 1,900 horsepower. At the end of 1905 the company was operating arc and incandescent lamps and motors to the equivalent of 361,722 10-candlepower lamps, and the number of customers was 10,096.

Vapor Rectifiers in Electrical Distribution.

A system of electrical distribution which is of interest has been patented recently by Richard Fleming of Lynn, Mass., and assigned to the General Electric Company. By referring to the accompanying drawing the features of the system can be seen and its method of operation understood.

The source of constant-potential alternating current is represented conventionally by the supply mains (1) and (2). In order to transform current from these mains into a constant current, or, in other words, a current having a constant value, a constant-current transforming device is employed, as represented at (3). The movable coil of this transformer, in the present instance the secondary coil, is indicated at (4), while the stationary primary coil is indicated at (5). The lever or counterbalance arm by which the weight of the movable coil (4) is partially counterbalanced is indicated at (6).

The current from the secondary (4) of the constant-current transformer is fed to a rectifying system, by which it is converted into direct current, and is then supplied to the series consumption circuit (7), containing arc lamps or other translating devices. The rectifying system consists in the present instance of four single-phase vapor



VAPOR RECTIFIERS IN ELECTRICAL DISTRIBUTION.

rectifiers (8) (9) (10) and (11). The rectifiers are all alike, so that a description of one will suffice for all. Referring, then, to the rectifier (8), it will be seen to consist of the rectifier tube having a solid electrode or anode (12), a cathode (13), of mercury, and auxiliary anodes (14) and (15). The tube enclosing these electrodes is highly exhausted, and the whole apparatus is mounted upon a tilting support (16), pivoted about its center of gravity, as at (17). A handle (18) permits the apparatus to be tilted so as to cause an overflow of mercury between the electrodes (13) (14) and (15), in order to start them to operation. The four rectifiers are connected in two parallel circuits across the supply mains leading from the secondary (4). One of these parallel circuits or shunts from the supply mains includes the rectifiers (8) and (9), while the other includes the rectifiers (10) and (11). The rectifiers (8) and (9) have their positive terminals connected respectively to the supply mains and their negative terminals joined together, as at (19). The reverse arrangement is made in the case of the rectifiers (10) and (11). In this case the negative electrodes of the rectifiers are connected, respectively, to the supply mains from the secondary (4), while their positive electrodes or terminals are joined together at (20). The consumption circuit (7) is connected across the points (19) and (20). By reference to the arrows marked on the drawings it will be evident that current will flow, in the case of one wave, down through the rectifier (8), through the consumption circuit (7), and return to the other supply main through the rectifier (11). The next wave of current will pass down through the rectifier (9), then in the same direction as before through the consumption circuit (7), and will return to the source through the rectifier (10).

The rectifiers which are indicated require for their operation the existence of maintaining arcs in each envelope. In the case of the rectifier (8) these maintaining arcs are produced by supplying current to the auxiliary electrodes (14) and (15) and the common cathode (13). This current is

FIG. 1. PUMP HOUSE FOR LOCOMOTIVE WATER TANK AT SOUTH BEND, IND.

supplied from an exciting transformer (21), fed, like the system itself, from the source (1) (2). The primary winding of this transformer is indicated at (22), and is provided with three secondaries (23) (24) and (25). The secondary (23) has its terminals connected to the auxiliary electrodes (14) and (15). The negative electrode (13) is connected, through an inductance coil (26), to a conductor (27), extending from the middle point of the secondary (23). In a similar manner the auxiliary maintaining electrodes (28) and (29) of the rectifier (9) are connected to the same secondary (23), while the corresponding cathode (30) is connected, through an inductance coil (31), to the same lead (27). The secondary (23) thus supplies the exciting currents for the rectifiers (8) and (9) and maintains these exciting currents at all times when it is desired that the rectifiers should operate. The presence of these exciting arcs renders the respective rectifiers pervious only to current waves which tend to flow from anode to cathode. Similarly, in the case of the rectifiers (10) and (11), the secondaries (24) and (25) are respectively connected, the one to the maintaining electrodes of the rectifier (10) and the other to the maintaining electrodes of the rectifier (11), and thus render the rectifiers conductive for current waves of one direction only.

In order to start the apparatus into operation, the rectifiers must be successively started up by shaking or tilting each one in turn to produce the

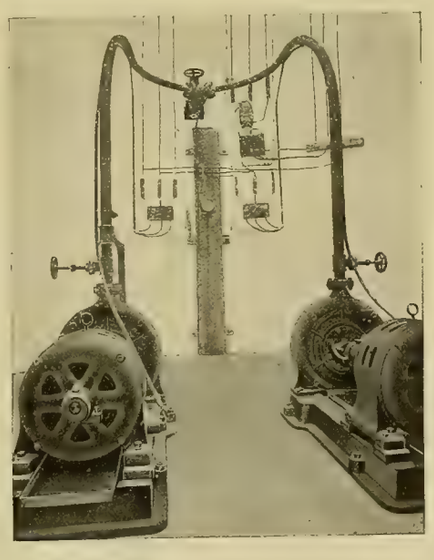


FIG. 2. ELECTRIC PUMPS FOR FILLING LOCOMOTIVE WATER TANK.

starting and maintaining arcs. The supply circuits for the constant current must then be closed, and current will pass through the rectifying system to load. An inductance coil (32) in the load circuit serves to smooth out the current and steady the action of the system.

The total production of coal during 1905 in Illinois was 38,434,363 short tons, with a spot value of $40,577,592, according to the report made by Mr. E. W. Parker of the United States Geological Survey. Illinois still ranks next to Pennsylvania in the production of coal, although in the output for 1905 the lead over West Virginia was by a very narrow margin.

Electric Pumping for Locomotive Water Tank at South Bend, Ind.

The ease of adapting automatic methods of control to the electric motor makes it most convenient for driving pumping machinery. It is generally a simple matter to arrange a float-operated switch to open and close the motor circuit so that the expense of an attendant, necessary with a steam plant, is eliminated, and the pumping set can be erected advantageously in an isolated position. This is especially true along railway lines, where, if electric current is available, an automatic electric pumping set may be installed to fill the water-supply tanks for the locomotives.

A very successful induction motor-driven pumping plant for the purpose above mentioned is in operation on the lines of the Lake Shore and Michigan Southern Railroad Company at South Bend, Ind. The pumping outfit consists of two Worthington single-stage turbine pumps, each direct connected to a six-pole 7½-horsepower three-phase 440-volt General Electric induction motor. Two complete pumping sets are installed, so that in case one set fails, repairs can be made without shutting down the plant. Power for operating the induction motors is taken from the lines of the St. Joseph and Elkhart Power Company.

In Fig. 1 is shown a view of the pumping house. This is a round brick structure erected at the top of a concrete-lined well. The floor is of concrete, supported by I-beams, and is 10 feet below the level of the ground. Upon this the pumps are

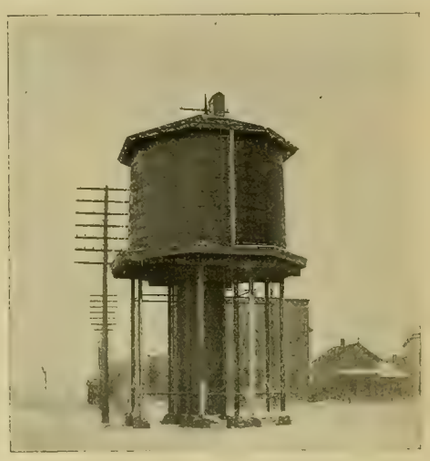


FIG. 3. LOCOMOTIVE WATER TANK, WITH AUTOMATIC CONTROLLING DEVICE ON ROOF.

erected, the interior arrangement being shown in Fig. 2. For keeping the pump room dry, four ventilating ducts are built into the wall of the pump house, the outlets appearing in the pilasters in Fig. 1.

Each pump discharges water through a 2½-inch pipe connecting with a four-inch main, which leads to the supply tank. This tank (Fig. 3) is located at the side of the tracks, about 100 feet from the pumping station. The controlling device is arranged in the housing on the roof, the motors being started and stopped automatically by a small oil switch operated by a float, which has a vertical movement of about one foot. The difference in level in the tank corresponds to 3,000 gallons of water. This is the average amount taken by a locomotive, and is replenished by the pumping set in about 25 minutes. The supply tank holds about 50,000 gallons and could supply 15 locomotives within a few minutes, if necessary. However, such a heavy demand will probably never be made, and in actual practice the pumps stand idle for the greater part of the time.

The Nashville Holiday Lighting Plan.

The idea of lighting the business district of the city of Nashville, Tenn., with streamers of incandescent lights, which was put into execution for the benefit of the merchants in that section of the city the first of the month, has proved to be a "taking" scheme, and so general has been the satisfaction that the service is to be extended. As stated in the Western Electrician of November 10th, the current will be given gratis by the Nashville Railway and Light Company, the merchants paying only for the cost of stringing the wires, etc. A trip through the business section of the city after dark reveals many persons on the lighted streets peering into the beautifully decorated show-windows. This service is to be extended on Church Street to the Vendome Theater; through the Arcade and out Fourth Avenue to the transfer station.

Electric Drive in the Manufacture of Spiral Riveted Pipe.

Among the larger industrial plants in Chicago is that of the American Spiral Pipe Works, covering 20 acres. The property comprises the four city blocks between Forty-sixth and Forty-eighth avenues south of Fourteenth Street. The main building, or pipe shop, of brick and mill construction, is well lighted by the saw-tooth roof. This

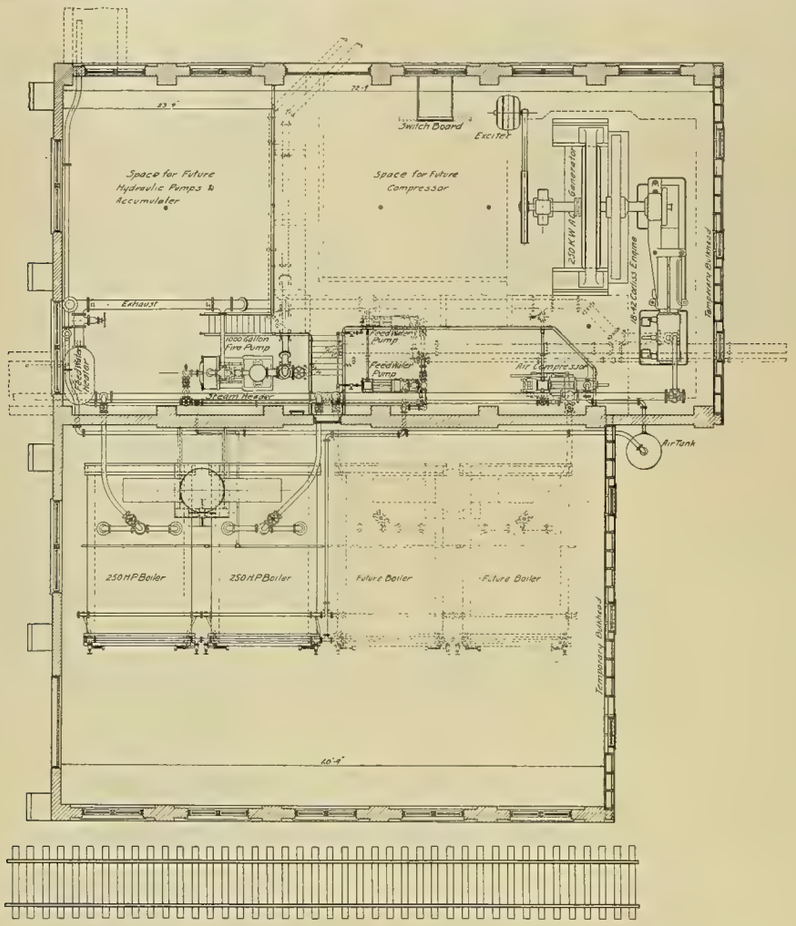


FIG. 1. PLAN OF POWER HOUSE IN SPIRAL RIVETED PIPE WORKS.

building is devoted exclusively to the manufacture of spiral riveted pipe and heavy sheet-metal work. Adjoining the pipe shop is a material shed, of steel construction, where the steel plate used in the manufacture of spiral riveted pipe is received and stored. North of the main shop are the asphalting and galvanizing plants and the testing room, so arranged that the finished product may be tested and galvanized or coated with asphaltum on its way from the shop to the shipping room. Parallel to and 50 feet away from the pipe shop are the forge shop, machine shop, stock room and shipping room, all of brick and steel construction. In the forge shop are many heavy special machines. This shop is devoted exclusively to the manufacture of forged and rolled steel flanges, and large quantities of drop forgings weighing from 100 to 400 pounds each, are handled with ease. The pipe and billet yard, for a length of 600 feet, is served by a five-ton 50-foot-span Whiting alternating-current electric crane. At the entrance to the plant is the two-story brick office building.

Just south of the material shed, fronting on the crane runway, is the power-house building, 84 feet long by 74 feet wide, of brick and steel construction, except the east end, which is closed by a wooden bulkhead, allowing for future extension. The wall footings, machinery foundations and floors are of concrete. The roof is corrugated galvanized iron, lined with asbestos. A plan of the power house is shown in Fig. 1, while Fig. 2 is a cross-section.

The boiler room (Fig. 3) is 60 by 42 feet in floor dimensions, with coal doors in the south wall, through which the coal is unloaded from a track running alongside. This is only a temporary arrangement, as a coal bunker is to be built in the future.

One of the most interesting and progressive features of this plant is the boiler installation. There are installed two 300-horsepower Munoz internally fired high-pressure sectional water-tube boilers, manufactured by the Munoz Boiler Company, Dayton, Ohio. These boilers are said to represent the highest development to date of the science of steam generation, having many unique and exclusive features not possessed by the standard brick-set water-tube boilers.

By the arrangement of the drums and cross boxes there is formed an arch of inclined tubes over the furnace. These tubes are arranged within the vertical center of the steam drums, allowing of expansion into the steam drums, directly at their center; a line of four-inch vertical tubes, spaced six inches apart between centers, which enclose the boiler, being connected at the bottom with a 12-inch side drum. As the greater portion of the work in a water-tube boiler is done on that portion of the heating surface on which the fire impinges directly, the heating surface is so arranged that the greatest amount of it is nearest the fire.

The casing, instead of being a mass of brickwork of great weight, consists of a four-inch tile set up directly against the four-inch vertical tubes, these tubes protecting the tile, as, should the tile become hotter than the water in the boiler, the tubes would at once absorb the heat from the tile. In each section there are 12 of these tiles placed one on top of the other, without fireclay or mortar. They are backed up and joints are broken by asbestos fire felt two inches thick, this being held in place and covered by steel-plate panels. These panels weigh about 60 to 75 pounds, and are held in position by small clamps, which makes them easily removed. This casing entirely surrounds the boiler, reducing to a minimum the radiation of heat common to brick-set boilers. It can be removed from the boiler in a couple of hours' time, with two common laborers, and the pressure parts of the boiler exposed for a thorough cleaning, repairing or inspection.

To maintain the boilers at their highest rate of economy, they are set individually, each unit being self-contained, with an alley four feet wide between boilers. From this alley there are eight points on each boiler, four on each side, from which to blow or remove soot from the tubes, they being so placed that it is possible to keep the boiler thoroughly clean of surface dirt while under operation. In doing this, no greater space is occupied than that required for brick-set boilers set in battery.

Gases from each boiler are carried by steel breeching to a steel stack located between the boilers. The stack is five feet in diameter, 130 feet high, and stands on a cast-iron plate, supported by a steel structure. In the space allotted for future boilers there is temporarily installed a water-gas generator of a capacity of 5,000 cubic feet per hour, which furnishes water gas for special forging and annealing work in the forge shop.

Fig. 4 shows the engine room, which is 72 by 38 feet in floor dimensions, with the floor line four feet above the boiler-room floor. At the west end and along the partition wall is a pump pit, the floor line of which is seven feet below that of the engine-room floor. On this lower level are located the air compressor, two 500-horsepower boiler-feed pumps, 1,000-gallon fire pump, and feed-water heater. The fire pump was furnished by the Buffalo Steam Pump Company, the feed pumps by the Gardner Governor Company, and the 1,200-horsepower Stilwell open heater by the Platt Iron Works. Sufficient space is also left for the hydraulic pumps and accumulator, which are to be installed at an early date. On the engine-room floor proper is the 18-inch by 42-inch heavy-duty Corliss engine built by Filer & Stowell, direct-connected to a 250-kilowatt 220-volt 60-cycle three-phase alternating-current generator, built by the National Electric Company.

The alternator is of symmetrical lines, with excellent operating characteristics. A special feature of this machine, which contributes very largely to low operating temperatures, is the use of widely separated pole-pieces, which construction requires a spider of large diameter, and prevents crowding of the coils; thus the coils have a large radiating surface. The generators are excited with a current from a 160-volt exciter, which is belted to the shaft of the engine. When the plant was started up, the alternator was operated with 85 per cent. overload for two hours without showing any undue rise in the temperature of its windings.

A two-panel switchboard, built by the Western Electric Company, distributes electrical power for lighting and power purposes to the entire plant.

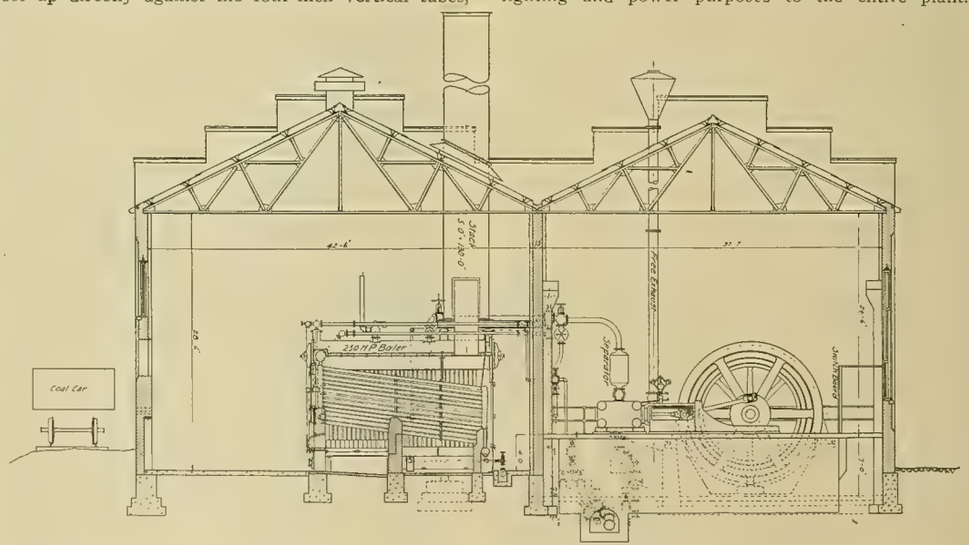


FIG. 2. CROSS-SECTION OF POWER HOUSE IN SPIRAL RIVETED PIPE WORKS.

The board is of black enamel slate. Each panel is 24 by 90 inches, divided into two sections. All feeders and generator leads are protected by three-pole double-coil I-T-E circuit-breakers, which are mounted directly on the slate. The instruments are Westinghouse, flush mounted, type E. Generator leads are carried to the switchboard in tile ducts laid in the floor.

The pipe, fittings and valves in the plant were

furnished by the Pittsburg Valve Foundry and Construction Company, except the exhaust-steam and water mains, for which spiral riveted pipe was used. The high-pressure steam piping is all fitted with forged-steel flanges manufactured by the American Spiral Pipe Works. The high-pressure piping is covered with Keasbey & Mattieson's magnesia sectional covering.

Just east of the power house is located a concrete reservoir of 150,000 gallons capacity, into which all roof drainage is turned. The floor of the reservoir is made of porous tile, which allows the surface water from the surrounding territory to collect, and be used in the power house. In case the reservoir is empty, water from the city mains is used. The water mains and fire-protection lines are of spiral riveted pipe, laid underground. There is about 2,500 feet of spiral pipe in the fire lines.

Fig. 3. Boiler Room in Power House.

Fig. 4. Engine Room in Power House.

ELECTRIC DRIVE IN THE MANUFACTURE OF SPIRAL RIVETED PIPE.

Cables for distributing electrical energy for light and power in the entire plant lead from the switchboard in the engine room to panel boards located in the various buildings. Open work is used throughout, the insulators carrying the cables being fastened to wood strips bolted to the lower chords of the roof trusses. Five panel boards control all the power circuits of the plant, the lines being carried their full size from the switchboard to the panel boards located at the centers of distribution of each building. From these cabinets branch circuits are run open overhead to the motors. The feeders enter the panels through the fuses, and fuses control the branch circuits, which are tapped off of polished copper bus-bars mounted on the face of the panel. All power circuits are three-wire three-phase. The lighting panels, 12 in number, are fed from the power panels, and are of the same general type as the latter. The branch circuits are two-wire, controlled by 10-ampere double-pole knife switches. All panels are of slate, mounted in dustproof steel cabinets lined with slate. New Code indicating enclosed fuses are used throughout.

Nearly all mounted on brackets supported on the columns or brick walls of the building, the motors are three-phase, 250 volts, made by the Westinghouse, General Electric and National companies. The starting compensators were furnished by the Westinghouse and General Electric companies, and are of the oil-insulated type. In general, the tools are grouped in sections, such that the motor units run from one to 30 horsepower, each motor driving a line shaft from which machines are driven. There are a few individual motor-driven units.

Cooper Hewitt mercury arcs are used for the principal illumination, one arc being installed for a group of machines.

William Thomas Branitzky, Chicago, had charge of the architectural features, the power-house layout and the general distribution system being designed by The Arnold Company of Chicago, the whole being under the personal supervision of Mr. J. Hall Taylor, vice-president and general manager of the American Spiral Pipe Works.

The Onondaga Lighting Company of Syracuse, N. Y., has been formed to manufacture and supply gas and electricity for light, heat and power purposes, with a capital of $1,000,000. The company is to operate throughout Onondaga County.

The Aerophore.

Many ships are now provided with wireless apparatus for sending and receiving the Hertzian waves, and they can keep "in touch" with the shore, as it were, for a part of their voyage at least; but, of course, unless the captain knows his own location and that of the sender, he cannot tell from what direction the messages are coming.

A system for enabling a ship to locate itself by means of the use of its radio-telegraph apparatus has been invented and patented by Lee De Forest, the well-known space-telegraph inventor.

Mr. De Forest names his apparatus the "aerophore," and says that the object of the invention is to provide a system whereby a ship or other moving body which is provided with receiving apparatus may be able to locate its position with respect to a stationary body provided with a sending apparatus. To do this he depends on the fact, as asserted, that by means of suitably shaped reflectors or an inclined antenna it is possible to concentrate the transmission of electromagnetic or Hertzian waves in one general direction.

In Fig. 1 (J) represents a prime mover—for example, a gas engine—operatively connected with the generator (G) by means of a belt passing around the sheave (K). (Q) is a signaling wheel driven by the worm gear. The shaft (O), which is provided with the worm (P), is driven by the belt (M), which passes around the pulley (N) on the shaft (O) and the driving pulley (L), which is operatively connected with the prime mover (J). A brush (R) makes electrical connection with the contacts (S), with which the wheel (Q) is provided. (T) is a step-up transformer whose primary is included in the generator circuit and whose secondary is connected to the spark-gap (A') of the oscillator or antenna (A) through the brushes (7) (8) and the rings (7') (8'). A condenser (C) may be connected in shunt to the spark-gap (A'). (B) is a reflector of parabolic or other suitable shape, which carries by means of the insulators (9) (9') the oscillator (A) and which is mounted on the rod (D), which is rotated by means of the shaft (I), bevel gears (H') and (H), shaft (F), and bevel gears (E') and (E).

The operation of the prime mover (J) causes the alternating current in the generator circuit to be interrupted by the contacts (S) and the brush (R') in accordance with the spacing of the contact. The current thus interrupted is then transformed into high-potential current by the transformer and is impressed on the oscillator (A), causing it to emit electromagnetic waves, broken up into signal elements, which correspond to the spacing of the commutator (S).

These waves are concentrated by the reflector (B) and sent out into space in a direction determined by the position of the reflector, which is continuously shifted and therefore shifts the direction of the waves.

An example of the working of the system is shown in Fig. 2, in which (V) represents the aerophore and (U) a ship within influence of the waves transmitted by the aerophore. The receiving apparatus on the ship will not respond to waves sent out except when the reflector is directed northeast. If the waves which affect the receiving apparatus of a ship in the position shown were characterized by a certain arbitrary or code signal, the pilot, by consulting his chart, would know that he was northeast of a certain aerophore, but would not know what aerophore. If shortly after he should receive a signal different from the first he could, by consulting a chart, ascertain the location of the point from which the direction signal had been transmitted.

The wheel (Q) is divided into sectors, corresponding to a number of the points of the compass, and each sector is provided with contacts adapted to produce the different signals desired when the reflector is directed towards the different points of the compass, so that the direction and location of the apparatus may be ascertained by the ships receiving the signals.

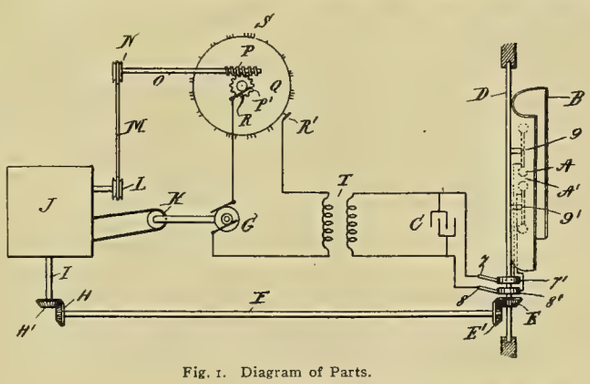


Fig. 1. Diagram of Parts.

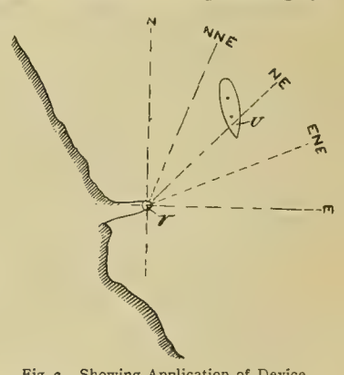


Fig. 2. Showing Application of Device.

THE AEROPHORE FOR LOCATING WIRELESS MESSAGES.

The Concrete Stack Question in Peoria.

Although there is good reason to believe that the existing concrete stack of the new McKinley traction power house at Peoria is of ample strength, it is, nevertheless, to be strengthened by an eight-inch retaining wall of steel-concrete (concrete reinforced by steel rods) around the entire stack. This is done in view of the collapse of the twin concrete stack, as a measure of precaution. The entire stack was tested by boring into each section and analyzing the borings to ascertain whether the cement had set properly. Although the tests showed no signs of weakness, the McKinley people, as an additional precaution, demanded the retaining wall.

The company having the contract for the stacks will not attempt to rebuild the other stack this fall. It has made one attempt and found that the weather was too cold. Consequently it has stopped all operations on the stack, and the flues from the boiler plant will all be connected with the single stack, which will be used during the coming winter.

WESTERN ELECTRICIAN

EVERY SATURDAY.

PUBLICATION OFFICES:

507 Marquette Building, - CHICAGO.

TELEPHONE, MAIN 1746.

Eastern Office, 150 Nassau Street, New York.

Telephone, 5220 Beekman.

Trade Supplied by Western News Co.

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SUBSCRIPTION, in advance, postage prepaid, $3.00 for a full year of 52 numbers; in clubs of four or more, $2.50, with free extra copy for eight subscriptions; foreign countries, $5.00 a year; single copies, 10 cents. When change of address is requested, the **old address** as well as the new should be given.

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DATES AHEAD.

Chicago Electrical Show (second annual exhibition), Coliseum, Chicago, January 14 to 26, 1907.

Northwestern Electrical Association (annual meeting), Coliseum, Chicago, January 16th, 17th and 18th.

IN SOME respects the last chapter of "The Small Central Station" series, published in this issue, is the best in the book, for if the advice it gives as to getting new business and keeping old business is disregarded, all that has previously appeared goes for naught. In other words, there is little use in having an up-to-date station unless the business is carried on in an up-to-date manner. The concluding chapter is full of meat and gives the manager many practical hints on how to succeed, written by one who has "been there." We call particular attention to this concluding chapter, for managers of small plants will find that in all the flood of "new-business" literature recently published nothing has appeared more succinctly, helpfully adapted to their particular needs.

MENTION of the "electric" hair-brush a few years ago would have been apt to cause the average electrical man to bristle with contempt of what he considered an imposition on the public. But an electric hair-brush of a different kind was exhibited at the recent engineering exhibition in London, and this appears to be genuine, at least so far as its use of electric power is concerned. Whether it is meritorious or practicable is a different matter. The device is intended for barbers' use, and is attached by flexible cord to an incandescent-lamp socket or other outlet. A small motor, controlled by a switch in the brush-handle, is concealed in the body of the brush. The bristles are assembled on a hollow aluminum cylinder, which slides over and forms an enclosing case for the motor. This cylinder is easily detachable, so that changes in the different grades of brush can be readily made to suit the customer, while perfect cleanliness of brushes can be maintained. The "electric" hair-brush of former years was supposed to generate a current of electricity in itself sufficient to have a soothing effect on the scalp. It was looked upon with suspicion, to say the least. But the modern article is a machine, perfectly practicable and perhaps useful.

WASHINGTON, and in fact all the District of Columbia, is ultimately to bar the steam locomotive, if a newspaper dispatch dated last Saturday is correct, as it undoubtedly is. On the completion of the large and beautiful union railroad station now building in Washington, steam railroad locomotives will be prohibited from entering the District. The commissioners of the District of Columbia took final action on the subject on November 17th in an order prohibiting the use of anything except electric locomotives in drawing trains into the new union station. This applies to all railroads entering the city, and is made in the interest of the anti-smoke crusade, which has been waged in Washington for several years.

This action merely foreshadows, we believe, a similar decision that is bound to be reached in all large cities. Whatever will be the ultimate course to be pursued in the operation of trunk lines, whether by steam, electricity or some other agency, it appears to be inevitable that the terminals in all cities of large population must be "electrified" before the lapse of many years. This will entail large expense on the railroad companies, and bring corresponding revenue to the electric companies; but the change is made, regardless of the operating companies and indifferent to the electrical interests, for the benefit of the public.

WHILE electricity plays a conspicuous part in the existing methods of obtaining the metal aluminum, it will be passing strange if, by means of the electric furnace (with which, for experimental purposes, the name of Moissan, the French scientist, is indissolubly linked), an entirely new method should come into use. This method, referred to by Outerbridge in his recent review of progress in metallurgy, before the Franklin Institute, does not depend upon bauxite and seems to make available vast deposits of clay, or alumina, which are not applicable to the electrolytic method. The following brief description of this new process is taken from an interesting popular article on "High Temperatures and Modern Industry," in the October issue of Harper's Monthly Magazine:

"Thanks to Moissan and his methods nearly every metal has its carbide. For example, there is aluminum carbide, which Moissan prepared some years ago by heating in the electric furnace a mixture of kaolin and carbon. It constituted a body of beautiful yellow crystals, which were apparently useless. Now, after all these years, comes the present discovery that this Al_4C_3, so produced, on being heated with alumina (the oxide of aluminum), yields the pure metal and carbonic-acid gas—a wholly new and elegant method of extracting aluminum, and one, obviously, of immense value when developed."

This announcement is of particular interest in view of the high price of all metals, and particularly copper and tin, for which aluminum is a promising substitute in some of the arts. It will be interesting to observe, when the new method is put to practical test, whether it lends itself to commercial conditions—in other words, whether it will mean cheap aluminum. This metal is now sold at about 40 cents a pound, but if it could be had for half that price or less, the effect would be far-reaching in many industrial pursuits, including several of those in which electricity is applied.

RECENT events, including the fall elections in this country and the election of members of the London County Council in England, point to a welcome reaction against the wave of public-ownership sentiment which a year or two ago threatened to sweep the country. On this side of the water New York state, after a spectacular contest, rejected the candidate for governor who stood for public ownership, while in the London elections municipal ownership, socialism and all that makes for what might be termed "extremism" in local affairs suffered a decisive defeat. London is divided into 28 boroughs, and the "reformers," or moderates, now control more than 20 of them, which will result in a check in the ill-advised "municipalization" policy for which the "L. C. C." has been noted.

In Chicago there is a fair prospect that the almost interminable traction controversy will be settled, at least for a few years, on the basis of private ownership and operation. An ordinance having this object is now under discussion. In Boston the project for a municipal lighting plant makes but slow headway, although it is the subject of acrimonious discussion by the aldermen. Milwaukee seems to be going ahead with its municipal lighting scheme, but Mr. Beggs of the central-station company has made such a conspicuously fair offer, based on the results of the Detroit municipal plant, as explained elsewhere in this issue, that it would seem that it must be accepted.

Government and state ownership of railroads, as suggested by Mr. Bryan, met with such a storm of opposition that the proposal seems to have been dropped. Governor Folk of Missouri, for instance, although of the same political faith as Mr. Bryan, said that the proposition would meet with no acceptance in his state, where the experiment had been tried and found wanting. European practice in this respect is often cited, but it must be remembered that a strong incentive to state ownership of railroads in Europe is the necessity or desire to provide ample precautions against the possibility of war. Europe is virtually armed at all times, and it is largely for the purpose of being able to control the arteries of travel in the event of hostilities that government ownership of railroads is the general policy.

One danger of public ownership is that it is a step in the direction of common ownership, or socialism. Archbishop Ireland emphasized this point in a recent speech at Council Bluffs: "A chief panacea put before us is common ownership, through city, state, or nation, of the chief agencies of productivity and of the transportation of the results of this productivity. Let all be on their guard. Common ownership in one direction leads readily to common ownership in another, the more so when the purpose really held in mind by the many is to grasp wealth without much personal effort, to despoil others to make up for one's own deficiencies."

Thus, from various quarters come encouraging indications that while the evils of corporations and corporation influence will continue to be vigorously attacked, the advantages of private operation of industrial enterprises will ultimately be fully recognized.

The Work of the Berlin International Wireless Conference.

[From the Berlin correspondent of the Western Electrician.]

Berlin, November 3.—The International Conference on Wireless Telegraphy, that met in Berlin early in October, has just concluded its sittings, it being anticipated that the treaty will be signed today.

The agreement arrived at, I learn, is based on the principle of free mutual communication between the various systems, but with certain restrictions which are apt to make the whole agreement of doubtful value.

Great Britain and Italy, with a view to safeguard their contracts with the Marconi company, will sign only with reserve, while Montenegro, as well as the representatives of one or two smaller governments, will probably follow their example.

The delegates of the United States from the very outset proved to be partisans of an international agreement for the unrestricted exchange of telegrams from ship to ship and from ship to land, no regard being taken to the system of wireless telegraphy chosen. Germany assisted the United States in so far as a mutual exchange of telegrams from ship to land is concerned; but practically the whole of the conference, with the exception of the delegates from the United States, opposed the idea of a free, mutual exchange of telegrams from ship to ship. England opposed both suggestions, but in the end was practically isolated, being assisted only by Italy. All maritime powers eventually adopted the modified views advocated by the United States, voting on its side in the last decisive vote.

From the outset the Italian delegates declared themselves to be unable to vote for an internationalization of wireless telegraphy, because of their contracts with Marconi, while the British delegates insisted on the adoption of the principle of mutual exchange generally, provided the several companies agreed thereto.

Great Britain eventually yielded in so far as the suggestion of an exchange from ship to land is concerned, but with the limitation that in the event of any private company refusing to transmit telegrams of another system, the government should be entitled to erect at the place in question stations intended for the transmission of wireless telegrams. Until the contracts with Marconi expire, England will not allow other companies to erect coast stations.

Marine as well as military stations are obviously excluded from the agreement, while any government is entitled to exclude also any station intended for public service. However, with the exception of Great Britain and Italy, all governments will probably be unwilling to take advantage of this privilege.

An International Information and Accounting Bureau, similar to that existing at Berne for the international post and telegraph service, is to be organized for the regulation of wireless telegraphy, while new legislation will have to control the application of the agreement to private wireless companies.

The term radio-telegraphy has been officially adopted to designate wireless telegraphy.

Sir Oliver Lodge, principal of the University of Birmingham, England, well known for his researches and inventions in space telegraphy, wrote an interesting letter to the London Times, dated October 27th, rather contravening the official English view. This is a part of the letter:

"No country is likely to wish to hamper enterprise and progress within its own borders or to prevent itself from adopting whatever methods it finds best. And although it is said by some that in the present instance Great Britain enjoys a peculiar advantage and pre-eminence, such a statement is based upon partial ignorance of facts. It is true that Sir William Preece and the British Postoffice assisted mightily in bringing Mr. Marconi to the front in 1896, but it so happens that many countries had contributed to the foundations of the subject—notably Germany, France, England and Italy—and it has been developed practically in nearly all.

"The admirable way in which Mr. Marconi worked up the invention, enlisted the interest and help of many, and brought it into extraordinary prominence is universally recognized. The financiers, also, who constitute the directorate of the Marconi company, are doubtless entitled to a share of credit and profit for their energy and enterprise; but they are not entitled to a monopoly. It would not only be unjust, it would be in high degree foolish, to allow a monopoly—whether a German monopoly or an English one—to arise in connection with this application of world-wide science.

"To create a monopoly in England, and to oust therefrom every system but one, would be thoroughly detrimental to national progress in the art, and would soon cause us to lag behind; for it is certain that other countries will allow free development. The three main divisions of the subject are coast and island signaling, ship signaling and land signaling, the latter being specially important for military purposes. No one system is likely to be best under all conditions and for all purposes."

Conference on Electrical Units and Standards.

By Professor Henry S. Carhart.

It is now generally known that the International Conference on Electrical Units and Standards, called by the British government to meet last month in London, was postponed till 1907 at the request of the French government. This conference is the outcome of the action taken by the Chamber of Delegates at the St. Louis International Electrical Congress in 1904.

Comments on the objects of the conference and its postponement and a letter relating thereto from Prof. Silvanus P. Thompson have recently appeared in The Times Engineering Supplement in London. The Times article gives an abstract of the conclusions of the preliminary conference held in Charlottenburg a year ago. A single statement needs slight correction. It is this: "At the conclusion of the preliminary conference it had been resolved that the experts of the various countries should come to an agreement in writing on these points before a final conference was called." To this point the following resolutions, taken verbatim from the official proceedings of the preliminary conference in Charlottenburg, relate:

"The conference expresses the wish that an international convention should be summoned in order to arrive at agreement in the electric standards which are in use in the different countries.

"The following resolution was further adopted:

"In view of the fact that the laws of the different countries in relation to electrical units are not in complete agreement, the conference holds it desirable that an official conference should be summoned in the course of a year with the object of bringing about this agreement.

"The conference further expresses the opinion:

"1. That the information before it is not sufficient to enable it to propose any alteration in the formerly accepted value of the ampere.

"2. That the information before it is not sufficient to enable it to lay down exact directions in respect to the silver voltameter and the standard cell.

"3. That if a proposal for a change in the accepted value of the ampere is to be brought from any source before a formal congress to be held later, an agreement in writing on the point should be come to previously between the parties interested. If differences of opinion in the matter cannot be removed, a new preliminary conference should be held.

"The same procedure should be observed in regard to the silver voltameter and the standard cell, in the event of such specifications being submitted to a formal conference from any quarter."

It appears, therefore, that an agreement in writing was regarded as essential only in case a proposal should be brought from any quarter for a change in the accepted value of the ampere; and the same procedure was to be observed in case any proposal should come to change the present specifications for the silver voltameter and the standard cell.

I am not aware that any such proposals had actually been made. The conference was deferred because it is inevitable that new specifications for the silver coulometer and the standard cell must be adopted, and no one is yet quite ready with these specifications; much less has agreement been reached by the experts engaged on researches relating to both standards. If the preliminary conference had chosen the ohm and the volt as the two fundamental units, it would not have been necessary to revise the electrochemical equivalent of silver and the specifications covering the silver coulometer. The international ohm having already been everywhere accepted, it would only have been necessary to perfect the specifications relating to the Weston normal cell, which the conference agreed to adopt.

As it is, a heavy burden is laid on physical research of the most exacting kind in order to correct, if necessary, the accepted value of the electrochemical equivalent of silver; to revise the specifications in accordance with which the silver must be deposited, washed and weighed. In addition, specifications must be decided upon for preparing the materials for standard cells and for setting them up; and their electromotive force must be determined in absolute measure, because admittedly the standard cell is the practical standard for electromotive force; and the only practicable method of measuring currents and calibrating ammeters is to measure the fall of potential over a standard resistance by means of a standard cell.

Researches on all these points are in progress in Germany, France, England and the United States. The work is by no means completed, and the decision to postpone the official conference for a year was undoubtedly a wise one. It is hoped that the necessary agreement may be reached before the conference assembles in London next autumn.

Professor Thompson's letter relates chiefly to the international ohm as defined by the resistance of a column of mercury. Singularly enough, he interprets the statement relating to this accepted international unit as "a proposal to change the present legal ohm standard, which is a standard made of wire of platinum alloy deposited at the Board of Trade and marked 'Board of Trade Ohm Standard, Verified 1894.' This is the standard verified as in accord with the international ohm agreed upon at the Chicago Congress of 1893."

Professor Thompson's apprehension about the platinum-alloy ohm of the Board of Trade is entirely groundless. The Electrical Standards Committee of the Board of Trade in its final report in 1894 defined the ohm in the language of the Chicago Congress; and the proposals relating to the international ohm at the Charlottenburg Conference were designed to reaffirm the agreement of the Chicago Congress. The mercury ohm is the primary international standard; wire copies serve as secondary practical standards for commercial calibrations.

Professor Thompson says of the "Board of Trade Ohm Standard:" "The proposal to abandon this legal and international standard for a new one made of mercury in a glass tube * * * * is a very serious one." Really this is a most astonishing statement. It is pertinent to inquire when the wire platinum-alloy standard of the Board of Trade became an international standard. Professor Thompson ought to be aware that the international standard of resistance since 1894 has been the mercury ohm. No proposal from any source has been made to change this. The precautions adopted at Charlottenburg were designed as a safeguard of this international standard of reference—the reproducible ohm. Professor Thompson need have no fear that the Board of Trade ohm will be deposed by the International Conference. That standard is a domestic one, with which the conference will have nothing to do. It may not turn out to be as unalterable as Professor Thompson fancies. In any event its integrity will have to be checked from time to time by direct or indirect comparison with the international standard in a glass tube.

The Niagara Power Question.

The hearing before Secretary of War William H. Taft in relation to applications for permits to transmit electric power from Canada to the United States will be held on November 26th, instead of the earlier date at first mentioned. In anticipation of this hearing the American Civic Association has sent out another call, asking its members to write Secretary Taft to deny the applications for extensive taking of water for power purposes. In this letter it is stated that 500 feet of the Horseshoe Fall have already been cut off "to give a better chance to one of the power companies." This statement has aroused great indignation at Niagara, and one of the daily newspapers suggests that "if McFarland ever comes to this city again our indignant citizens should ride him out on a rail."

Still another statement in President McFarland's letter is that should the secretary of war grant permits to transmit 160,000 horsepower from Canada to the United States, it would be giving approval "to abstract from the Niagara River above the falls a vast amount of water, equal in flow, in connection with the quantity now being diverted on the American side, to a rapidly running river nearly a half mile wide and 18 feet deep."

The fact is that permits have been granted for the diversion of 12,600 cubic feet of water per second on the New York side, and to develop 160,000 horsepower would mean about 13,000 cubic feet of water per second, or possibly a grand total of 26,000 cubic feet of water. Instead of making a rapidly running river of the size referred to, its velocity would be about one-half foot a second, or about one-sixth of a mile an hour.

Location of Illuminating Units for Best Efficiency.

Three papers were read at the meeting of the Illuminating Engineering Society in New York on November 9th. These papers were: "Location of Lamps and Illuminating Efficiency," by Preston S. Millar; "Fixture Design and Location," by Major E. L. Zalinski, U. S. A., and "Fixture Location in Residence Lighting," by F. N. Olcott. They were given in abstract in the Western Electrician of last week, pages 397 and 398. After the reading of the papers President Marks announced that they were open to discussion.

Discussion (in Abstract).

Major Zalinski: In regard to Mr. Millar's paper, I wish to say that he has given us data which will aid illuminating engineers in determining definitely what is requisite for any desired illumination. Coming from one who has devoted so much attention to this subject, the paper is more than ordinarily instructive. The data given are hardly obtainable elsewhere.

I am compelled to call attention to one particular portion of the paper, broaching on my own investigations. This is embodied in the latter part of Table II. I have already had measurements made in my own behalf with clear prismed glass reflectors, and with diffusing (coated) reflectors, of similar dimensions and angle of opening. But I see, for the first time, in Mr. Millar's paper, the comparative data obtained with opal and other reflectors. I have reason to be satisfied with the more uniform distribution and the much lesser variation as between maximum and minimum illumination securable with the diffusing reflectors. An inspection of Table II. will make the extent of this obvious.

Some of the data given is not in some ways quite comparable with that obtained for me. In the investigations made in my behalf, the variations between maximum and minimum were as follows:

Clear prismed glass reflectors.....122.1 per cent.
Diffusing (coated) reflectors..... 73.6 per cent.
or an advantage of 48.5 per cent., or a gain of 65 per cent.

The results as given by Mr. Millar, both for the opal and clear prismatic reflectors, far exceed this relative advantage. As previously indicated, this greater advantage may be ascribable to the particular conditions of these latter investigations. But the results of these are of value.

J. H. Hallberg: Mr. Olcott's suggestion of using the lamps on chandeliers in a vertical position, whether turned up or turned down, is a good one, because of the introduction of high-efficiency incandescent-lighting units, which I believe will require the placing of the lamp either straight up or straight down in its position.

E. Y. Porter: It seems to me, from a practical point of view—and these tests brought out by Mr. Millar seem to carry out the matter from a scientific standpoint—that the value to the illumination on a horizontal plane of the reflection from the walls and ceiling is very great, but even more than that, perhaps, is the general effect. In a great many cases we light a room, not only for the purpose of lighting a particular horizontal plane, but for lighting the whole room, the walls and ceiling, as well as the floor and desk, or whatever the particular object to be lighted may be, both from an artistic and utilitarian standpoint, as well as to prevent a great contrast of light and darkness and other effects upon the eye. Therefore, it seems to me, the use of shades or arrangements of lamps in any form of lighting whatever, which throw all the light downward, is not necessarily the best, or the most practicable, or the most artistic.

With regard to the effect of the inverse-square law, and the parabolic reflectors, I offer the suggestion that the size of the parabolic reflector would have a great effect upon this law, when used with incandescent lamps or light sources which are not strictly a point, because then the variation from the point loss applied to the parabola would be much less in the case of a large parabola than in the case of a small one, so that a thing as large as an incandescent lamp, if shaded by a large parabolic reflector, might throw the light in parallel rays, whereas if the reflector were very small it would more nearly follow the inverse-square law. The uniformity, I believe, has a very great effect on the actual illumination required for various kinds of work.

Dr. C. H. Sharp: I think that, while in one way the classification which Major Zalinski has made of reflectors is a valid one, yet we should not lose sight of the fact that the inverse-square law applies to reflectors, parabolic or otherwise—to all reflectors, in fact—which can be practically used as practical sources of light, provided only you go far enough away from the reflector to make the measurements. Within a certain region near the reflector the inverse-square law does not apply rigidly, but if you get far enough away it does apply. An extreme case is the case of the searchlight. At the focus of the mirror is the end of the positive carbon of the arc. The source of light is the crater of the arc. This crater is pretty small compared with the area of the whole reflector, but the actual practice in measuring searchlights is to measure them in accordance with the inverse-square law, only we must go a mile or two away in order to have the inverse-square law hold.

Now, in the actual case of measuring reflectors, we have to use the reflectors on lamps at distances which are comparatively short, and within the distance at which reflectors are commonly used, the inverse-square law would probably hold vigorously in all but a very few cases. It would be quite valid in nearly all of them.

The distinctions which are made between reflectors parabolic throughout and reflectors partially parabolic and conical reflectors, etc., are not very useful distinctions from the standpoint of the illuminating engineer, because, whatever the shape of the reflector, the inverse-square law is not going to hold vigorously if you are too close to it; and, as has been pointed out by the author of the paper, if we use an incandescent lamp with a reflector, there is only one point in the filament which comes within the focus anyway, and the other points will be out of focus, and the direction of the rays reflected will be a very complex one.

G. V. Williams: I will ask him (Dr. Sharp) whether he thinks there should be some change in the design of the incandescent-lamp filament for the purpose of meeting the needs of the illuminating engineer.

Dr. Sharp: I will say, in answer to that question, that I do not think it is of sufficient importance to make incandescent lamps with reflectors to obey the laws of the inverse square; that is, to justify any change in the design of incandescent-lamp filaments to produce that result.

Mr. Millar: I succeeded in getting nine gentlemen to give estimates as to the effect of the ceiling and walls on the illumination of a horizontal plane three feet above the floor. I was able only to get them to give me estimates on the percentage of increased illumination which the ceiling and the walls would produce in addition to the light from the lamps direct. In actual measurement we found that this proportion of increased illumination due to the ceiling and walls varied from 45 to 166 per cent., with different locations of the lamp.

Mr. Elliott: I have a word on the subject of parabolic reflectors. I had a series of experiments carried out in my private laboratory with a number of reflectors, and, to my surprise, I found the law of inverse squares held for all distances to which the effect would be practically used, unless you get within a very few feet, where it is so close you may say it is impracticable to use it. The size of the light source I used was an incandecent lamp, and the variation of the shape of the reflector from the theoretical was such that in practice I think that illuminating engineers can stick to the law of inverse squares.

Mr. Millar: Major Zalinski said in his discussion, in connection with the measurements of distribution of light, about the diffusing reflector, that I had given in my paper the comparative data obtained with opal and other reflectors. It was very distinctly stated in the paper that no comparison was drawn among these different reflectors. If such a comparison could have been drawn, the data would not have appeared in this paper. I desire it put on the record, very emphatically, that the conditions are so dissimilar that it would be very improper indeed to attempt to draw any comparison whatever between the different lighting auxiliaries used.

As to the remarks on the question of the adaptability of the inverse-square law to reflectors, it seems to me that it depends altogether on the nature of the reflector. I cannot agree with Mr. Elliott that illuminating engineers will do well to stick to the law of inverse squares for the time being. One of the chief difficulties in applying the law of inverse squares to the photometry of lamps used with reflectors in the usual way is that we have as a result the measurements at different distances. This means that comparisons between different reflectors are not likely to be valid when based on photometer measurements, for it is a fact that to some reflectors the law of inverse squares does not apply accurately, and therefore our comparison is vitiated as soon as we have measurements based on different distances, and with the usual photometer practice, where the photometer is moved different distances to the lamp under the screen, to secure a proper balance, we are in ignorance as to the exact distance at which the various settings are obtained.

Electrical Railroad Operation in Simplon Tunnel.

Trains have been running regularly in the Simplon Tunnel since the beginning of September, and are all taken through by the three-phase electric locomotives, with the exception of the trains "de luxe," which are using steam locomotives for the present. Between Brigue and Iselle, the two terminal stations, the average time of the trip is 20 minutes 30 seconds, which is somewhat faster than before. Going in the other direction the time is 29 minutes 30 seconds. In the second week of September the electric locomotives took 120 trains through the tunnel.

City Lighting in Milwaukee.

Agitation in Milwaukee, Wis., for a municipal lighting plant is reported to have advanced to a point where work is to be begun on construction. The discussion brought out an interesting proposition from Mr. John I. Beggs, president of the Milwaukee Electric Railway and Light Company, whereby he proposes to prove that public utilities cannot be conducted by municipalities as economically as by private corporations.

Mr. Beggs, it is reported, offers to furnish the city of Milwaukee with electric light at the price which the city of Detroit pays. Detroit has a municipal plant which is conceded to be one of the best and most up-to-date in the United States, but Mr. Beggs takes the position that he can sell light at Detroit prices and still make a profit. His offer would give Milwaukee light at the best-known municipal rates without going to an expense of $1,000,000 or more for a city-owned plant. And he expects to make a reasonable profit out of the venture.

The Detroit plant is conducted by a commission of business men and is considered the best municipal electric-lighting plant in the United States. But Mr. Beggs argues that no municipality can operate a plant as economically as a private corporation, because it costs more for help, the work is not so thoroughly done, the supervision is poorer, the waste of material is much greater, and naturally the cost of production is greater. He contends that this state of affairs cannot be eliminated while politics has influence, and politics, he asserts, cannot be eliminated from departments or institutions conducted by a municipality. Consequently, he holds that a private corporation can do as well and better than a municipality.

The offer is to give the city light on a five-year contract at $65 a lamp. If the city makes a ten year contract, he says he will furnish light at a price not to exceed $60 a lamp, and cheaper if Detroit produces light at a lower figure in its municipal plant. In short, he will meet the Detroit prices at all times, plus the difference in the price of coal between the two cities.

When Milwaukee installed its street arc lamps in 1890 the cost was $150 a lamp of 2,000 candlepower. Later it made another contract and paid $99 for lights of the underground circuit and $81 for overhead wiring. The light contract expired last December, and since that time the city has been lighted by the street-railway company without a formal contract.

Advancing Prices for Electrical Apparatus.

On account of the continued prosperity of the industries of the United States, it has been difficult for the producers of raw materials to meet the constantly increasing demand made upon them, and in several instances, although the sources of supply remain unaffected or even increased, the prices have gone up on account of lack of facilities for getting out the raw material with rapidity. Within a year, for instance, the price of copper has gone up from 20 to 25 per cent.; iron, 40 to 50 per cent., and rubber from 10 to 15 per cent. On account of labor conditions in the South, cotton yarn has advanced in price to a considerable extent.

All of these advances have their effect on the electrical industries, the price of copper and iron having, of course, the greatest effect.

The situation today as expressed by a man who is in constant touch with prices and their effects on the electrical industries is that copper will probably remain in the neighborhood of 22½ cents, which is about its present price, and that the demand for rubber will be fairly well supplied, while cotton depends largely on the condition of southern labor.

As it takes about six months to build furnaces, iron will probably increase in price somewhat with the increase in demand. The quantity of ore being almost unlimited, the question of production will depend on whether the producers have faith in the continued prosperous condition, and prepare to meet the demand that the condition indicates.

The following is given on the authority of the General Electric Company:

Prices in the electrical trade continue to show a distinct upward tendency, in sympathy with the well-maintained advance which has taken place in the prices of all raw materials. Orders for future delivery can only be placed in many instances at a considerable advance over present market quotations.

The General Electric Company, in common with many other large manufacturing concerns, is announcing a general advance in prices of electrical apparatus and supplies. This will not unlikely be followed by further advances if present market conditions continue.

Electrical Trades Associations Meet.

The eleventh annual meeting of the Electrical Trades Association of Chicago was held at the Grand Pacific Hotel, Friday evening, November 16th. More than 80 manufacturers and jobbers from the central, southern and western states were in attendance. A dinner preceded the business meeting, which was called to order by President Frank S. Beardslee. The reports of the officers of the association showed a remarkable increase in membership and an ever-widening field of efficient service. The board of directors was increased, by an amendment of the by-laws, from five to seven members.

The election of officers resulted as follows: President, Seymour Guthrie of the Kellogg Switchboard and Supply Company; vice-president, William A. Browne of the M. B. Austin Company; members of the executive board, Thos. I. Stacey of the Electric Appliance Company, Harry R. Parsons of the Western Electric Company, Frank S. Beardslee of the Beardslee Chandelier Manufacturing Company, S. E. Kennedy of the Central Electric Company, Frank M. Pierce of the Manhattan Electrical Supply Company. James Wolff of the New York Insulated Wire Company was re-elected Chicago member of the board of managers of the National Electrical Trades Association. Frederic P. Vose, who has done valuable work for the association, was reappointed secretary and treasurer.

After the conclusion of the business session Thomas G. Grier of the American Circular Loom Company acted as toastmaster, and a delightful programme followed. Mr. Grier thoughtfully supplied each guest with a booklet containing the words of the old melodies that have been popular for two or three generations, and, led by Messrs. Parsons and Pierce, the company sang the songs with much gusto and pleasure. Instrumental music was supplied throughout the evening by Tomaso's Orchestra. More than 20 of the gentlemen present responded to the invitation of the toastmaster to speak of their regard for the association, and one and all voiced the sentiment that the association service had become an indispensable adjunct to their business and that the underlying principles of co-operation in the exchange of credit information had resulted in safeguarding their credits, protecting their business from financial loss, and engendering a spirit of unity and brotherhood among the jobbers and manufacturers of the trade.

The eleventh annual meeting and dinner of the Electrical Trades Association of Philadelphia was held Thursday evening, November 1st, at the Manufacturers' Club, Philadelphia, Pa. The reports of officers showed that the value of the association to its members is of the most substantial character. The combined membership of the several local associations comprising the National association now numbers over 350 of the leading manufacturers and dealers in electrical material. After the termination of the business meeting an enjoyable social session was held, enlivened with wit and practical addresses by several of the members and guests.

The officers and directors of the Philadelphia association for the coming year are: C. E. Trump (president), representing the Novelty Electric Company, Philadelphia; C. M. Wilkins (vice-president), representing Partrick, Carter & Wilkins Company, Philadelphia; H. G. Kepler, representing Walker & Kepler, Philadelphia; F. D. Sweeten, representing Sweeten-Crossan Electric Company, Philadelphia; T. E. Hughes, Pittsburg, representing Standard Underground Cable Company; G. S. Smith, representing J. F. Buchanan & Co., Philadelphia; L. P. Dickey, representing Lawrence Gas Fixture Manufacturing Company, Philadelphia; E. A. Symmes (secretary-treasurer).

The Hammer Collection of Incandescent Lamps.

Acting after a eulogistic report from its committee on science and the arts, the Franklin Institute of Philadelphia has awarded, or is about to award, the Elliott Cresson medal to Mr. William J. Hammer of New York for his historic collection of incandescent electric lamps. This collection was exhibited at the St. Louis Exposition of 1904, and excited enthusiastic appreciation, as it is remarkably complete and interesting. Mr. Hammer has been working on his collection for 27 years. In the language of the committee, "At a great personal outlay of time, labor, thought and money, he has secured material showing practically every step in its development, from Edison's early platinum thermostatic-regulator lamp, platinum-iridium spiral lamps, multiple foil platinum lamps, oxide-of-zirconium lamps of 1878, up to the most modern type of lamps. The collection embraces not only the entire art under Edison, dating from his first commercial lamp, the famous 'paper horseshoe' lamp of 1879, his plumbago, graphite, bamboo and other vegetable-filament lamps, but also the work of Edison's contemporaries here and abroad from this early period down to the present time." Since the collection was exhibited at St. Louis, Mr. Hammer has supplemented it by samples of various lamps which have appeared since, as the tantalum and tungsten lamps. The collection is well entitled "The History of an Art," and is unique.

BOOK TABLE.

Elements of Gas-engine Design. By Sanford A. Moss, M. S., Ph. D. New York: D. Van Nostrand Company. 1906. Pages (3¾ by 6 inches), v., 197. Price, 50 cents.

In this little book the author has covered all of the fundamental principles with which a designer of gas engines should be familiar. A complete exposition of the elements only of all subjects of direct interest to the designer is given, including a discussion of the nature, derivation and relative power of gas-engine fuels. The book should be valuable to the designer, and should also prove of interest to the engineer.

Elementary Principles of Continuous-current Dynamo Design. By H. M. Hobart, B. Sc., M. I. E. E., M. A. I. E. E. London and New York: Whitaker & Co. 1906. Pages (5½ by 8¾ inches), x., 220, with 106 illustrations. Price, $3.

This book is intended, in the first instance, for students, but as the author has made available a large number of his more recent methods, formulæ and tables in accessible form, it should be useful to the practitioner of dynamo design as well. A useful and novel feature of the treatise is the introduction of 18 complete designs in tabulated form. For convenience of calculation and study, tables have been placed in each chapter, giving just enough data of the 18 machines to enable the student to calculate the parts of their design with which the chapter deals. In the appendix is given a set of tables corresponding to those occurring in the text, but with the calculations completed. The six chapters deal with the subject as follows: Chapter I., The Electric Conducting Circuit; Chapter II., The Magnetic Circuit; Chapter III., Armature Interference and the Design of Field Spool Windings; Chapter IV., The Proportioning of Continuous-current Dynamos and the Voltage Between Segments and the Reactance Voltage; Chapter V., Dynamo Design Coefficients; Chapter VI., The Application of Reversing Poles and Design for High Speed and High Voltage.

Electricity as Applied to Mining. By Arnold Lupton, G. D. Aspinall Parr and Herbert Perkin. (Second edition.) London: Crosby, Lockwood & Son. (New York: D. Van Nostrand Company.) 1906. Pages (5½ by 8¾ inches), 320 with 190 illustrations. Price, $4.50.

This book is intended to present the leading truths and main principles of electrical engineering without going into detail, and to deal especially with the subject in relation to its mining applications. By the joint authorship both the "electrical" and "mining" sides are presented by men expert in those fields. The work gives an elementary treatment of electricity in the first chapters leading to a description of dynamos and motors and the steam turbine. The subjects of electrical distribution and central plants are next dealt with, and then the authors take up the subjects of electricity as applied to various operations of the mining industry, such as coal cutting, pumping and hauling, blasting, drilling, etc. The machines and typical plants referred to are mostly English and the appendix contains the rules for installation and use of electricity issued by the Home Office under the Coal Mines Regulation Act of the English Parliament in 1887, but even though the practice may be slightly different from the American practice, the book should be of value to the mining enginer, for the use of electricity in mines and mining is growing more widespread. In this second edition the authors have brought the work thoroughly up to date and added valuable data.

Dynamo-electric Machinery (Vol. II., Seventh Edition). By Silvanus P. Thompson, D. Sc., B. A., F. R. S. London: E. and F. N. Spon. (New York: Spon & Chamberlain.) 1905. Pages (5½ by 8½ inches) xx., 848, with 546 illustrations, 15 colored plates and 24 folding plates. Price, $7.50.

Owing to the enormous increase in the use of electrical machinery since the publication of the sixth edition of "Dynamo-electric Machinery" the author of this well-known and standard book has divided the work into two volumes. Volume I. has been published and is devoted to direct-current machinery. Volume II., which is the subject of this review, is complete in itself and presents a systematic account of the subject of alternating-current machinery in its actual stage of development, and contains much that has not been published in the older editions.

The subject is taken up from the beginning, the first chapter being devoted to the principles of alternating currents. The second chapter on periodic functions is entirely new. Chapter III. describes the various types of alternators and the details of their structure. The wave form of alternating electromotive forces, magnetic leakage and armature reactions are dealt with in the next two chapters. Chapters VI. and VII. deal with winding schemes for alternators and the design of the machines and include photographic reproductions and colored plates to illustrate the subjects. An appendix to Chapter VII. describes methods of compounding alternators. In Chapter VIII. analyses are made of 14 different alternators, and in Chapter IX. especial attention is called to recent developments in steam-turbine driving. Chapter X. deals with synchronous motors, motor-generators and converters, and Chapter XI. is concerned with the question of parallel running of alternators. Chapters XII. and XIII. deal with transformers and their design; the three-phase induction motor is treated of in Chapters XIV., XV. and XVI., while Chapter XVII. takes up the subject of single-phase induction motors. The concluding Chapter, XVIII., gives a concise account of the single-phase commutator motor. Schedules have been introduced into the chapters dealing with design to facilitate the computations and to systematize the work. Twenty-four large folding plates are bound with the volume and give the designs of various alternators.

The work, which is one of the very best on the subject, has been greatly improved by the division into separate volumes, each covering a class of its own. With the new matter that has been added the present volume forms a complete, up-to-date treatise on the subject of alternating-current machinery, ranking as one of the standard authorities on the subject.

The Copper Handbook (Vol. VI.). By Horace J. Stevens. Houghton, Mich.: Published by the author. 1906. Pages (5¾ by 8½ inches), lxvi., 1,116. Price, $5.

The sixth annual edition of "The Copper Handbook" is exhaustive in its treatment of the manifold phases of the copper industry. In the first 14 chapters it contains the history, geology, chemistry, mineralogy, metallurgy and uses of copper, in addition to a glossary of mining terms and a list of copper deposits in different parts of the world.

The fifteenth chapter includes the major portion of the book and gives a short detailed description of the copper mines of the world, arranged in alphabetical order by name, regardless of location. About 5,000 different mines are listed in this edition. The last chapter contains general statistics on copper, including the world's production and the production of the leading mines, with a prediction of the future production of copper, based on the past history.

With increasing demand and abnormally high prices, the question of copper supply is becoming most important to the manufacturer and engineer and to the public. It would seem that a standard work such as this should prove to be of general value. As it also gives ratings to the mines and companies—not hesitating to denounce those which the author thinks fraudulent—it should be of aid to those who are about to consider investing money in copper properties.

Berlin Street Lighting.

Street lighting in Berlin is the subject of a letter from Consul-general A. W. Thackara, who records that the supply of electricity for lighting and industrial purposes has for many years been in the hands of a private company, which is bound to light the streets at the same price charged for industrial purposes, which is 3.8 cents per kilowatt. Moreover, the company has to pay the city treasury 10 per cent. of its gross proceeds and to give it a share in the clear profits of its business. If the clear profit exceeds six per cent. of the joint stock up to the amount of $4,760,000 the company must pay 50 per cent. of the clear profit; should the joint stock be augmented beyond $4,760,000, 50 per cent. must then be paid of the clear profit that exceeds four per cent. of the capital. Although this contract grants to the company the right to use the streets for electric conduits, it provides that competition shall not be excluded. The municipality shall also be entitled in 1915 to claim that the whole electric plant shall pass into its hands on payment of the estimated value.

For the fiscal year 1903 the Berlin Electric Works paid to their shareholders $569,772 and a total to the municipality of $677,419. In 1899 $449,820 went to the shareholders and a total of $368,630 to the municipality. For lighting purposes the cost of electricity in Berlin ranges from 7.6 to 9.5 cents per kilowatt-hour. Between the hours of 10 p. m. and 6 a. m. the rate is 7.14 cents. For industrial-power purposes the rate is 3.8 cents per kilowatt-hour.

An English company which secured the charter 80 years ago for providing Berlin with gas continues in active operation, competing, however, with municipal gas works, established later. The price of gas has been reduced several times, and now stands at 83 to 87 cents per thousand cubic feet for lighting and 80 cents for cooking and for power. For the fiscal year 1903 (the latest figures obtainable) the value of the municipal plants totaled $24,564,000 and the receipts were $7,085,896. The different systems of street gas lighting are the inverted Welsbach lights and the Erich and Gratz, each of which consumes 100 liters every hour, the upright Welsbach lights, which consume about 125 liters, and the Millenium, which consumes nine-tenths of a liter per Hefner candle.

THE SMALL CENTRAL STATION.

Practical Hints on Its Construction and Operation.

CHAPTER XVII.

Business Getting.

New-business Department.—The "new-business" department was until a few years ago an unknown proposition among electric-light and power companies; but no phase of the electric-light and power business demands greater thought and more careful consideration than that involving the expansion of the connected load and the broadening of the peak. Time was when the central-station manager thought that all persons who needed light or power would call at the office, sign an ironclad contract and oftentimes make a deposit to insure prompt payment of bills. But that day has passed.

For years the larger gas companies have conducted "new-business" departments, and have found the same very profitable; but it has only been within the last few years that central-station managers have awakened from their lethargy and have organized special departments for this important part of the work.

Nearly all of the larger central-station companies now have a corps of solicitors constantly in the field seeking new business, the number depending upon the size of the town, one solicitor being sufficient for about each 10,000 of population. The small central-station companies, however, are prone to look upon this as a fad, and very few central stations in cities of 10,000 or less engage any solicitor for this work. However, new business will not come to those who sit and wait for it. It must be sought, and electric opportunities are everywhere in any city that is of sufficient size to support a central station.

True, expenses need closer attention in the smaller stations than in the larger ones, but there is only one way of increasing the net revenue, and that is by securing additional profitable business. By profitable business is meant more especially the business that can be secured for power, sign lighting and other long-hour consumers and the various heating devices, more especially the electric flatiron, as it gives the central-station companies a greater opportunity for successfully conducting such a campaign than ever before.

A healthy electric company should at this season of the year be rushed with orders and straining to keep up with them, as the fall months are of course the time when the greatest volume of new business is secured. Houses that have been erected during the summer are nearing completion and are ready for lighting fixtures. Stores that have not been in need of light during the summer months are now clamoring for light, but there will be a number of opportunities that will be lost unless the companies have the full advantages of a properly conducted "new-business" department.

The Day Load.—It is not a very difficult matter to build up a peak load in any growing city, but it takes effort and hard work to build up a day load and to reduce the difference between the minimum and maximum demands, and the main object of the "new-business" department should be to obtain this class of business, by selling energy during those hours when it would not otherwise be utilized.

It is safe to say that in almost any city there are a number of opportunities for installing power motors. Perhaps a number of these industries are being operated by steam or gasoline engines simply because their owners have a wrong idea as to the cost of electrical energy and are not properly informed as to the many advantages to be derived from its use. In nearly every case if the central-station man will install an electric motor on trial, with the distinct understanding that if unsatisfactory it will be removed, he can obtain the consent of the owner to make the trial, and after a reasonable trial it is seldom, if ever, that the user would again consider the former method.

This business is so desirable that every possible effort should be put forth to secure it. The solicitor should have a fair knowledge of the requirements for certain machinery, and should be thoroughly posted on all the usual power-consuming devices, such as medical and dental appliances, wood cutters, laundry apparatus, etc. He should also know the special uses for which standard articles are available. For instance, one central-station company sold over 100 ceiling fans, which were placed in the entrances of restaurants, saloons, etc., to keep out flies. Fan motors are also extensively used in winter for removing frost from windows.

Have a Solicitor.—In a good many of the small stations the work of securing new business is left to the manager, but this is false economy, as the manager's time is nearly entirely occupied in looking after other important matters in connection with the station. If a central-station company feels that it cannot afford to engage a solicitor to give soliciting his entire time, secure a bright, active young man for a combination of work. The meter reader is perhaps best suited to do this work, as he is acquainted with all of the consumers, having occasion to visit them each month at the time of reading the meters. He can at such times look over the installations and can oftentimes better the existing lighting conditions. In addition to reading meters and soliciting, this man can also be utilized for collecting bills; but this refers only to small stations that would not have sufficient territory to keep a man constantly at work soliciting. Every central station, however, should, in some form or combination, maintain a "new-business" department.

Practice What You Preach.—This department should have a regular ledger account, to which should be charged soliciting, advertising, appliance demonstrations and such free appliances as are given to consumers for the purpose of increasing business or securing new business, and the appropriation should be as liberal as possible.

It is poor economy to have the office on the second floor or on some side street, or, as is often the case, at the station located on the outskirts of town. The office of a central station should be on the ground floor, in a central location, with ample show windows for the display of fixtures, fan motors, power motors, heating devices, etc.

Make the office as bright and attractive as possible, demonstrating all of the various forms of lighting. "Practice what you preach" by installing both direct and indirect show-window lights. Install an electric sign in keeping with the style you are selling. An outline-letter sign is attractive, but there is little call for it in small cities on account of the expense of operation; hence it would be better to have a reflector or transparency sign, using from five to 10 lamps; it is comparatively an easy matter to induce the merchant to install a sign of this description.

Sign and Window Lighting.—This is a source of good revenue, as it is from long-hour consumers. Most of the larger companies install window and sign lights on a flat rate, and this plan is advocated for this purpose. Have the lights controlled by a time switch, which can now be secured at a nominal cost. This induces the merchant to keep his windows properly lighted, and, aside from making the windows attractive, it gives the town an air of prosperity.

Often an order for an electric sign can be secured by making a flat rate sufficiently high to enable the customer to pay for it on monthly payments. For instance, a sign costing $60 and requiring 10 eight-candle, or 20 four-candle lamps can be sold very much easier on a contract at $10 a month for one year, or, better still, $7.50 a month for two years, than if the manager were to charge the customer $5 a month for light and $60 in cash for the sign.

Interest the Public.—The electric-light company should carry a complete line of electrical devices, properly connected, for the purpose of demonstrating the uses of such devices to customers. Install a wattmeter at a prominent place in the office and have it enclosed in a glass case, so that the customers can see it in operation. Have it properly connected to a bank of lamps, controlled by switches, so that you can readily explain the "mysteries" of meter service.

Remember that the public is very skeptical, and is usually of the opinion that all public-service companies charge exorbitant rates for their utilities. The manager's constant aim should be to overcome this prejudice. He should teach his consumers to read their meters, by sending them printed instructions. Test customers' meters in their presence if they believe them incorrect, and be liberal in adjusting the difference if it is found that the meter has been running too fast or creeping on no load, as is sometimes the case.

Advertising.—Advertising is just as essential in the electrical business as it is in the shoe or grocery business. Newspaper advertising accomplishes double duty, for, aside from its value to the company, it establishes friendly relations with the press, which is helpful at times of municipal-ownership agitation. However, do not place your advertising on the patent-medicine page, simply because it is cheap, but have it in the most conspicuous part of the paper, and change your copy frequently. Specialize each time, and have the wording short and to the point. It may be well to secure electrotypes from one of the various companies making a specialty of electrical-newspaper advertising matter.

Simple catch phrases, such as "You would enjoy reading by electric lights;" "Let us figure on wiring your house;" "Keep cool; Get a fan motor," scattered throughout the paper, form an inexpensive way of advertising, and are sure to attract attention.

An effective method in a small city is systematically to send out circulars, letters, booklets and mailing cards. These receive more attention in a small city, as the general public has more time to read and digest such articles. If monthly bills are mailed, possibly it may be well to include a circular furnished by some manufacturing company advertising the merits of some heating device, fan motor, power motor, reflector, etc.

New Devices and New Wrinkles.—Get the people interested and keep them interested in new devices.

Give one or more of the prominent physicians a heating pad, with the understanding that if it is satisfactory you may refer to him.

Give electric flatirons to some of your fashionable dressmakers and one or more of your laundries. If you can induce the laundry to demonstrate them in their windows, furnish them with free current and advertise the fact that they are using them. Also, place them on trial with any family that wishes to try them, but be sure each iron is equipped with a switch and that the fuse in the rosette is of sufficient capacity. You will find that only a small percentage of the electric irons are returned. Sell them at practically cost, as they require no additional meter, transformer or station capacity, and will increase your revenue from $5 to $10 a year. The larger central stations are buying them in lots of 1,000, and many of the companies are giving their customers the free use of irons, as the increased revenue will usually pay for them in six months' time.

Many fan motors can likewise be disposed of in a like manner. On the first hot day send your delivery wagon out with a load to be delivered to possible customers. This should be followed by a solicitor calling within a week and offering to sell the fan at cost. By starting this early in the season you can dispose of more fans than by any other method, and as each fan increases the revenue from $6 to $9 a season, it is well worth the trial; but you must be willing to spend a dollar to make two.

At certain dull seasons of the year offer special inducements to owners of old buildings to have their houses wired. Wire their house complete, including switches and two fixtures, for $40, to be paid for in 10 equal payments. Be liberal in installing switches at the proper place, for the convenience of electric lights is one of the strongest talking points, and switches, perhaps more than anything else, make it so.

The practice of giving free lamp renewals is good policy, and is steadily gaining adherents. Do not wait for a lamp to burn out, but replace it whenever it gets dim. If, however, you are charging for renewals, make a special price in dozen lots. If they are purchased only when needed, many lamp sockets will remain unfilled for considerable periods, during which time you are losing the lighting revenue.

Rates.—The question of rates is, of course, of vital importance. The rates should be fair to all classes of consumers, and there should be no discrimination. Lighting rates may be based on a maximum demand for the first hour and a reduced rate for the second hour and a low rate for the third hour and over. Exceptions, if any, should only be made to theaters, churches, public halls and such other class of consumers as use lights only after the "peak load," which usually occurs between 5:30 and 7:30 p. m., has been passed.

Power rates should be sufficiently low to secure this business in competition with other forms of power, especially in considering large units. Oftentimes a contract can be secured for operating a local flour or feed mill or for pumping the city water at practically the same cost as the steam power previously used at a fair profit to the central-station company. The sliding scale of rates should apply to power as well as lighting customers. If this rate be fixed at seven, five and three cents a kilowatt-hour, the consumer using his maximum

demand for 10 hours a day would secure an average rate of 3.6 cents a kilowatt-hour, whereas the consumer using his motor for only short periods each day would be paying the maximum rate.

Gasoline and Gas Competition.—Do not get "cold feet," and reduce a consumer's rate if he threatens to install a gasoline-lighting system, but devise means of either increasing his light or reducing his monthly consumption by installing Nernst, Gem, Meridian or other high-efficiency lamps. Often Holophane or Pagoda reflectors will bring him back into the fold. If, however, he does actually install gasoline or gas lamps, do not "knock" or boycott him. On the contrary, "nurse" him as you never did before and keep him from persuading others to follow his example.

Gasoline lights must have their run in nearly every town, but they are usually very short-lived, as they are unreliable and also dangerous. Two years ago there were 32 gasoline lighting plants in a certain town of 8,000 inhabitants, whereas today there are but four, although the electric company has maintained the same rate.

Please Your Customers.—The "new-business" department should also take care of complaints regarding poor light, high bills or poor service. In fact, it should be its duty to keep old as well as new customers in line by frequent visits and by prompt attention to their wants. Divorce the merchant from the belief that you are a "grasping corporation;" show him that you are human, and take an interest in his welfare.

[*The end.*]

Chicago Street-railway Situation.

While electrolysis of water and other service pipes has been known to exist in Chicago, to some extent, it is said that the recent equipping of the old cable lines of the traction companies with electric service has greatly added to this danger. The change from cable to trolley was hurriedly made, and the work in some instances was largely of a temporary nature, due partly to the uncertainty regarding a settlement of the traction question. The traction companies, however, promise to equip and improve their lines to such an extent as to offer proper return of the current to the power houses.

The tracks of the old cable lines are in bad shape, and in some cases poorly bonded. The Union Traction Company is said to be considering a plan to carry its return current through cables placed in the old cable conduits.

Tests made by the city electrician this week are said to show an escape of from 1½ to five volts in Randolph Street, whereas the municipal code provides that railways operated by electricity shall maintain a metallic return circuit sufficient to limit the maximum difference of potential between the return circuit and the service pipes to one volt.

Cable cars have now been entirely abandoned in Chicago, and the two surface companies are gradually perfecting the trolley service as best they can until the traction situation is finally settled and a more comprehensive scheme is worked out for the entire city. The change generally has been a decided improvement.

At this week's meeting of the City Council an order was passed instructing the local transporation committee to report at the meeting on December 3d the Cullerton ordinance providing four-cent street-car fares. "For ten years the street-car question has been before this committee," said Alderman Cullerton, "and it is no nearer settlement now than it was eight years ago. And in all this time the street-car companies have not paid the city more than $100,000 annually. The city collects from dog licenses $68,000 more than it does from the street-car companies. If the city is to get no compensation it is high time the people got some benefits, and for that reason I urged the four-cent fare."

Sleeping Cars on Illinois Traction System.

General Manager Fischer of the Illinois Traction Company has given orders for the construction of two sleeping cars to be known as "Frances" and "Theodore." They will be put in service between Decatur and St. Louis about the first of January. The two cars will cost $45,000. They are to be equipped with four motors of 100 horsepower each. One car will leave Decatur at 9:30 p. m. It will leave Springfield at 11 p. m., and will get to East St. Louis about 2:30 in the morning. A sleeper will leave St. Louis for Decatur at the same hour that one leaves for that city. The price of a berth will be a dollar. For some time Decatur and St. Louis will be the terminals of this sleeper service, but later it may be extended beyond Decatur to take in Champaign and Danville. General Manager Fischer and Superintendent Harry were in St. Louis recently trying to arrange to have interurban cars run to the Eads Bridge in East St. Louis.

Possible Transfer of Chicago Edison Properties to Subway Interests.

No evidence of any contemplated "merger" of the Chicago Edison and Chicago Subway interests was found by the City Council committee on gas, oil and electric light, and the committee went on record to that effect at a meeting held on November 16th.

Alderman Snow's resolution, providing for an investigation of the apprehended "merger," was ordered filed. Alderman Young, chairman of the committee, was instructed to submit a report of the committee's investigation, together with the opinion of the corporation counsel, at a future council meeting. Samuel Insull, president of the Chicago Edison Company, appealed to Mayor Dunne and to the Council to deal fairly with the corporation. "The company," he is reported to have said, "is not owned by rich men. More than 50 per cent. of the capital stock is owned in the city by an ordinary class of people and by widows and orphans. It appears to me that capital is being frightened away by unfriendliness." William G. Beale, counsel for the company, is said to have stated that the company had no legal authority to lease its rights, and to have asserted that there was no danger of any combination, although he understood some of the stockholders had been approached with offers for their stock.

As the Western Electrician stated in its issue of November 3d, there is little doubt that negotiations have been discussed for the transfer of the central-station interests of Chicago to the Harriman group of capitalists, which dominates the Chicago Subway Company. What the outcome of these discussions will be is unknown.

Turbine Waterwheel Tests.

A publication of unusual interest to engineers and users of waterpower is a compilation of turbine waterwheel tests and power tables by Mr. Robert E. Horton, that has just been issued by the United States Geological Survey as Water Supply Paper No. 180. The results of tests of McCormick, Hercules, Samson, Swain, and other modern wheels by the Holyoke Power Company serve as a basis for the bulk of the data, but other tests and manufacturers' tables have been utilized whenever available.

One object of the paper has been to furnish information required in measuring the flow of streams where the turbine is used as a water meter. The paper contains rating tables and the results of tests of different makes of turbines with register, pivot or cylinder gates, so that the power developed at the mills and the quantity of water used can be determined from the size and type of the wheels. As the water rights of mills can often be definitely ascertained only from the quantity of water used, and as some of the wheels are no longer built or catalogued, the records of tests of the older types will be of great value to engineers who may be required to determine questions of water rights. The pamphlet (which contains 134 pages) contains also a clear presentation of the evolution of the different types of turbines, all available data relative to the efficiency of the wheels and the power developed, a description of the best methods of turbine setting and arrangement, and a discussion of the conditions that govern the economy in size and number of turbines used.

This work, which may be obtained on application to the director of the United States Geological Survey, Washington, D. C., is probably the only published compilation of such data. Many wheels have been tested, but as a rule such work has been done for private interests and the results have not been available to the engineering public.

The Storage-battery Industry.

At a recent meeting of the Society of Engineers in England Mr. Sherard Cowper-Coles read a paper on storage-battery improvements. The author said that the annual monetary outlay for storage batteries in England and Germany was estimated at about £1,000,000 sterling, so that any economy effected in the manufacture and life of accumulators was of great importance to the industrial world. Reference was made to the alkali-nickel cell, various types of grids, and the important bearing on accumulator work of thermo electricity. Other points referred to were the need for a new type of cell for ignition, the cut-off point of discharge, with particular reference to ignition cells, the defects of the negative pasted plate, solid cells, network cells, solid network cells, and the solid non-conducting network type. The author, in making a forecast of the course development would follow, suggested that it will be in the direction of electrodes containing the electrolyte within themselves.

It is of some interest, in considering the volume of storage-battery business, to note that the value of storage batteries produced in the United States in 1905 was estimated in the Western Electrician of January 6, 1906, as $6,200,000. This is larger than the figure Mr. Cowper-Coles gives for England and Germany combined.

Trade Prospects in India.

Reports from various sources in India indicate that the United States has an opportunity to extend its sales of machinery in that rapidly progressing country. Consul-general William H. Michael writes from Calcutta that it would pay American builders of electric roads and of electric cars and appliances to send representatives to the state of Mysore. The Mysore government has recently passed a tramway (electric-road) regulation which extends to the whole state of Mysore, although primarily conceived to meet the convenience of the Mysore Manganese Company. A project is on foot to build an electric line connecting the civil and military station with the old Bangalore City line, and other extensions from that point. The whole system can be furnished with electricity from the Cauvery Falls, a head of water quite sufficient for not only the tramways but for lighting purposes and mills and factories.

Charles M. Pepper, special agent at Bombay, writes that manufacturers of the United States could enter the Indian market and capture a considerable portion of the trade now supplied by Great Britain. The many small sawmills and flour mills alone offer a profitable field for the installation of electrical machinery.

"Electrical installation in Bombay," says Mr. Pepper, "has just begun. Several years ago the Boston capitalists who owned the tramway system proposed the change from horses to electric traction and to provide power for a variety of purposes. A local English official who was strangely opposed to American enterprise succeeded in blocking an agreement with the municipality which would have enabled this to be done. Finally the Americans closed out their interests, and the work was undertaken by a British company, which, after several years, is just getting into shape to supply power. At present not more than 200 electric fans are in use in Bombay, but their number will be largely increased. The business of supplying hotels, bungalows, etc., with small electric plants appears to be in the initial stage."

As Others See Us.

To the onlooker the study of American character is often a study in contradictions; Americans are at once the most thorough and the most superficial people on earth. One may see an undertaking carried out on a scale grand enough to excite our admiration and stimulate our enterprise, while the next moment one may be face to face with something which outrages almost every principle hitherto supposed to govern its design and construction, yet withal not an unqualified failure. One reason for this is the American habit of ignoring everything that is not American. To the average American anything that has its origin outside his native country is scarcely worth notice; and if the outside world doesn't recognize this, so much the worse for the world. Such a characteristic is known in this country as swelled head, and it is by no means rare, though the owners of such heads seldom reach positions which would enable them to exert much, if indeed any, influence on the nation's work.—Electricity, London.

The foregoing characterization is of some interest if not entirely convincing. But it also serves a useful purpose, for henceforth let no critic say that the expression "swelled head" is American slang. Here it is in full transatlantic dignity.—Ed. W. E.

Gregory Company Electric Club.

The employes of the Gregory Electric Company, Sixteenth and Lincoln streets, Chicago, on November 9th organized an electric club, which will meet hereafter regularly every two weeks. About 75 members have so far joined this club. Mr. A. L. Kuehmsted, president of the company, gave an address on the "History of Electricity." Mr. J. D. Zook read a paper on "Shop Practice," and Mr. G. S. Besold gave a general talk, outlining the purposes of this club. A systematic course of lectures will be given on electricity and its applications, with demonstrations. Papers will also be read at each meeting on various topics of interest by different members, and a general discussion will follow. The meetings take place at 5:15 p. m. and last one hour. It is believed that these meetings will result in a great deal of benefit to all of the members and that the interest in the club will be maintained.

Funeral Cars for Indiana Electric Roads.

Funeral cars are the next thing to be put in operation on the trolley lines of Indiana. These cars are being fitted up in Anderson and Indianapolis to take the place of funeral carriages. These cars will be black and will have three compartments, the first for the coffin, the second for the chief mourners, and the third for friends. Willow chairs will be upholstered in leather. The windows will be elegantly draped with purple broadcloth with black satin facing. The cars will be complete in every particular, and the rates proposed to be charged will, it is said, reduce the expense of a funeral to less than one-half the cost under present methods.

Grounding of Conductors for Safety.

At the meeting of the Western Association of Electrical Inspectors in Indianapolis, October 17th to 19th, the committee which reported on the grounding of conductors for safety stated that the subject was a very broad one and should be dealt with along experimental lines. The committee urged that its suggestions be given due consideration and that hurried action be withheld because the adoption of recommendations with respect to safety in numerous cases is liable to incur great expense. Rule 13A of the National Electrical Code, which has reference to the grounding of low-potential circuits, was criticized as being not broad enough.

Especial attention was given to the electrolytic action caused to underground piping systems by the improper grounding of railway return circuits. The committee quotes extracts from the special committee on electrolysis of the American Waterworks Association, the closing paragraphs of which are as follows:

"Your committee [American Waterworks Association] is convinced after careful consideration of reliable data on the subject that there is no known practical method by which owners of underground pipes can protect them against electrolytic injury from single-trolley currents, but that there are two methods of operating electric railways by which the return currents can be kept out of the ground; namely, the conduit system as is used in New York city and in Washington, D. C., and the double overhead-trolley system as operated in Cincinnati, Ohio, and on suburban lines in the District of Columbia.

"The conduit system is more expensive to construct, and is peculiarly adapted to the larger cities. The first cost of installing a double-trolley system would be a little greater than that of a single-trolley system for the same service; while the cost of converting an existing single-trolley system to a double-trolley system would be trifling, as compared with the enormous interests endangered by the single-trolley current.

"Ten years' experience with the double trolley in Cincinnati proves that that system is entirely practical, possesses many advantages over the single trolley, is more economical in operation and maintenance, and that it completely stops the injury to the pipes."

The committee of the Western Inspectors then makes the following recommendations:

Circuits and Connections.

1. Street-railway companies should be compelled, as are electric companies and all other electric-power companies, to provide a complete metallic circuit for their current, absolutely insulated from the rails and ground. This will keep the return currents out of the ground and off the pipes, and can be accomplished either by the conduit system or by the double overhead-trolley system.

2. No connections by which a current is carried to the pipe, or induced to flow thereon, should be allowed from pipes to rails, or to other return conductors; and no other alleged remedy which permits the mains to carry any portion of the return current should be countenanced by those in charge of waterworks plants. Even the failure to prohibit or to protest against such connections might be construed by law to be a tacit consent on the part of the waterworks management to the use of the pipes as conductors, and might relieve the electric-railway company from the responsibility for the injury which would inevitably result if the mains were allowed to convey current.

It is also essential that the rails of street-railway systems be well bonded at each and every joint and that return feeders be tapped in at certain points to relieve the excess return current. Cross-overs and switches should be bonded through parallel cables completely shunted around same. If the ground return wires from light and power systems be made universal, this would also afford additional carrying capacity. It might be further suggested that at all possible points return wires or grounded conductors be tapped into underground piping system and in this manner parallel piping systems, that in case of a possible leak currents would be returned by means of copper conductors, relieving of the passing of currents from pipes to the ground.

Guard Wires and Guard Nets.

Guard wires and guard nets are for the protection or rather prevention of accidental contact between high and low potential systems. It is recommended that joints in these nets be made mechanically and electrically secure, nets to be cross laced, wires forming nets having a carrying capacity equal to the system that they are designed to protect, and be thoroughly and effectually grounded with at least two grounds having a carrying capacity equal to the maximum load carried by high-potential systems.

High-potential Pole Lines.

It is suggested that on high-potential pole lines in places where same are in access to the public, bands of zinc or copper be fastened around poles at a point not less than eight or 10 feet from ground, with bands spaced intermediate top band and the grade line, all of these to be electrically connected and thoroughly grounded with at least two grounds. This is to afford protection against life in cases where high-tension insulators break and allow high-potential wires to come in contact with pole or cross-arm, and also to guard against possible static discharges over face of insulators due to the formation of moisture or sleet over face of insulator. It is recommended that strain guys be thoroughly grounded and strain insulators be left out. On arm guys, where it is not feasible to carry ground to cross-arm, strain insulator may be interposed but anchor end should be grounded.

Protection in General.

It is further recommended for the protection of life that all metal-lamp cables, arc-lamp span cables, police and fire-alarm call boxes and all apparatus that the public may come in contact with, where there is a chance of cross with high-potential systems, have their outside shells and cases thoroughly and effectually grounded.

Grounded System for Interior Wiring.

The following is an outline of a grounded system interior wiring. While this outline does not have the sanction of the committee on grounding of conductors, yet it is recommended for consideration.

Referring again to Section 13A of the National Electric Code and its supplement covering the grounding of systems inside of buildings, would suggest that this point be carried further and a change in the system of interior wiring be formulated. In the Edison three-wire system the neutral wire should be grounded at the point of entrance in accordance with the rules under 13A of the supplement. From this point carry the neutral wire as one solid conductor without fusing throughout the system. In other words make the neutral wire in the three-wire system, or one outside in two-wire system, or one leg of one phase in the three-phase system be treated as a common return. This common-return wire would be common to every outlet, and in lieu of insulating joints where fixtures are hung on gas outlets, connect grounded wire to gas pipes at this point and also to fixture shell and stem. However, it will be necessary to wire fixtures as is required in the present system. This system of connection, as recommended at the outlet, would make the shell of the socket and the fixture stem the same polarity as the grounded side of the circuit. The opposite side of circuit would radiate from junction box thoroughly insulated in accordance with rules now in vogue, but would be protected by single-pole fusing. On installations where gas pipes are not available ground wires should be connected to fixtures as recommended above, and at every possible point ground wires should be connected to all water pipes or any such available grounds that may be had at hand.

Considering again the grounded wire, the carrying capacity of this line must be the same as the outside wire to the center of distribution and this carried on in lesser-sized wire sufficient to carry load. No fuses or switches are to be interposed on this size of system.

The first objection that presents itself to this system is the tendency of the contractors to want to make their ground wire of bare copper. It is evident that this would not be feasible on account of subjection of bare copper to moisture and the possibility of corrosion. This wire should have the same insulation covering as is now required and joints should be thoroughly soldered and protected with insulation equal to that of the wire. However, it does not seem necessary to provide porcelain tubes where wire passes through woodwork. However, it would not be deemed advisable to support this wire by means of staples, nails, etc., but would recommend that it be rigidly supported on glass or porcelain knobs merely to protect it against abrasion or mechanical injury.

In conduit systems this wire would still continue to be common to each outlet and grounded to each conduit outlet available, making the conduit pipe the same polarity as grounded wire.

The committee was composed of Frank R. Daniel (chairman), Frank S. Anderson, F. R. Easton, W. J. Canada, F. J. McDugal, George Cotton, A. M. Paddon.

A Telegraph Line in the Sahara.

The French government is building a telegraph line across the Desert of Sahara, and in connection with that work is making thorough geological and biological surveys. Within another year anybody will be able to send a telegram to Timbuctoo, says William E. Curtis, special correspondent of the Chicago Record-Herald. He says the telegraph line is being built and the surveys are being conducted under the immediate direction of the governor-general of Algeria. The wires will run from the city of Algiers to the oasis of Touat. From there they will follow a caravan trail that has been used for centuries south of the Ahagar Mountains, and thence southwestward to Timbuctoo and thence follow the river bank to the port of Dakar on the Atlantic Coast, in the province of Senegal. The work was begun last winter, and has been going on nearly nine months. Many precautions and considerable preparation were necessary, but thus far no great difficulties have been encountered. All water, provisions, materials and everything that is needed must be carried in on the backs of camels, and supply trains are passing to and fro with great regularity between Algiers and Timbuctoo and the camping grounds of the several parties. The manual labor is being done by natives from desert tribes. The explorations of the French have demonstrated that the great desert is not such a frightful place as has been represented, says Mr. Curtis.

Electric Steel Making in Germany.

Mr. G. E. Eager, the United States consul at Barmen, Germany, furnishes interesting information relating to the practical working of the Heroult process of smelting iron and steel by electricity. As reported in the Daily Consular and Trade Reports of November 8th, he says:

During the entertainment given to the visiting society of American engineers by their German colleagues at Dusseldorf on the Rhine, in August, a visit was made to the electric steel works of Richard Lindenberg, at Remscheid Haston, Rhenish Prussia, to witness the production of steel after the new patent electric process, the invention of Dr. Engineer Paul Heroult, France. On arrival at the Lindenberg works surprise was expressed by the visitors to find that under this new process the production of the highest grade steel had been in successful operation continuously night and day since February, 1906, and that after a sufficient trial of the new process the old crucible methods formerly employed had been entirely discontinued.

This plant produces almost exclusively high-grade and alloy steel, for which there is a great demand by the immense skate, cutlery and tool manufactories in this district, of which industries those at Remschied and Solingen are the most important in Germany, and the demand for the new steel has been so great that an enlargement of the plant is being made to increase the output. Up to the present time high-quality steel has been produced by a smelting process in graphite crucibles with a capacity of only 65 to 110 pounds, and as the necessary raw material had to be imported from Sweden or Steiermark, the expense was very great, costing from 80 marks ($19.04) to 350 marks ($83.30) per ton, with an additional smelting expense of from 37.80 marks ($9) to 100 marks ($24) a ton.

At the Lindenberg electric works high-grade steel is produced from the most ordinary scrap-iron rubbish of the cheapest kind and quality, and its condition is quite immaterial, as by the process all damaging substances, such as sulphur and phosphor, are practically eliminated, being reduced to one one-hundredth of one per cent. The cost of this scrap iron varies from 45 marks ($10.71) to 60 marks ($14.28) for 1,000 kilos (2,200 pounds), and the loss of material in slag and refuse varies between six and eight per cent.

This rubbish is first melted in a tilting furnace or oven, constructed similarly to those ordinarily used in our American smelting works. After being thoroughly reduced to a fluid state it is poured and conveyed in a retort by a traveling crane to the Heroult patent electric oven, which has a capacity of from 1½ to two tons. In this oven the necessary quantities of carbon, manganese, chrome, silicum, nickel, tungstate, arsenical iron, etc., are added, to produce any kind or quality of steel desired. The whole process of production takes from two to 2½ hours.

The developing bath is heated by an electric current of 100-volt tension, which is brought into connection with the oven by means of a coal [carbon?] electrode and carried back to the current by a second coal electrode, both of these electrodes being suspended perpendicularly through the top of the oven, and adjustable so as to nearly, but not quite, come in contact with the melted mass. The current leaps from the electrode in a wide, mighty voltaic arc, and passes through the mass to the second electrode, thus producing the requisite degree of heat sufficient for the purifying and finishing process.

The casting molds for the electric steel are the same as are used in any other factory. The cost of production depends upon many points which will become clearer after further experience with the new process. Raw material, fuel, electric current, wages, etc., depend largely upon the locality, etc., and the improvements in the process that may be made make it difficult to quote reliable figures, but it is safe to say that an average quality of steel, as heretofore produced by the crucible process, can be made by the electric process for from 90.66 marks ($23) to 100 marks ($24) per ton.

We were assured by Mr Lindenberg that a great saving could be made by having ovens of 10-ton capacity. The consumption of electric current in the present two-ton furnace amounts to 360 kilowatt-hours per ton of steel of the highest grade, and it is believed that by the employment of 10-ton furnaces the current could be reduced to 160 kilowatt-hours per ton of steel of the same quality. If a lower standard of grade and purity were desired, the current might be reduced to 100 kilowatt-hours to the ton of steel.

The consumption of the electrodes is less thus

far than was calculated with the two-ton oven in use; it costs about 75 cents an hour. In a 10-ton oven this would probably be reduced to 30 cents an hour per ton. No damage to the steel from the electrodes has ever taken place, as they are never allowed to come in contact with the steel. We were assured by Mr. Lindenberg that a 10-ton oven could be as easily operated as the two-ton furnace, which, with the help of an electric traveling crane, is now performed by two men and a boy. Thus far no repairs to the oven have been necessary.

The electric steel produced at the Lindenberg works surpasses greatly any crucible steel ever made, both in quality and chemical purity. By this process the steel is freed and kept clear of all gas and bubbles, which has never been possible by the old methods. This advantage of the electric steel over the steel manufactured by the old system results in its superior purity, and permits the introduction of from 20 to 30 per cent. more carbon than in the crucible steel. The electric steel can be forged easier, is not easily affected, like the crucible steel, by the damaging influence of overheating; it is stronger and more firm, and offers a much greater resistance to wear and tear. The new system also gives added independence on account of the very ordinary material used for producing the steel.

A New Departure in Manufacturers' Agencies.

On October 1, 1906, the sales-agency partnership existing between Mr. J. Allen Haines and Mr. Dwight G. Welling was taken over by J. Allen Haines, Inc. (capital stock, $100,000), with the idea in view that a company in Chicago with a large capital, advertising independent of the companies represented, with branch offices throughout the West, numerous salesmen, etc., could not only aid the manufacturer, but could greatly aid the jobbers, electrical contractors and big buyers through the territory represented.

The active management of J. Allen Haines, Inc., is vested in the hands of men who have had long experience in the electrical trade. President James V. Watson is also president of the United Supply and Manufacturing Company. Vice-president and General Manager J. Allen Haines was formerly Chicago manager of the Electric Gas Lighting Company (now the Electric Goods Manufacturing Company), and previous to that was president of the Haines & Noyes Company. Sales Manager and Engineer Dwight G. Welling was for a number of years with the sales department of the Western Electric Company, and previous to that with the Kellogg Switchboard and Supply Company. General Salesman Otis D. Allen was formerly with the Western Electric Company, Kansas City, W. P. Crockett Company, Cnicago, and I. A. Bennett, Chicago. Manager of the Railroad Department A. Conro Fiero was formerly with the Chicago, Milwaukee and St. Paul Railway Company and the Indiana Harbor Railroad Company.

The main office of J. Allen Haines, Inc., is located at 324 Dearborn Street, Chicago, while the warehouse is at 59 Plymouth Place. A large stock of all the standard lines manufactured by the companies this company represents is always carried in stock. Branches will eventually be opened in St. Louis, St. Paul, Denver and Los Angeles. The first branch opened will be in St. Louis, in charge of a resident manager, and a large stock will be carried there.

This company has started out with the idea of doing business in the following way: Complete stock; prompt shipments; courteous treatment; the best of everything of its kind; to protect the trade; to maintain prices; on high-class articles prices always the lowest. The future of the company promises to be a big one in view of the personnel and the prominent companies which it represents in the West. These companies are as follows:

American Electrical Heater Company, Detroit, Mich., manufacturer of electric heating apparatus; Bishop Gutta-Percha Company, New York city, manufacturer of Bishop "White Core" insulated wires and cables, and 30 per cent. pure Para rubber wire, Chatterton's compound, etc.; Clifton Manufacturing Company, Boston, Mass., manufacturer of highest-grade insulating tapes, compounds, rubber goods, etc.; The Dayton Electrical Manufacturing Company, Dayton, Ohio, manufacturer of "Apple" ignition apparatus, dynamos, storage batteries, magnetos, belt and friction-clutch governors, etc.; The Electric Cable Company, New York city, manufacturer of "Voltax" insulated wire, weatherproof wire, magnet wire, railroad signal wire, underground and marine cables, etc., and "Voltax" insulating compound and preservative paint; The Reed Electrical Cordage Company, Syracuse, N. Y., manufacturer of "Kalamos" insulated wires, battery cords, annunciator and office wires, and special wires and cables for all purposes; Schwarze Electric Company, Adrian, Mich., manufacturer of the Schwarze "Universal" bell, railway crossing alarms, bells for signal towers and for fire-alarm systems, etc.; Stanley & Patterson, Inc., New York city, manufacturers of the "Faraday" and "Competition" bells, Simplex annunciators, Fielding receptacles for stage use, "Matchless" flashlight novelties, weather proof sockets, etc.; Wire and Telephone Company of America, Rome, N. Y., manufacturer of "Romoid" interior telephone wire, rubber-covered wire, magnet wire, bare copper wire, etc.

J. Allen Haines, Inc., has issued some interesting literature and catalogues, which will be furnished on request.

A VIEW IN THE CHICAGO OFFICES OF J. ALLEN HAINES, INC.

ANOTHER VIEW IN THE CHICAGO OFFICES OF J. ALLEN HAINES, INC.

Greater Safety in Green for "Clear Track" Signal.

The white light as a night signal of clear track is being banished from the Erie Railroad as unscientific in principle, and practically all of the system as far east as the Rochester division has now been equipped with a new code of lights, which makes green, instead of white, read "clear," and yellow, instead of green, read "caution." The red lenses in the low or dwarf signals, which mean "stop," have been changed to violet, not because of the teaching of scientists that this color acts more powerfully on the color-sensitive nerves than straight red, but simply to distinguish the stop signals on the through tracks from the multitudinous red signals at the interlocking points in the switching yards. White as a signal light has been doomed, because it is no color at all, and every danger and precautionary signal on a railroad is a potential source of disaster from the fact that it becomes a "clear" signal at once should anything happen to the lens of colored glass. This danger is avoided by the adoption of green as the "clear" signal, for if either a violet or green lens is broken the yellow light of the unscreened lamp in the signal lantern would spell caution to the approaching engineer. Even if the lantern should be burning bright enough to appear white, the clear light would give notice that something was wrong.

Another count which the engine drivers have held up against the white light is the ever-present danger of mistaking some chance night light beside the track for a signal that all is clear.—New York Times, November 11th.

The United States Civil Service Commission, Washington, D. C., announces an examination on December 12th and 13th at a number of cities in each of 18 states, to secure eligibles from which to make certification to fill a vacancy in the position of miscellaneous piecework computer in the Naval Observatory and other similar vacancies as they may occur in the Naval Observatory. Miscellaneous computers are paid by the hour, and earn from $800 to $1,000 per annum.

Developments in Telephone-franchise Negotiations in Chicago.

Interest in the Chicago telephone situation centers in the council committee on gas, oil and electric light, which is hearing the arguments of the several interests which are contending for the telephone privileges of the city after 1909.

The Chicago Telephone Company says that a service equal to that now given in Chicago cannot be maintained at the rates proposed by its opponents. The company has circulated petitions said to have been signed by 140,000 telephone users and other citizens favoring its proposition.

H. D. Critchfield appeared before the committee in support of the efforts to get a franchise for some company that will connect with the Independent lines of the country. Mr. Critchfield is president of the Milwaukee Independent Telephone Company and is a prominent telephone man. He is quoted as saying that the Independents within 450 miles of Chicago have 1,090,000 telephones, twice as many as the Bell has. They come to within 65 miles east of Chicago, 20 miles west and 75 miles to the south, and all are waiting to get into Chicago. What is said by the Independents to be a correct estimate of the comparative number of long-distance connections possible with either system in Chicago is shown by the following table:

State.	Independent.	Bell.
Ohio	280,000	112,000
Indiana	183,000	42,000
Michigan (lower peninsula)	90,000	90,000
Illinois (outside Chicago)	112,000	40,000
Wisconsin (except Milwaukee)	46,000	48,000
Iowa	187,000	42,000
Minnesota	35,000	35,000
Missouri	112,000	61,000
Kentucky	40,000	40,000
Kansas, Nebraska, Dakotas	185,000	30,000
Total	1,270,000	540,000

General Manager A. S. Hibbard of the Chicago Telephone Company contends that control of the lines and instruments at both ends of the line is necessary to carry on good service. He says that some of the Independent local systems are good, some bad. But if the service at the two ends of a long-distance line, run by local companies, is bad, that interferes with the Bell company's giving good long-distance service, because of lack of control of the operating conditions.

A point which may have some bearing on the Chicago situation is the fact that business men in nearby cities and towns complain of the inconvenience and expense of maintaining both telephones. Some use only the Bell, others the Independent, while many have both. Only recently the Business Men's Association of Naperville, the nearest city to Chicago where both systems are in operation, discussed this subject, and it was decided to vote on a proposition to dispense with one or the other service. The decision in this case was in favor of the Independent company, whose residence rates are slightly cheaper, the business rates being the same.

Indiana Telephone Items.

The Westland Telephone Company of Hancock County has filed articles of incorporation and proposes to purchase a switchboard and material to establish an exchange and system of telephones in the Westland church, near Greenfield. The directors include William H. Powers.

The Citizens' Telephone Company of Tell City has been incorporated to operate a telephone system in Tell City. John Sweeney, Frank J. George and Vincent Smith are directors.

A. D. Jones of New Albany and Louisville has invented a telephone by which he says a conversation can be had by a person on a moving train with a person either on or off a train at distant points. He is to make a public test of the apparatus in southern Indiana and Kentucky in a short time.

Judge Evans of the Federal Court at Louisville, Ky., has granted a temporary restraining order prohibiting the city from putting in effect the new telephone rates in accordance with the ordinance passed by the council and signed by the mayor. The signing of this ordinance was regarded as the first step toward municipal regulation. The temporary order was granted upon the motion of the Cumberland Company (Bell). A hearing for a permanent injunction was set for trial on December 8th. The ordinance which made the business rates $4 a month and residence from $2 to $3 was to take effect immediately.

Judge Alford of the Indianapolis Criminal Court has fined the tree destroyers connected with the local telephone company $30 each. It was shown that trees were ruined and destroyed almost daily in some part of the city. It is said that this incident will lead up to more stringent laws for the wanton destruction of trees in the public highways and upon private or corporate grounds.

Concrete telephone poles were manufactured in Indiana during the last week by the Richmond Home Telephone Company. They will be erected and tested as to their efficiency. These poles were designed by Superintendent Bailey. Four corrugated iron rods are covered with ordinary concrete, the material being poured into a box-like mold. The pole is octagonal in shape, 30 feet in length, and provided with mortises to be used by linemen when climbing. Cross-arm gains are provided near the top. The cross irons are to be fastened in place by means of iron bolts. The pole is as ornamental in appearance as the general run of pine poles and has the additional virtue of being perfectly straight. The strongest point in favor of concrete poles, however, is their durability, and thus the cost will be less than that of wooden poles. While the style of framework beneath the covering of the concrete might be protected by a patent, there are a score of ways by which the framework might be constructed, and for this reason it is thought that the concrete pole cannot be monopolized and may be made by the telephone companies themselves without the expense of freighting. Should the experiment with the concrete pole prove successful, it is likely that the Home Telephone Company of Richmond and many other companies throughout the state will substitute them for pine poles as fast as these become unfit for further service. S.

Telephone News from the Northwest.

The Sullivan Telephone Company of Sullivan, Wis., has been incorporated with $10,000 capital stock.

The North Star Telephone Company of Beresford, S. D., has been incorporated with $25,000 capital stock.

The Pleasant Telephone Company of Beresford, S. D., has filed articles of incorporation with $10,000 capital stock.

William M. Kerkhoff, formerly treasurer of the Twin City Telephone Company, committed suicide at Minneapolis last week. Despondency, caused by the death of his wife, is given as the cause for the act.

The franchise of the Milwaukee Independent Telephone Company, which was recently granted at Milwaukee, contains a provision for an annual investigation of the company's books by representatives of each political party.

The farmers of Valley County have organized a mutual telephone company at Ord, Neb. It will connect with the Automatic company's system at Grand Island. R.

GENERAL TELEPHONE NEWS.

The Western Telephone Company of Big Springs, Tex., has increased its capital stock from $60,000 to $120,000.

The Potter County Telephone Company has been granted a franchise for a local exchange in Gettysburg, S. D.

The San Angelo Telephone Company will construct a line from San Angelo to Wall, Tex., and another from Robert Lee to Valley View, Tex.

The North Carolina Corporation Commission has sent out notices requiring all telephone companies in the state to submit a scale of rates for the commission's inspection.

The Comstock Telephone Company of Comstock, Neb., and the Spring Ranch Telephone Company of Spring Ranch, Neb., have been incorporated, each with a capital of $10,000.

In the city of Washington, D. C., in accordance with an act of Congress, the work of removing wires and poles is progressing rapidly, and the ultimate idea of a city without overhead wires seems to be near at hand.

The Lorton (Va.) Telephone Company is chartered with a capital of $5,000. Howe Totten is president. The proposed line will be 100 miles in length when completed, running through Prince William, Fairfax and Alexandria counties.

The new Independent telephone company at O'Neil, Neb., announces that it will make arrangements at once to secure or to erect four new buildings for its plant. One of these will be a warehouse on trackage property.

The telephone company at Bahia, Brazil, hitherto the property of Sr. Pedro Caminha, has been sold to Messrs. Guinle & Co. for the sum of 400,000 milreis ($133,333 gold). The service is to be remodeled and a new central office erected.

The new Independent telephone company at Omaha is said to be about to contract with a manufacturer of automatic telephone systems to install the plant in Omaha in its entirety, the work to cost $1,500,000. The first work will be on an exchange building, and Manager Stowe of the construction company has said that he believed he could push the work through in eight months with fine weather. The exchange is to be built to handle 25,000 telephones.

E. A. Klippel, superintendent of telegraphs on the Harriman system in Oregon and Washington, is making a series of experiments with train telephones, the purpose being to devise a plan whereby the conductor will be able to converse with anyone in any part of the train from the engine cab to the sleeper. It is also purposed to install the service on freight trains. The telegraphone has been worked successfully on a distance of 200 miles and gave satisfaction. The test was made from a freight caboose during the early morning hours when no train orders were being sent over the wires in the regular way.

CORRESPONDENCE.

Continental Europe.

Paris, November 6.—The Societa Elettrochemica di Pont St. Martin has recently erected a hydraulic plant in Italy for the purpose of carbide manufacture, as well as for power distribution in the surrounding region. Having secured a concession for a fall of 45 feet and an output of 1,000 cubic feet per second from the Doire Baltea stream in the Aosta Valley, it has some 4,200 horsepower available. Of this amount the company uses 3,000 horsepower for the power lines and the remainder it proposes to utilize for carbide manufacture. The engineering designs have been carried out by V. Soldati, an Italian engineer of note. In the station there are five turbine groups. Three-phase alternators are used, giving current at 3,000 volts. Step-up transformers raise the voltage to 15,000 for the overhead line. Six wires are used for the latter, and at present the power lines have about 50 miles total length.

The municipality of the town of Avilès, in the Oviedo province of Spain, is advertising for bids for the public electric-lighting service of the town during a period of 20 years. The municipality of Linares, in the province of Jaen, applies for bids for the lighting of the streets, squares and promenades of that town for a 12-year period. Gas, electric lighting or a combination system will be considered. Bids for public lighting for a period of 15 years have been opened by the municipality of Pontevedra.

Application has been made to different nations by the Commercial Museum of Osaka, Japan, for specimens of articles such as will be likely to find a market in that country. Such specimens should be accompanied by the proper explanations, and they will be exhibited free of all charges.

Single-phase traction on the Westinghouse system is now in use on a suburban line running from Rome to Civita Castellana. A motor car having a pantagraph trolley mounted on the roof takes current from a single wire. The car takes one or two trailers of the open type. At present there are seven motor cars in use on the suburban line.

At the Milan Exposition the Compagnie Internationale d'Electricite of Liège, Belgium, exhibited a new electric locomotive for handling railroad cars in the station yards. It is ordered by the Belgian government. The combination gasoline-electric system is used here, and the locomotive contains a four-cylinder engine coupled to a dynamo, using a storage battery in parallel with the latter. Current is sent to the motors which drive the axles.

They also exhibit a new form of motor-driven capstan, which is of use in railroad yards or wharves. It winds up the cable at the rate of three feet per second by using a 22-horsepower motor.

A patent for a process has been applied for in Austria relating to the manufacture of tungsten or molybdenum filaments. Compounds of these metals, especially the sulphides or the oxides, are mixed with amorphous sulphur at a moderate heat, so as to make a paste which can be drawn into filaments. These are treated by heating in a reducing gas until all the sulphur is driven off; then the resulting metallic filament is consolidated by passing a current through it so as to bring it to incandescence. A. de C.

Great Britain.

London, November 7.—The London County Council is risking nothing this session in the matter of expert advice in connection with its electric-power scheme. In addition to the services of its two permanent officials, the chief officers of the tramways and the tramways electrical engineer, three independent experts have been retained. Robert Hammond and J. F. C. Snell are again engaged on the bill, and to them H. F. Parshall is added. Mr. Parshall is well known across the Atlantic, and noteworthy examples of his work here are the Central London Railway and the Lancashire and Yorkshire electric-power schemes. The fact that in the council's power scheme this year the Greenwich tramway power station, with only 6,600 volts, is left out of the question and that the probable site of the new power station will be well down the River Thames, where ocean-going steamers may unload coal direct, is a complete vindication of the scheme and ideas put forward by Mr. Merz last year.

Recent electric-railway accidents have raised the question of the abolition of the hand brake, seeing that in more than one instance the application of this was the direct cause of the catastrophe, in that the locked wheels prevented the use of the magnetic brake. It is a large question, and difference of opinion exists among the experts, but in view of the comparative scarcity of such accidents, it is pretty clear that a more intelligent understanding of the brakes at his command is needed on the part of the driver, and this, of course, it is the business of the tramway authority to insure.

The session of the Institution of Electrical Engineers opens two days hence, the occasion being that upon which Dr. R. T. Glazebrook, F. R. S., will deliver his presidential address. Dr. Glazebrook has been closely identified with the movement towards

the establishment of an international system of units. It may be that his address will have something to say on this subject.

The engineering and machinery exhibition which recently ran for a month at Olympia has emulated the electrical exhibition of the previous year by realizing a substantial sum to be placed to the credit of engineering benevolent funds. The sum in question was $2,500. It is proposed to hold a similar show next year.

Some speeches made at the transfer of the Brighton municipal telephone system to the postmaster-general have given rise to considerable mirth, but there would be a serious side to the matter were it not for the knowledge that municipal telephony is dead. The mayor of Brighton took advantage of a little ceremony at the transfer to expatiate upon the sound, genuine business which the postmaster had acquired, but whether this view is shared in official quarters or not may be judged from the decision of the postoffice authorities to reconstruct the exchange and increase the subscription rates, which are regarded as unremunerative. This is not a question of private versus municipal ownership. It rests between a national and a local governing body, and the difference of opinion thus revealed is a sufficient index to local-government business methods, from which the electrical industry here has had to suffer much.

An installation of thermal storage in the boiler house of the electricity works at St. Pancras (London) is interesting. The growing business in this district necessitated further boiler plant, and an estimate has been arrived at by which, for the sum of $15,000, an installation of Mr. Druitt Halpin's thermal storage system can be put in to give the required additional power, as against $60,000 for the erection of four new boilers which would be required. In this way two additional turbines may be put upon the load and run from the existing boiler plant without extensions.

Two more electric railways in London are now practically ready for traffic. One is a branch line several miles long which works in conjunction with the "Circle." When this is finally in operation—electric trains are gradually being put into service—the last steam trains will be withdrawn from the "Circle," and no longer will the complaint exist that the electrical working is hampered by the existence of steam trains. The other line is the belated Great Northern, Piccadilly and Brompton tube line, one of the Yerkes group, which gives a most important and much needed communication between the North of London and the Southwest.

A home office return just made, dealing with accidents in mines, states that out of 138 such accidents, fatal and non-fatal, only four can be attributed to electrical causes. Two are traceable to coal-cutting machines driven electrically. G.

Dominion of Canada.

Ottawa, November 17.—At a meeting of the directors of the Montreal Street Railway a resolution was adopted authorizing the issue of 20,000 additional shares of stock of the par value of $100 each.

Representatives of the Grand Falls Power Company of New Brunswick say that the company will begin to install its plant early in the spring.

Mr. A. V. Bax, secretary of the Ontario Hydro-electric Power Commission, has notified the civic authorities of the city of Brockville, Ont., that the commission has obtained such tenders as will enable it to give the city an estimate for power as follows: 1,000 horsepower at $25 per horsepower per annum, including 30-year sinking fund. It was pointed out that should Brockville induce Prescott, Gananoque and Kingston to co-operate, the estimated price would be reduced to at least $20 per horsepower. These prices cover a 24-hour continuous service. Some months ago the commission came to Ottawa and made an agreement with the Hull and Ottawa Power Company in regard to supplying power to the Ottawa municipal electric plant. Nothing definite has yet been given out, but in the course of a few days the contract is expected to be closed. The price to be paid for power will be $15 per horsepower per year. J. H. Fryer, president of the Western Municipal Power Association, states that things are shaping splendidly for Niagara power. The prices given by the commission are considerably under first estimates and the figures now given, even, are the maximum figures. The price of power delivered in Galt, Ont., will range between $16 and $19, provided 2,500 horsepower is taken; in Guelph, from $17 to $20, and in Berlin, $15.50 to $18.50.

A dispatch from the Niagara Falls Power Company announces that one of the new electric generators installed there for the purpose of supplying electricity to the city of Toronto has been started and has proved a complete success. This generator, which is one of four such to be put into service by the company, is capable of generating 15,000 horsepower. It was manufactured by the Canadian Westinghouse Company, of Peterboro, Ont. It is expected that by the 24th inst. the Niagara Power Company will be supplying electricity to Toronto. W.

New England.

Boston, Mass., November 15.—The New England Telephone and Telegraph Company has installed the common-battery system in its Waltham, Mass., exchange, which has a capacity of 8,800 lines and is connected with 22 other exchanges by 104 trunk lines.

The Bryan Marsh Company of New York, manufacturer of incandescent lamps, bought the Farwell Worsted Company's mills at Central Falls, R. I., when they were sold at auction on Tuesday. The Bryan Marsh Company has a factory at Marlboro, Mass., and it will start another one in the Farwell mills, where 500 people will be employed.

The Publishers' Paper Company is preparing to apply for a legislative charter to furnish electric power to Portland, Me., and some of its suburbs, in competition with the Portland Electric Light Company. The Publishers' Paper Company has extensive water privileges in southwestern Maine, from which electrical power will be conveyed to its paper-manufacturing plant at Portsmouth, N. H.

It is rumored that the New York, New Haven and Hartford Railroad Company, through a subsidiary company, is to secure control of the Ray system of electric railways, connecting Providence and Woonsocket, R. I., the Rhode Island Security Company's lines centering in Providence, and the Uxbridge and Blackstone Street Railway Company's road, making a through electric railway between Providence and Worcester, Mass.

The Boston City Council committee on municipal lighting has again met and adjourned without taking any action regarding a report to the City Council.

The Southern New England Telephone Company's stockholders have voted to authorize an issue of new stock amounting to $2,000,000, making a total of $8,000,000. The new stock will be offered to stockholders to the extent of 40 per cent. of their holdings on November 15th.

The Boston and Northern Street Railway Company has petitioned for authority to issue additional stock amounting to $300,000, and the Old Colony Street Railway Company $200,000, the proceeds to be used for additions and improvements to their properties. These companies form the Massachusetts Electric Companies.

The General Electric Company has obtained a contract to supply a considerable portion of the apparatus for the electric-railway laboratory at the Worcester (Mass.) Polytechnic Institute. The apparatus includes a motor-generator set, an equipment for an electric car with four motors, a set of multiple-unit-control apparatus, an air-brake equipment and a pair of railway motors.

The Boston Elevated Railway Company reports for the year ended September 30th as follows, the figures in parentheses being for the previous year: Gross earnings, $13,527,185 ($12,689,676); operating expenses $9,306,950 ($8,617,653); net earnings $4,220,235 ($4,072,023); total net income, $4,327,661 ($4,123,916); charges, $3,475,882 ($3,288,831); dividends, $798,000 ($798,000); surplus, $53,779 ($37,085). The assets aggregate $29,087,222, the liabilities are $26,359,998, and the balance-sheet surplus is $2,727,224. The company's trackage amounts to 457½ miles and three passengers, seven employes and 17 other persons were killed, and 2,683 passengers, 89 employes and 944 other persons were injured on its property during the year. Its salaries amounted to $3,866,781 and it paid $318,265 for legal expenses and $603,576 for damages through injuries to persons. B.

New York.

New York, November 17.—With Thursday's suggestion of winter announcement was made by the New York City Railway Company, which operates all the surface trolley lines in Manhattan and the Bronx, that all its cars will soon be equipped with vestibules. This promise follows years of agitation to get the company to give its employes in winter the same sort of shelter long ago adopted all over the United States outside of New York.

When the State Board of Railroad Commissioners met in Buffalo on November 14th it was recommended that the New York City Railway Company should increase its service in Manhattan 10 per cent. during the hours of 6:30 to 9 a. m., and from 5 to 7 p. m. The recommendations are to take effect on November 26, 1906. The action of the committee is the result of many complaints, especially by those traveling over the Broadway lines.

Petitions signed by several thousand residents of Washington Heights and Inwood were presented to the Rapid Transit Commission at its meeting of November 15th, asking that the Interborough Railway Company be ordered to give rapid transit above Ninety-sixth Street. The Board of Aldermen took up the matter also and passed a resolution petitioning the Rapid Transit Commission to act. As a result, the Interborough company was ordered to begin the operation of express trains on the Broadway division of the subway as far up as One-hundred-and-thirty-seventh Street. This will materially shorten the running time from and to points north of One-hundred-and-forty-fifth Street.

At the same Rapid Transit Board meeting President Orr told the other members that several members of the contract committee were inclined to favor the granting of a franchise to the Behr monorail concern for the construction of a road from the Atlantic Avenue ferry, Brooklyn, to Coney Island. The board agreed to leave the matter entirely in the hands of the contract committee.

In his report to the commission, Chief Engineer George S. Rice of the New York Central Railroad gave information to the effect that the New York Central Railroad is considering the building of a two-track subway through Fifty-third Street, from its tracks on Park Avenue to the proposed freight subway to be built on Eleventh or Twelfth Avenue, to take the place of the surface tracks on the former thoroughfare, which were ordered removed by an act of the last Legislature. Such a subway as that proposed would enable the New York Central to bring much of its suburban traffic into the Grand Central by way of the river-front route through a subway which would be constructed with the company's money, but probably without any large payment to the city for the franchise. The proposal might also put the Central in competition with the Interborough for the upper West Side traffic, and it might have some slight effect on the building of a cross-town subway under Fifty-ninth Street, which is contemplated in the plans of the commission. Mr. Rice proposed two alternative routes for the accommodation of the trains now operated over the Eleventh Avenue surface tracks. One route follows the present lines south to Canal and West streets, and proceeds thence down West Street to Franklin. The other route is under either Twelfth or Thirteenth avenues and Marginal Street to West Street, and thence south under West Street. The engineer estimates the cost of the first-named route at $29,700,000 and the second at $33,150,000, with an additional cost of $850,000 for spurs to wharves and warehouses.

The Richmond Light and Railroad Company announced through Edward Lauterbach, on November 15th, that it would immediately spend a large sum to put its plant in proper shape. Mr. Lauterbach said that the company is prepared to spend $80,000 for new apparatus.

The Electric Floor Surfacer Company and the United Electric Service Company, both of New York, have been incorporated recently.

A dinner of the directors of the Telharmonium Company was given at Martin's restaurant, in this city, a few days ago. The guests were entertained with music which came over the wires from the Thirty-ninth Street station, a mile away. This is the first transmission of this music since the installation of the plant at Thirty-ninth Street. By those present it was remarked that the sound filled the room and was as full and pervasive as if the keyboard had been but a few feet away. A two-pair cable was run from the Thirty-ninth Street plant to the Thirty-eighth Street telephone central station. From there two pairs of the telephone company's spare cables were led into a manhole on Fifth Avenue at the corner of Twenty-sixth Street. From this manhole ran a two-pair cable through the telephone conduit into the basement of an apartment next door to Martin's, and thence to the dining room, where it was connected to two telephone receivers. When the line was tested with a one-to-two transformation it gave about 30 volts on the line, and the music was much too loud for the room. Finally, however, the ratio was changed to one to 1½, giving an average voltage of about 20 and a volume of sound exactly suited to the room. C. I. C.

Southeastern States.

Charlotte, N. C., November 17.—The South Carolina Public Service Corporation, recently announced, with $10,000,000 capital, promises to be a bigger undertaking than was anticipated. This company proposes to build electric railways during the next two years connecting the larger towns and extending probably to Charlotte, N. C. It is undoubtedly the biggest thing of the kind of the South, and if its present plans materialize they will succeed in introducing a new era in transportation in the section covered by the system.

The new manufacturing plant of the Bailey Manufacturing Company, in Waycross, Ga., will be entirely equipped with electrically propelled machinery.

The Southern Power Company is making good headway in its preparations for developing the waterpower at Ninety-nine Islands, and it is calculated that about 30,000 horsepower will be developed. The Electric Manufacturing and Power Company is also developing a power at Gaston Shoals in the same section of South Carolina.

The city of Richmond, Va., has accepted the offer of the Virginia Passenger and Power Company to supply arc lights to the city at $54.75 each for one year. A proposition to furnish bulk power to the city at the switchboard was turned down. This apparently puts out of sight for the present the question of municipal ownership.

The plant of the Rome (Ga.) Light and Railway Company has been sold to S. S. Bush and others in the Columbia Finance and Trust Company of Louisville, Ky., for $400,000, including the purchase price and the contemplated improvements. The purchasers control traction properties in a number of towns in the Northeast.

After two years of work the electric power plant on Saluda River near Greenville, S. C., is being completed and will be ready for use soon.

The Atlanta and Carolina Construction Company has been granted a franchise to build its proposed interurban lines to West Point and Conyers, Ga. A part of the necessary material has already been secured.

The movement to organize a company to build

an electric railway from Albany, Ga., to Macon, to connect with the line from Macon to Atlanta, has proven a success, and James S. Davis has been sent by the Albany promoters to New York to solicit capital for the venture.

The W. M. Perry Electric Company of Columbia, S. C., has a contract for furnishing motors for the Southern Aseptic Laboratories, 11 motors in all; also the contract for electrical equipment for several large hotels.

The new electric-light plant at Bamberg, S. C., has been started up and is satisfactory. It was installed by the Electric Supply Company of Savannah, Ga. L.

Ohio.

Cleveland, November 17.—The Cleveland, Alliance and Mahoning Valley Railroad Company of Cleveland has been incorporated with a capital stock of $10,000. James W. Holcomb of Cleveland is the leading spirit of the company. The route will parallel the present Cleveland and Pittsburg steam road. Connection will be made at Alliance with the Stark electric, and gaps will be filled in to give a through east and west line from Sharon, Pa., to Mansfield, Ohio.

Western Union telegraph operators at Cleveland are considering a demand for a 10 per cent. advance in wages.

Stockholders of the Gold Mines and Power Company, a Colorado corporation, with general offices in Columbus, have elected directors, headed by Cyrus Huling. It is the intention to build a generating plant in San Juan County, Colorado, where waterpower can be secured from an elevated lake. Current will be furnished to mine plants in locations adjacent to the station.

The Citizens' Light Company of Manchester has been incorporated by J. E. Leas and others. The capital stock is $25,000.

A reduction of 50 per cent. will be made in the commercial lighting rates at Akron by the Northern Ohio Traction and Light Company. This will be done in competition with the natural-gas company, which is selling gas at 30 cents a thousand feet.

Former Governor Myron T. Herrick of Ohio has been made president of the Central Colorado Power Company, which was recently incorporated at Denver with a capital stock of $22,500,000. The company was formed to utilize the waterpower of the swift mountain streams and generate electricity for all purposes.

The Springfield, Wilmington and Cincinnati Railway Company of Springfield has been incorporated by George F. Parmalee, Horace Andrews and others. The capital stock is $3,000,000 and the articles of incorporation provide that the road shall be built through Clark, Green, Clinton, Warren and Hamilton counties, with a branch in Green County reaching Xenia.

A handsome pavilion has been completed by the Columbus, Delaware and Marion at Glenmary Park. It is comfortably heated and furnished with a kitchen, so that it may be utilized by parties in winter.

The W. J. Barr Electric Company of Cleveland has increased its capital stock from $25,000 to $50,000.

The Indiana, Columbus and Eastern Railway has announced that through-freight service between Indianapolis and Zanesville, Ohio, has been arranged and that a reduction of 20 per cent. has been made in the rates.

Considerable speculation has been caused by the announcement that A. S. White, representing the Columbia company, has purchased control of the Cleveland Gas Light and Coke Company and the People's Gas Light Company of Cleveland, and that he is negotiating for the Cincinnati, Newport and Covington and Newport Light and Traction Company and the Union Gas and Electric Company. It is understood that the Union Gas and Electric has no intention of selling and that the negotiations for the railroad property have not made very rapid progress.

The injunction case of the Cleveland Electric Railway Company against the city and the Forest City Railway Company was argued in the United States Supreme Court at Washington Monday and Tuesday. Each side expects to win.

John J. Stanley, vice-president and general manager of the Cleveland Electric, and C. F. Emery, vice-president of the same company, submitted bids for franchises on the streets of Newberg Heights, offering a two-cent fare. The Forest City Railway Company offered to carry people for three cents. The Cleveland Electric officials made their bids individually, and they have nothing to do with the company. A forfeit of $10,000 was required of each bidder. O. M. C.

Michigan.

Grand Rapids, November 17.—The Benton Harbor-St. Joseph Electric Railway and Light Company has recently been given a new franchise, which is the most binding ever granted by the city of Benton Harbor. It provides that the company pay one-third of the cost of a new highway bridge between the two cities and furnish the electricity for turning the same. The company agrees to pave its part of all streets whenever the city is ready to pave. It is to carry police and firemen free of charge and mail carriers when in uniform and in the performance of their duty. Within two years it is agreed to have interurban lines running into the city from either Dowagiac or Watervliet, and possibly from both, and the city is to be made the terminal for a number of projected lines. The city lines are to be extended to give service to every section of the city.

The vast possibilities of the Michigan Lake Superior Power Company at the Soo are to be utilized at last. The affairs of the old company have been straightened out and there is a prospect for going ahead with the plans. Bids are being asked for the construction of a watertight forebay, 1,336 feet long and from 75 to 200 feet wide, and for 40 immense buttresses to strengthen the power house. When this is in condition it will be possible to develop the full head of water available.

Plans are on foot for the installation of a lighting plant in Stephenson. T. F. Goulder and Michael Durocher are back of the proposition.

General Manager Frank B. Kamarke of the Trans-Michigan Street Railroad Company, which is preparing to build a line from Allegan to South Haven, has been in Chicago to purchase material for the construction of the line. A franchise has been secured in Allegan and one is asked for in South Haven.

The Grand Rapids Railway Company of this city is experimenting with some new types of fenders, the Common Council having ordered the present fenders removed from the cars and others substituted. Several deaths beneath the cars have resulted in the past year. L. W. B.

Mexico.

Mexico City, November 14.—The Mexican Light and Power Company, which owns the electric power and transmission plant at Necaxa and the lighting system of this city, as well as extensive transmission lines, has added to its large holdings by purchasing the electric-lighting plants of the Compania Electrica Robert, S. A. The latter company provided the suburban towns of Tlalpam, San Angel, Coyoacan, San Pedro, Mixcoac and Tacabaya with electric lights. The price paid was $700,000 cash. R. F. Hayward, general manager of the Mexican Light and Power Company, has appointed W. N. Parsons general manager of the acquired system. Mr. Parsons' jurisdiction also extends to the company's lighting system in Churubusco and all the federal district south of Mexico City.

The government of the state of Oaxaca has awarded contracts for the installation of electric-lighting plants in the towns of Tehuantepec and Juchitan.

At a recent meeting of the stockholders of the El Oro Mining and Railway Company, Ltd., the officers said that the replacement of steam by electric power was commenced last February, and has now been applied throughout the company's property. The installation of electric power has resulted in a considerable saving in the cost of power.

A company has been organized at Puebla with a capital stock of $6,000,000 for the purpose of constructing an extensive system of electric street railways and interurban lines. It is called Compania Limitada de Luz y Fuerza Motriz de Puebla. The state and municipal governments have granted the company valuable concessions, including franchise rights to use the principal streets of the city. H.

Indiana.

Indianapolis, November 17.—It is announced that the merged companies controlled by the McGowan-Schoepf syndicate and owning the Indianapolis Terminal Station have leased for a period of 99 years 72 feet of ground directly west of the train sheds, upon which to enlarge the present train shed facilities for the admission of a number of new interurban lines that will be completed and entering Indianapolis by next spring. At least six new tracks will be added to the 11 tracks now in existence, making it the largest interurban station in the world.

Horrified at the large number killed at the wreck on the Baltimore and Ohio Railroad at Woodville last week, the Indiana Railroad Commission proposes to make a rigid investigation of the causes of the wreck, with a view, if possible, to prevent the recurrence of such a disaster. It is also proposed to punish those who are responsible for this loss of life under the laws.

Contention and dissatisfaction with the street and interurban service in Terre Haute continues. The city authorities are of the opinion that it is inadvisable for one company to undertake to furnish local and interurban-railway service, and also furnish electricity for lighting the city.

The officials of the Indianapolis and Plainfield Traction Company, commonly called the "Coal Road," are now pushing the construction of the Amo extension, and hope soon to be hauling coal from the mines into the Indianapolis market.

The Water and Light Company of Crawfordsville has completed the task of installing the big 3,000,000-gallon pump at the water and light station.

The Board of Public Works of Terre Haute has refused a franchise to the Rush Hydraulic Company, which proposes to supply the cities of Southeastern Indiana with electric light and power from a waterpower plant to be established in White River. The refusal is based on the demands of the company that the contract for street lighting be let several years in advance of the completion of the plant.

The City Council of Kokomo has declared the franchise of the Kokomo Gas and Light Company forfeited, and insists that the corporation is a trespasser in the streets. The City Council is holding out encouragement to any new company to come and occupy the field for lighting and power purposes.

The Indianapolis Light and Heat Company is proposing to make use of concrete poles. The company has made every effort to place the new arc lamps ordered, but cannot do so because of its inability to secure wooden poles.

James M. Dennis, an inventor of Richmond, Ind., has made application for a patent on an electric sign, which, it is said, will be very economical. He uses small mirrors to reflect the light of a few lamps, and it is claimed for the new sign that it can be read as well by day as by night. He has already begun the manufacture of the sign, and has put a number in operation in Richmond, Newcastle and other cities.

The Board of Public Works of Terre Haute has granted the Reagan Gas Company a franchise to furnish the city natural gas from the Illinois field at 30 cents a thousand feet, or artificial gas at 50 cents a thousand, the company to pay two per cent. of the gross receipts to the city, and agrees to a clause forfeiting the franchise in case of collusion of other gas companies. S. S.

Illinois.

Peoria, November 17.—The Tolono Ice, Light and Power Company of Tolono has been incorporated with a capital of $10,000 by A. L. Vanmeter, E. L. Brya and W. N. Riley.

Articles of incorporation for the Aurora Railway Company, with a capital stock of $300,000, have been filed. The new company has been formed by interests identified with the Aurora, DeKalb and Rockford Railway, and the plan is to take over the franchise for city lines granted that company, which was recently granted a franchise to enter Aurora.

The Ajax Line Material Company of Chicago has increased the capital stock from $15,000 to $30,000.

The National School of Telegraphy of Danville has been incorporated by K. B. Abernathy, William L. Williamson and William W. Ray.

The council of Galesburg has decided to abandon the former moonlight schedule and burn the lights every evening.

The survey for the Rock Island Southern's interurban road between Rock Island and Monmouth has been finished. General Superintendent W. W. McCullough has had the work in charge.

The three expert engineers employed by the city of Joliet to ascertain the stability of the walls being erected by the Sanitary District of Chicago for waterpower development have submitted their report. They condemn portions of the work and call for some changes. The report is signed by Edward P. North of New York, Walter F. Rice of Cleveland and Desmond Fitzgerald of Boston.

The Central Union Telephone Company has built a copper line between Greenview, Petersburg and Mason City.

The dynamo and accessories for the municipal lighting plant at Mason City have arrived and the plant is rapidly nearing completion.

The T. J. Lynn gas and electric power syndicate is negotiating for the purchase of the Quincy street-railway system. The Lynn company owns the Quincy Gas and Electric Company and has long desired the railway lines. The report is out that Mr. McKinley, who represents the owners, has offered the line for $500,000.

The board of school inspectors has accepted the bid of the Interstate Telephone Company to furnish the various schools of the city with telephone service, to center at the office of the board, for $15 a year for each instrument. The Central Union also bid.

Water mains in this city near the power house of the Peoria Railway Company were dug up this week for inspection by the Peoria Water Company. Upon being taken up they crumbled to pieces and in many places a knife blade could be pressed through them. A case is now pending in the United States Court before Judge Grosscup, in which the water company asks that the railway company be enjoined from using its present system. Much expert testimony was taken here.

In Danville the Illinois Traction Company has just finished a new concrete smokestack for the new power house. The stack was brilliantly illuminated and a banquet was served to the contractor and his employes on the top of it.

The Illinois Traction Company will ask the City Council of Bloomington for the privilege of establishing a loop in that city. The loop is to be used in connection with the Peoria and Bloomington line.

President Daily of the fifth district Independent telephone association will issue a call for the regular winter meeting of the association, to be held in this city early in December. V. N.

Northwestern States.

Minneapolis, November 17.—The Minneapolis General Electric Company is preparing plans and specifications for a new sub-station to cost about $150,000. The capacity of the old station is now being increased 50 per cent., to serve until the new one is completed, which will be next fall. The company has already commenced to lay its cables in the downtown district according to the ordinance recently passed.

The Milwaukee and Fox River Valley Railway Company has filed articles of incorporation, J. M. Saemann heading the list of stockholders. The company proposes to build a trolley line from Cedarsburg to Appleton, Wis. It is capitalized at $25,000.

The Mississippi River Electric Company, which proposes to build a dam near St. Cloud, Minn., has changed the site by coming further downstream, where better facilities for construction are afforded.

The Wisconsin Rapid Transit Company is being financed by Chicago capitalists. It is proposed to build a trolley line from Milwaukee through Fond du Lac to Ripon.

R. A. Bushnell is arranging to put in an electric-lighting system at Wessington Springs, S. D. A franchise will be voted on shortly by the council.

The Duluth Edison Electric Company is installing its first large motor and generator in its new power house near Duluth, Minn. The generator is of 1,500 kilowatts and the motor 2,100 horsepower. Duplicates of these will also be installed in the near future.

Fred Hegemeister is talking of putting in an electric-light plant at Steel City, Neb.

Paul VanAckeren has decided to install an electric-light plant at Lindsay, Neb.

The White River Power Company will apply to the council at Ashland, Wis., for a lighting and power franchise.

It has been voted at Washburn, Wis., to establish a municipal light plant.

The municipal lighting plant at Menasha, Wis., will make a trial in the spring of furnishing commercial lighting.

The Aitkin Light and Power Company wants to develop waterpower near Aitkin, Minn., and has opened negotiations with the council for furnishing the village with lighting facilities. R.

Pacific Slope.

San Francisco, November 15.—The electric street-lighting situation has been improved somewhat by the United Railroads putting into effect its promise to light Market and Sutter streets in return for the privilege granted last spring of operating overhead trolley cars on those thoroughfares. Arc lights have been hung on the company's poles both sides of Sutter Street for its entire length. Market Street has also been lighted in the same manner from the Ferry depot to Valencia Street. Permanent arc lights on ornamental poles will be installed by the company as soon as the material can be obtained and installed.

A considerable number of the 200 new cars in course of construction in the East for the United system will be of the heavy type now in use on Sutter Street. They will have separate end-compartments, partitioned off for smokers. These cars will cost about $13,000 each. A dozen new suburban cars, each carrying 48 passengers, will soon be ready for service. About 1,500 laborers are at work at reconstructing the company's street-railway lines in the city and suburbs. A connection has been put in at Market and Haight streets and the old Haight Street cable line is being rebuilt as a trolley road. By December 10th this line will be in operation from Market to Scott Street. The cable roadbed over the Powell Street hill is being repaired, and it is expected to be in operation by February 1st. It is possible that the cable loop line on Washington and Jackson streets will be ready for operation as far out as Steiner Street about the same time. The steepness of the hills on parts of these lines necessitates the restoration of the cable system, although the United Railroads is changing from cable to trolley in every part of the city where it is feasible. The counterbalance system in connection with the trolley, such as is in use on the Fillmore Street hill, is not looked upon with favor for extensions.

The Stanislaus Electric Power Company, which has a large force of men at work on its hydro-electric plant on the Stanislaus River, in California, has closed a contract with the Risdon Iron Works of San Francisco for a considerable quantity of steel pipe of large diameter for conducting power water to the waterwheels. This company expects to reach San Francisco with its transmission lines in advance of any other new company now in the field.

The city of Oakland, Cal., will have 814 arc lights in use during the coming fiscal year. In addition to this, the city will be called upon to pay for 95 ornamental electroliers on Twelfth Street, beginning in December, and 115 on Clay Street, Thirteenth Street and Eleventh Street in January. The total cost of all this will be $69,822, which exceeds the appropriation by $946. The current for this public lighting is furnished by the Oakland Gas, Light and Heat Company, subsidiary to the Pacific Gas and Electric Company of San Francisco.

The Oakland Traction Consolidated, which has a monopoly of the street-car service of Oakland, Cal., has effected a merger of its interests by formally taking over the Berkeley Traction Company, a new concern incorporated a few days previously, by stockholders of the Traction system and their friends. On the strength of this consolidation, the new Oakland Traction Consolidated filed articles of incorporation with a capital stock of $17,925,000, all of which has been subscribed. The new company owns 90 miles of electric railway besides several power houses and much rolling stock.

A new company which has been formed by State Senator Smith of Los Angeles and his associates proposes to construct a central station in Sacramento, Cal., and furnish wireless-telegraph reports of the proceedings of the state Legislature next January.

The American Amber Mica Company has been incorporated at Los Angeles, Cal., and capitalized at $300,000. The sum of $151,000 has been subscribed by C. D. York, H. L. Miller and F. M. Miller.

The Vallejo and Northern Electric Company, which was recently incorporated with a capital stock of $2,500,000, to build an interurban electric road connecting Vallejo with Cordelia, Dixon, Winters, Suisun, Vacaville and Woodland, has opened offices at Vallejo. A line of fast steamers is projected to make close connections with San Francisco. Melville Dozier of Oakland and Attorney Thomas Gregory are completing the plans for commencing construction work.

The Home Telephone Company of Alameda County has been disappointed by the amendment of the franchise ordinance which it had requested the town trustees of Berkeley, Cal., to pass. By the changes made at the last meeting, the life of the franchise was reduced from 50 to 35 years and the trustees were given power to regulate telephone rates. Final action was deferred for a week. This company is making considerable progress on its system in Oakland, Cal., having laid many miles of underground conduits. Work is still progressing in some of the principal streets, where four-duct terra-cotta conduits are being laid in banks of five. A central office is being constructed at Eighteenth and Franklin streets.

The manager of the Ventura Power Company has promised the citizens of Ojai, Cal., that he will furnish them electric lights next February, either from an independent plant to be installed in the valley or from a transmission line from the Kern River generating plant.

The Edison Electric Company's new gas plant at Whittier, Cal., recently suffered almost total destruction by fire, but a temporary plant has been installed to replace it.

The City Council of Anaheim, Cal., recently opened 10 bids for installing a light and water plant for the city, but postponed the decision on the matter to a later meeting.

The Pacific Light and Power Company has awarded Carl Leonardt the contract for constructing an electric power house at the Ocean Beach subdivision, Redondo Beach, for $72,000. Oil fuel will be used in a steam plant at this point. A.

PERSONAL.

George Fugate has been made terminal superintendent of the Illinois Traction system at Springfield, Ill.

Charles S. Pratt, Jr., superintendent of the fire-alarm telegraph system of Northampton, Mass., died in that city on November 10th.

John S. Wise, Jr., has been appointed superintendent of the new Consumers' Electric Light and Power Company of Hazleton, Pa. For five years he has been superintendent and general manager of the Electric Light, Heat and Power Company of Auburn, N. Y. Mr. Wise is a graduate of the University of Pennsylvania.

W. Kelsey Schoepf, president of the Cincinnati Traction Company, has presented $5,000 to the Street Railway Men's Mutual Benefit Association of that city. Some time ago he announced that he would make a donation of $5,000 for each increase of $20,000 in the surplus funds of the association. The first $20,000 has just been reached.

C. W. Brown, for 40 years connected with the Bell Telephone Company at Westmount, Can., has bought "The Snuggery," a farm of 30 acres at Marshfield Centre, Mass., on which is a colonial-style dwelling built by the grandson of Peregrine White, who was born on the Mayflower, the first child born to the Pilgrims after their arrival in America.

Congressman William B. McKinley, head of the Illinois Traction Company, has gone on a western trip. His first stop was at Wichita, Kan., where he inspected the only street railway owned by the McKinley syndicate outside of Illinois. Before returning Mr. McKinley will spend several weeks in New Mexico, to gain a little rest after a period of hard work.

F. A. Tucker, for 18 years superintendent of the Omaha and Council Bluffs Street Railroad Company, died on November 11th. Mr. Tucker was a native of Maine. In the early '70's he helped build the first cable street railway in San Francisco, and rose from gripman to superintendent of the road. He later became the first superintendent of the first cable line in Kansas City, going from there to Omaha, Neb., where he resided at the time of his death. He was 58 years of age.

Captain Willard Candee of the Okonite Company, New York, visited Chicago last week, making his headquarters at the offices of the Central Electric Company. Captain Candee is looking unusually well.

Mrs. Norvin Green, widow of the late Norvin Green, who was president of the Western Union Telegraph Company from April 22, 1878, to February 13, 1893, died at her home in Louisville, Ky., on November 6th. She was in her eighty-fifth year. Her husband was the first president of the American Institute of Electrical Engineers, serving from 1884 to 1886.

ELECTRIC LIGHTING.

The David City (Neb.) Electric Manufacturing Company has been incorporated with a capital stock of $50,000.

R. A. Bushnell has received a franchise for establishing a lighting system in Wessington Springs, S. D.

W. H. Standish of Granite Falls, N. D., proposes to install an electric-light, power and railway system at Cotter, Ark.

L. H. Evans of Henderson, Texas, has sold his electric-light plant to the Henderson Lumber and Planing Mill Company.

Work on the municipal electric-light plant in Clinton, Mo., has been started, and it is thought the plant will be in operation by the middle of January.

E. Humphrey, D. N. Bolton and T. J. Name have been appointed a committee to secure plans and specifications and let contracts for constructing an electric-light and water system in Clinton, Okla.

The council of Gunnison, Colo., has purchased the plant of the Gunnison Gas and Water Company. The city engineer will prepare plans for improving and extending the water and light plants.

The city of Carrollton, Ky., has voted affirmatively the proposed $25,000 bond issue for the purchase and enlargement of the electric-light plant and improvement of the waterworks. W. F. Schuerman is mayor.

Louisville (Ky.) capitalists, headed by Atilla Cox, Jr., and S. S. Busch, have purchased the Rome City (Ga.) electric-railway and lighting plant. The purchase price, including contemplated improvements, is $300,000.

W. P. Conery, representing the Bayou Teche Electric Light and Railway Company of New Orleans, has offered to buy the municipal light plant of the city of New Iberia, La. If he cannot buy the plant, he will endeavor to lease it until such time as the Legislature authorizes the city to sell out.

G. C. Adams and E. W. Hesser, electricians of Carthage, Mo., have been granted a franchise by the City Council of Alba for a light and power plant to be built in that city, the franchise to be for 10 years. A special city election is to be held to decide whether the citizens shall uphold the decision of the council.

The Board of Public Works of Knoxville, Tenn., has approved a contract with the Knoxville Railway and Light Company for 25-candlepower incandescent lamps for lighting alleys and dark corners at a rate of $22 a year per lamp. The city will replace broken globes and the company is to replace the burned-out lamps.

A newspaper dispatch from Kirkwood, Mo., says: "This city built its own lighting plant, but finds municipal ownership a failure and will close the plant. The city will buy electricity from a private company at one-third what it cost the city to make it, and then will resell to the inhabitants for enough to get the city lighting free."

The City Council of Tacoma, Wash., has decided to ask bids for the installation of an electric plant to generate current for lighting the city. The city already owns its lighting system, but buys its current from the Seattle-Tacoma Power Company, whose contract expires in one year. Recently bids were asked for renewal of the contract, and the proposals submitted were considered too high.

The Salt Lake Public Service Company announces that word has been received from W. H. Schott and J. J. Chambers, respectively consulting engineer and general manager, from Chicago, to the effect that contracts have been closed for much of the machinery for the equipment of the local plant. Locally the work of constructing the plants is progressing steadily. All the men that can be obtained are being put to work, both on the local power and steam-heating plant and on the power stations in the Big and Little Cottonwood canyons. The company is handicapped in its efforts by a lack of help.

ELECTRIC RAILWAYS.

The directors of the Wichita (Kan.) Railway and Light Company propose to build an interurban line connecting the cities of Wellington and Ar-

kansas City with Wichita. S. L. Nelson of Peoria, Ill., is general manager.

F. M. Mills has asked the city of Sioux Falls, S. D., for a franchise for a street-railway line.

The Seminole Power Company of Ft. Meyers, Fla., will build an electric railway from Ft. Meyers to Ft. Thompson.

About 2,000 motormen and conductors of the Cincinnati Traction Company will receive an increase in wages of one cent an hour on January 1st.

A certificate of merger of the Olean (N. Y.) Street Railway and the Rock City Railroad Company, forming the Olean Street Railway Company, has been filed. The capital stock is $1,400,000.

An ordinance has been passed by the Belleville (Ill.) City Council granting the Mascoutah and Belleville Electric Railway Company the right to construct and operate an electric railway over certain streets in that city.

J. M. Seaman of Sheboygan, Wis., has incorporated the Milwaukee and Fox River Valley Electric Company, and may erect an electric road to connect with the Milwaukee Northern electric line at Cedarburg, extending from that point north to Fond du Lac.

C. N. Wilson of the American Engineering Company was in Dallas, Texas, a few days in the interest of J. M. Carter and associates, who propose to build an interurban electric railway with Dallas as the center. Mr. Wilson reported favorably on the project, and the road may be built the coming year.

The Northern Indiana Railway Company of South Bend is having plans prepared for the erection of a large power plant at South Bend from which sufficient electric power will be generated to operate the cars on the Goshen-South Bend, South Bend-St. Joseph, St. Joseph-Logansport and Michigan City lines.

A report from Milwaukee, Wis., says that city has granted the Milwaukee Northern Company, which is building an electric railway from the north to the city, a franchise on the condition that it give a three-cent fare from Lindwurm farm into the city. The Milwaukee Street Railway Company was a competitor for the franchise, but the Milwaukee Northern won by agreeing to the low-fare proposition. It also guaranteed to have its road in operation within one year.

The Westinghouse Machine Company has on order for the Philadelphia Rapid Transit Company's Wyoming Avenue power station three turbine generator units, each of 6,000 kilowatts capacity. These with the one now in course of erection, will make four units of 6,000 kilowatts capacity each in this station. Six 1,500-kilowatt Westinghouse turbine generator units have been operating in this station for the last year, their satisfactory performance leading to the placing of the order for the larger ones.

On November 11th, in conjunction with the Houston Electric Company, Messrs. Bellow and Doane of Houston, Texas, inaugurated a street-railway sight-seeing service in that city. An electric touring car named "Seeing Houston" makes the trip, which is over a route taking in the residence section, Houston Heights and the manufacturing district. Every feature of the trip is fully explained by an accommodating and competent guide. Each trip will consume three hours, and cover a distance of 20 miles. The car will leave the City Hall Square on dates and time announced in the local paper.

The Illinois Central Railroad (steam) has entered into an agreement with the Chicago and Milwaukee Electric Railroad Company for the interchange of freight. The former is the first road to act on the recent opinion given by Commissioner Knapp under the new rate law to the effect that the agreement by which the railroads refused to enter into shipping arrangements with the electric roads doing interurban and interstate business was a violation of the rule relating to common carriers. It is expected that other agreements will follow, and electric lines may become a large factor in the handling of short-haul freight.

POWER TRANSMISSION.

All the cotton mills at Maiden, N. C., and the Maiden Milling Company have signed contracts with the Catawba Power Company of Rock Hill, S. C., for electric power, beginning next June. The Catawba Power Company is now stretching wires to Gastonia, and as soon as the mills at that place are equipped, the line will be extended to Maiden. It is declared that electric power will be cheaper for the mills than steam produced from either wood or coal as fuel.

The Fremont Power Company is installing an electric power plant at Granite, Ore., the power for which is generated from Olive Lake and Lost Creek. When completed the plant will be one of the largest and most complete in the Inland Empire. The power house is built of concrete blocks. It is intended to house three generators, which are connected to Pelton wheels. The power house is on Congo Creek, about two miles above the Red Boy mine, and it is the intention to convey the water, as it is discharged from the first power house under a 470-foot head to a second power house located at the mine. A power-transmission line is being constructed from the power house to Bourne, a distance of 20 miles. There will be six large copper wires in this line.

PUBLICATIONS.

The latest souvenir of the Electric Controller and Supply Company, Cleveland, is a wall card, 13 by 10 inches, bearing, in relief, the head and bust of "Laurie," a beautiful young woman. The production is a very attractive one and will be prized by recipients.

Single-phase alternating-current motors as manufactured by the Century Electric Company of St. Louis are fully described and illustrated in bulletin No. 7 from the Century company. It is stated that the company is rigidly adhering to its determination to supply motors that will be second to none in quality.

The Truxal-Painter Manufacturing Company, Chattanooga, Tenn., has issued a bulletin descriptive of the Painter hoist, which is driven by electric motor or gasoline engine. The bulletin contains illustrations of the hoist with both driving methods and showing the novel points in the apparatus.

The Westinghouse Traction Brake Company, Pittsburg, Pa., has issued Bulletin T2001, in which is described the Westinghouse straight-air-brake equipments, Schedule S M. The illustrations given show very clearly each piece of apparatus in the system and their connections and relation to one another.

The French Battery Company of Madison, Wis., makes all sizes of dry batteries. It has just issued a dainty illustrated booklet in which it gives reasons why its batteries are different from others on the market. This company's Fleur de Lis dry batteries are made under advanced French processes.

One of the latest publications issued by the Allis-Chalmers Company is an interesting bulletin, No. 1417, of smelting furnaces and accessory equipment. This company is a large manufacturer of mining machinery. The new bulletin describes and illustrates modern machinery for lead and copper smelting.

The paper by J. M. Robb of Peoria on "Organization and Conduct of a New-business Department Suitable for Central Stations in Cities of 50,000 Population and Under," which received third prize in the recent competition of the Co-operative Electrical Development Association, has been published in neat pamphlet form by that association, which is addressed at Cleveland, Ohio.

"What We Do in Iron and Steel Works Equipment, Ore and Coal-handling Machinery, etc.," is the title of a pamphlet issued by the Wellman-Seaver-Morgan Company, Cleveland, Ohio. Many illustrations are given, including views of the company's plants and works designed for various purposes, besides interior views and illustrations of different apparatus constructed by the company.

A pamphlet entitled "The New Pennsylvania Terminal, New York City" is issued by the Nernst Lamp Company, Pittsburg, Pa., and contains "a word about its architecture and another word about its lighting." The building, which is to be lighted by Nernst lamps, as readers of the Western Electrician are aware, is shown in an illustration, and it is stated that about 13,000 glower units will be used for the purpose.

An attractive advertising novelty has been issued by the National Carbon Company of Cleveland to call attention to the Columbia carbons for arc lamps. The point is that the use of a photometer will show a difference in carbons, that difference being usually in favor of the Columbia. This statement is printed on a folded circular card. On the back there is a picture of outstretched arms holding lighted candles, which illuminate the legend, "Ever try a photometer?"

Persons interested in the operation of street railways will do well to get bulletins No. 4,465 and No. 4,467, just issued by the General Electric Company. The former treats of trolley frogs, their proper selection and location for different services, and the latter of the emergency straight air-brake system. In order to meet the rapidly changing conditions in street-railway operation, the General Electric Company has developed this emergency system for the combined operation of single cars and short trains.

A valuable report on the "Composition and Character of Illinois Coals," by Prof. S. W. Parr of the University of Illinois, has been issued as Bulletin No. 3 of the Illinois State Geological Survey, Urbana, Ill. The report is accompanied by several colored maps showing location and character of coal beds and intensity of production in the state. In addition to the report, the bulletin contains chapters on the "Distribution of the Coal Beds of the State," by Mr. A. Bement of Chicago, consulting engineer, and "Tests of Illinois Coals Under Steam Boilers," by Prof. L. P. Breckenridge of the University of Illinois.

Jeffrey crushing and pulverizing machinery forms the subject of catalogue No. 31 from the Jeffrey Manufacturing Company of Columbus, Ohio. Nearly every one of the 70 pages is attractively illustrated, showing machines made to suit a wide variation of requirements.

The Allis-Chalmers Company of Milwaukee has issued a complete index of its publications—catalogues, bulletins, leaflets, etc.—giving a numerical list and also a list classified according to the subject. Within the last 16 months the department of publicity of this company, in charge of Mr. C. A. Tupper, has covered with new bulletins about 80 per cent. of the company's products. It has taken nearly 80 publications, averaging about 24 pages each, to do this. When the list is complete, the number of publications will be considerably in excess of 100. The fact is significant of the extent and variety of the company's products.

Data on bipolar ventilated motors in sizes from one-sixteenth to one-eighth horsepower for direct current are given in Bulletin No. 3205, from the Emerson Electric Manufacturing Company of St. Louis. This new type of small motor has been developed to meet the demand for a substantial, serviceable motor at a comparatively low price. Bulletin No. 3206 gives the latest data on bipolar enclosed motors, one-twentieth to one-fifth horsepower. From the same company Bulletin No. 3303 illustrates and describes direct-connected volume blowers for alternating or direct current for small heating, ventilating, drying and dust-collecting systems.

MISCELLANEOUS.

Chief Price of the Champaign, Ill., fire department advises the establishment of an electric fire-alarm system.

Raphael Haase of Indianapolis has interested the engineering department of the Panama Canal Commission in a plan he has for applying electricity on a large scale in the digging of the canal. He was invited to Washington several weeks ago, and the canal engineers are in conference with him on the plans. Mr. Haase would operate all the canal machinery from a central electrical plant, and would excavate, load cars and unload them by devices run by electricity.

Railroad companies are giving a great deal of attention to the safeguarding of their tracks at the present time. An instance is the recent contract for the installation of the automatic block signal, placed by the Boston and Maine Railroad with the Union Switch and Signal Company. This contract calls for all the material necessary to cover the equipment of the automatic block signal over at least 1,000 miles of track. The work involves an expenditure of several hundred thousand dollars and is one of the largest single contracts for automatic block signaling that has ever been placed by any company.

Several individuals are agitating a project to build a wire-rope tramway between Gangtok and Chumbi, India, in order to improve trade with Tibet. A company has been formed which has issued a prospectus under the name of the Tibet Ropeway Company. The proposal is to carry goods by means of a wire-rope tramway at a lower cost than they can be transported in any other way and much quicker. The ropeway from Gangtok to Pheema (near Chumbi) will be 20 miles long, and the estimated cost of the undertaking is $166,665. The promoter of the scheme is J. M. Korb of Darjeeling, India.

TRADE NEWS.

Owing to its increasing business in the city and vicinity of Baltimore, the H. W. Johns-Manville Company has opened a branch office at 315 Equitable Building, Baltimore, Md. This office will be in charge of Mr. W. F. Baird, previously connected with the Philadelphia branch of the company.

The sales department of the Electric Storage Battery Company of Philadelphia held its annual convention at the Bellevue-Stratford Hotel, Philadelphia, on October 24th, 25th and 26th. The convention was attended by the managers of the sales offices of the company throughout the United States, the district engineers and other officers of the company.

Under date of November 8th the New York Commercial published this dispatch from Pittsfield, Mass.: "It was announced that the Stanley Electric Manufacturing Company was to be dissolved as a corporation, and soon would be merged with the General Electric Company. Changes are to be made in the business in Pittsfield, which, it is understood, will be run along the same lines as the General Electric plant in Schenectady and in Lynn. This will mean that all the officers except those directly connected with the manufacturing of electric equipment and supplies will be transferred to Schenectady. Senator W. Murray Crane is president of the Stanley company, and C. C. Chefney of Pittsfield first vice-president."

BUSINESS.

The National Brake and Electric Company of Milwaukee, Wis., reports recent orders from a long list of well-known street-railway companies for air-brake equipments. Among the larger orders is one from the Chicago Union Traction Company for 120 equipments, 110 equipments for the United Railroads of San Francisco and 33 for the Norfolk and Portsmouth Traction Company of Norfolk, Va.

Among the recent sales secured by the Crocker-Wheeler Company of Ampere, N. J., appear the following: Two 100-kilowatt direct-current generators, to the De Laval Steam Turbine Company of Trenton, N. J.; one 1,000-kilowatt direct-current generator, to the National Tube Company of McKeesport, Pa.; one 225-horsepower 250-volt direct-current generator and 22 direct-current motors from two to 50 horsepower, to H. L. Judd Company, Wallingsford, Conn.; three transformers to the Southern Railway Company, Nashville, N. C.

The Blake Signal and Manufacturing Company, 246 Summer Street, Boston, says that in the last month it has signed contracts for its signals with various roads in the East and Middle West amounting to over $12,000. The company says that the interurban roads using a telephone system of train dispatching are beginning to realize what a valuable supplement the Blake signals make to their telephone systems. Blake signals enable the dispatchers to stop a car at any telephone point for orders, thus saving much time and also adding to the safety of operation.

The Central Electric Company of Chicago has just issued a little booklet of 28 pages of "Holiday Suggestions." The cover design is done in three colors, and is very appropriate, suggesting as it does the holiday season. The first few pages are devoted to electric reading and desk lamps, and many handsome designs are shown, and the next two pages to electric heating devices, the electric chafing dish and flatiron being given prominence. Considerable space is also given to miniature street railways, showing various motor cars, trailers, track and all parts that go to make up a complete street railway. Motors, engines and a motor boat are shown; a learner's telegraph outfit is illustrated and described, as well as a complete wireless-telegraph outfit. Flashlights, electric clocks and many other electrical novelties are shown. Persons interested may write the Central Electric Company for a copy of this booklet. Dealers and central stations will find it interesting and of value as suggesting a large field for doing a nice business among their patrons in this line during the next few weeks.

The Boston Edison Company has placed another order with the Stanley-G. I. Electric Manufacturing Company for 500 Wright demand indicators, making a total of, approximately, 20,000 of these instruments used in the territory served by the Boston Edison Company. The Chicago Edison Company has, approximately, 30,000 Wright demand indicators in use in connection with the demand system of charging for current in vogue in this city. The Wright demand indicator determines the actual maximum current which passed through it since it was last set. Connected in series with a watt-hour meter, it offers what is considered the logical and scientifically correct means of charging for electricity.

ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued (United States Patent Office) November 13, 1906.

835,493. Cut-out. Rollin A. Baldwin, New Haven, Conn., assignor to the Baldwin & Rowland Switch and Signal Company. Application filed September 8, 1905.

A floating armature having a shank projecting into a solenoid makes contact by gravity with two points on a plate and breaks this contact by action of the solenoid.

835,504. Bend, Elbow and Other Angle-piece for Electric Conduits. David M. Edwards and Ernest A. Brown, Kilburn, England, assignors to Conduits and Fittings, Limited, Kilburn, England. Application filed July 7, 1905.

A longitudinal sectional elbow has a plane of division separating the sockets into unequal parts and shoulders are provided to insure proper placing of sections together to prevent longitudinal movement of one part with respect to the other.

835,516. Electric Clock. Peter G. Giroud, New York, N. Y., assignor to the American Electrical Novelty and Manufacturing Company, New York, N. Y. Application filed October 25, 1905.

There is a clock train and escapement, and a motor therefor. Electric means are provided for storing power in the clock motor and a circuit controls the electric means. A circuit-closing member is actuated by the motor-driven movement of the clock train and an impulse spring, the circuit-closing member and impulse spring having inclined engagaing means whereby a quick circuit-closing movement is imparted to the circuit-closing member.

835,529. Portable Electric Light. Conrad Hubert, New York, N. Y. Application filed May 19, 1905.

A battery and electric lamp are carried in a casing. The lamp-carrying part is slidably movable transversely of the casing and controls the contacts of the lamp circuit.

835,605. Train Annunciator. Edward A. Everett, Detroit, Mich., assignor to the Union Switch and Signal Company, Swissvale, Pa. Application filed May 8, 1906.

An electric annunciator operates a display device and an audible signal simultaneously. Means are provided for stopping audible signal and restoring display device without a movement of the armature.

835,608. Cap for Signal Lamps. Francis L. Gilman, Montclair, N. J., assignor to the Western Electric Company, Chicago, Ill. Application filed December 18, 1905.

This is evidently for telephone switchboard signals. A tubular member has an annular flange at one end. A lens is seated outside of the flange, and a perforated shield has its rim turned under the flange, so that the lens is held in position and protected.

835,618. Fuse. Otto C. Hoffmann, Chicago, Ill., assignor to William W. Merrill, Chicago, Ill. Application filed February 26, 1904.

Two terminals of a tubular fuse each have three parts, one a tubular part to enclose the end of the tube, another a flattened portion projecting beyond the tube and the third a stop within the tubular part to abut the end of the tube within the terminal. A fuse is within the tube and attached to the terminals.

835,642. Electric Accumulator. Paul Schmitt and Charles Fabre, Paris, France. Application filed November 6, 1902.

The conductive frame or support for the active material comprises a vertical metal strip, forming one side of the frame, and horizontal strips or partitions each connected at one end to the vertical strip and having their free ends bent to form the opposite side of the frame.

835,647. Telegraph Instrument. Daniel O. Stinson, Falkville, Ala. Application filed August 26, 1905.

A coil spring is used for obtaining an adjustable tension on the armature.

835,661. Electrolytic Process of Making Bases of the Alkali-earth Metals. André Brochet and Georges Ranson, Paris, France. Application filed February 14, 1901.

This process consists in electrolyzing an anode liquid composed of a solution of sulfide of an alkaline earth and a cathode liquid composed of a solution of chloride of an alkaline earth, interposing a suitable diaphragm between the solutions, then charging the solution of the chloride of the alkaline earth with the base of the alkaline earth, then effecting the crystallization of the charged solution and finally causing the base of the alkaline earth to be deposited by cooling.

835,704. Selective Signal for Telephone Systems. Michael H. Degnan, Nashua, N. H. Application filed February 20, 1906.

A tilting box has a tortuous runway therein. There is a circuit-closing roller in the runway. A shaft has a selective cam thereon and connections are provided between the cam and the box to tilt the box according to the position of the shaft. Means are provided connected to the main line to turn the shaft.

835,728. Contact Spring for Trolley Harps. John Hensley, Huntington, Ind. Application filed March 22, 1906.

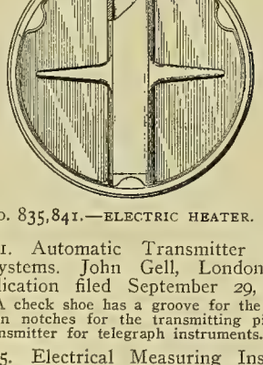
V-shaped contact springs are loosely interposed between the wheel and the arms of the harp, the end of the spring having outwardly extending portions passing through openings in the arms of the harp to prevent the rotation thereof with the wheel.

835,731. Trolley for Electric Railways. Ezra F. Landis, La Salle, N. Y. Application filed September 11, 1905.

The trolley wheel has an annular chamber and has retainers within the chamber.

835,750. Automatic Transmitter for Telegraphic Systems. John Gell, Highgate, London, England. Application filed November 28, 1904. Renewed October 19, 1906.

In combination with an automatic telegraph instrument there are a star-feed wheel, a transmitting pin, a lever connected thereto for operating it, and means for operating the lever consisting of a lantern wheel having adjustable pins.



NO. 835,841.—ELECTRIC HEATER.

835,751. Automatic Transmitter for Telegraphic Systems. John Gell, London, England. Application filed September 29, 1905.

A check shoe has a groove for the star-feed wheel and open notches for the transmitting pins of an automatic transmitter for telegraph instruments.

835,755. Electrical Measuring Instrument. Frank Holden, Rugby, England, assignor to the General Electric Company, Schenectady, N. Y. Application filed January 2, 1904.

Two similar permanent magnets having overlapping pole ends of opposite polarity are arranged in parallel planes, and a coil moves within the air gap between the pole ends. The field magnets are made of hard steel and the pole ends of soft steel.

835,759. Gas Engine. Thomas N. Kellett, Los Angeles, Cal. Application filed October 16, 1905.

A switch in the normally opened sparking circuit is arranged to close the circuit and means are secured to and operated by the circulating pump to throw the switch to close the circuit while the pump is operating. Means are provided to open the switch when the pump ceases operating.

835,763. Electric-current Regulator. Oscar H. Pieper and Alphonse F. Pieper, Rochester, N. Y. Application filed February 7, 1906.

Contracts are controlled by the movements of a pivoted member which is yieldingly held in different operative positions by a positioning device. Means are provided for throwing the positioning device out of operative condition.

835,772. Telegraph Repeater. Paul E. Bliss, Leesburg, Fla. Application filed April 18, 1906.

The circuit includes a battery, a first resistance and a second resistance higher than the first, all in series. A shunt circuit includes a battery and the first resistance in series and contains a circuit-breaker. An electromagnet has its armature mechanically connected with the circuit-breaker and a main-line circuit-breaker.

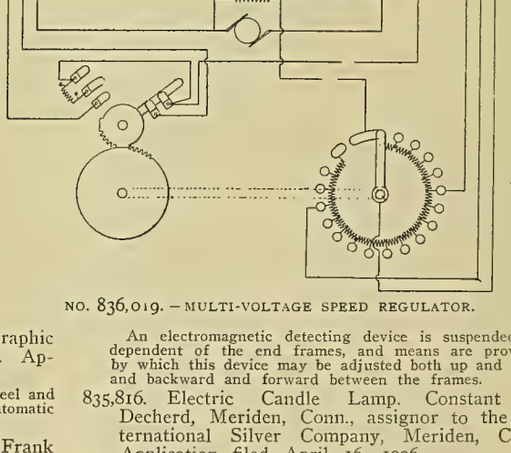
835,801. Telephone Wire-securing Means. Harvey W. Ragsdale, Morgantown, Ind. Application filed June 19, 1905.

For use with a cylindrical insulator the telegraph-wire-securing means comprises a body portion and opposing horizontally extending wire-supporting arms formed integral on the body portion provided with hooked receiving supporting ends. A lever is pivotally mounted on the body portion intermediate the ends of the arms and provided with a projecting pointed toe for kinking the unsupported central portion of the wire.

835,802. Telephone-exchange System. Harry G. Webster, Chicago, Ill., assignor to Milo G. Kellogg, Chicago, Ill. Application filed December 16, 1904.

One of the talking contacts of a spring jack is associated with a certain telephone line, the contact being normally disconnected from the line. There is a plug and a cord circuit. A battery is associated with the circuit adapted to be included in the metallic circuit of the line to furnish current for talking purposes. A relay is operated from a second source of current over a portion of the talking circuit to connect the contact with the line during such use.

835,807. Warp Stop-motion for Looms. John T. Bolton, Fall River, Mass., assignor of one-half to George Grime, Fall River, Mass. Application filed February 8, 1905.



NO. 836,019.—MULTI-VOLTAGE SPEED REGULATOR.

An electromagnetic detecting device is suspended independent of the end frames, and means are provided by which this device may be adjusted both up and down and backward and forward between the frames.

835,816. Electric Candle Lamp. Constant K. Decherd, Meriden, Conn., assignor to the International Silver Company, Meriden, Conn. Application filed April 16, 1906.

An electric-light plug is secured to the upper end of a stem, which has a collar on it and which is adapted to engage a nut located in a socket.

835,821. Trolley-pole Clamp. Hugh W. Fellows and Ira A. Cammett, Los Angeles, Cal. Application filed September 15, 1905.

A wedge and cam are used for forcing together the two jaws which form the socket for the pole.

835,841. Electric Heater. Frederick M. Vogel, Lynn, Mass., assignor to the General Electric Company, Schenectady, N. Y. Application filed March 31, 1906.

A metallic receptacle having high thermal conductivity is provided with electric heating means, the receptacle being so proportioned and arranged that the energy lost by radiation at substantially 100 degrees Centigrade equals the energy supplied. (See cut.)

835,848. Electric-sign Letter. Charles A. Chase, Chicago, Ill. Application filed April 13, 1905.

A bracket is rigidly attached to the back of an electric sign letter and suspends it on the frame. The bracket has a passageway for an electric wire.

835,860. Microtelephone. Arvid A. Lind, Malmö, Sweden, assignor to Elektromilitära Aktiebolaget, Stockholm, Sweden. Application filed February 28, 1905.

The hollow handle, serving as a mouthpiece, is mounted on the casing. A receiver is also mounted on the casing.

A double-diaphragm transmitter is in the casing and has its center plane, which is parallel with the diaphragms, situated substantially in the center plane of that end of the handle on which the casing is mounted.

835,865. Head Telephone Set. Joseph Pieringer, Jersey City, N. J., assignor to the Western Electric Company, Chicago, Ill. Application filed December 1, 1905.

A receiver and a transmitter are mounted on opposite sides of a harness and adapted to fit over the ears of the user; a tubular member having one end secured to the communicating orifice of the transmitter is provided at its other end with a spherical head. A second tubular member is provided with a mouthpiece and incloses the head to form a ball-and-socket joint therewith, so that the members are adjustable. Means are provided for holding the members in their adjusted positions.

835,868. Central-energy System for Telephone Exchanges. John G. Roberts, Evanston, Ill., assignor to the Western Electric Company, Chicago, Ill. Application filed April 2, 1903.

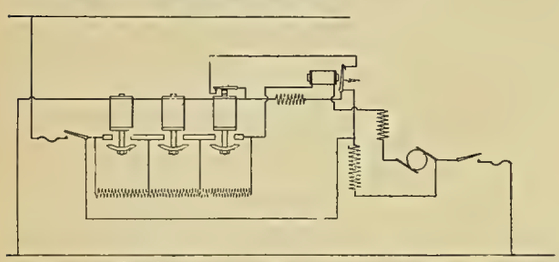
Two doubly wound relays have one winding of each included permanently in each limb of a telephone line. A source of current is connected with the line at the central offices. Means are provided at the sub-station for controlling the flow of current through all of the windings. Means are provided at the central office for directing an excess of current through those windings included in one limb of the line and for detracting part of the current through those windings included in the other limb when connection is made with the line, and a line signal is controlled jointly by the two relays.

835,870. Alternating-current Pole-changer Circuit. Edwin H. Smythe, Chicago, Ill., assignor to the Western Electric Company, Chicago, Ill. Application filed February 1, 1906.

A party telephone line extends from two sub-stations to a spring jack at a central office. Signals at the stations are responsive to positive and negative pulsating current, respectively. A conductor at the central office carries alternating current, and a pole changer is adapted to separate the alternating current into positive and negative pulsations. A plug and plug circuit are provided for making connection with the spring jack, and there is mechanism for operating the pole changer. Switch keys at the central office control the mechanism and are adapted to apply pulsations of either character to the line.

835,878. Automatic Telephone Exchange for Double-wire Telephone Systems. Gotthilf A. Betulander, Stockholm, Sweden. Application filed April 5, 1904.

A slide is arranged to move in the direction of movement of a movable part, and there are means for causing the slide to move step by step in the direction of movement of the movable part during the first period of the connection operation. Means are provided for connecting together the slide and the movable part in a fixed position with relation to each other, and there are means for feeding forward the slide, together with the movable part connected therewith, in the same direction of movement during the second period of the connection operation. Means are also provided for restoring the slide and the movable part to their initial positions.



NO. 836,036.—AUTOMATIC MOTOR STARTER.

835,909. Section Insulator for Trolley Roads. Charles M. Means, Punxsutawney, Pa., assignor to the H. W. Johns-Manville Company. Application filed April 9, 1906.

A pair of wire clamps are supported on a main frame and insulated one from the other, each of the clamps having a grooved channel in its side for reception of the trolley wire, the upper portion of each channel being provided with set-screws and the under portion with a horizontally projecting lip.

835,918. Milking Machine with Electromagnetic Closing Device. Axel Sabroe, Aastrup, Germany. Application filed February 1, 1906.

The armature of an electromagnet holds the passage of the milk open while the electromagnet is energized, and is adapted to close the passage at its release. Contact plates are connected to the electromagnet and placed within the passage of the milk and are adapted to permit the circulation of the electric current by the flow of the milk.

835,938. Electric Incandescent Lamp. Francis M. F. Cazin, Hoboken, N. J. Application filed February 2, 1899. Renewed April 15, 1902.

One claim reads as follows: In a luminant for an incandescent electric lamp a filament consisting of a metal core having a high point of fusion and affinity for oxygen, and a plating thereon of metal different from that of the core and having little affinity for oxygen, embedded in rare metal oxides.

835,942. Lifting Magnet. Arthur C. Eastwood, Cleveland, Ohio. Application filed August 30, 1905.

A frame includes a plate of magnetic material having a central pole piece, a winding extends around the pole piece, and a metallic casing is held to the plate for maintaining the winding in position. The casing extends inside the winding and around the outside edge of it.

835,946. Electric Gas Lighter. Giorgio Giorgi, Florence, Italy. Application filed September 16, 1905.

A supporting member is provided with an opening for admitting gas to the burner and a separate opening for admitting gas to the pilot lamp. A ball is adapted to close each of the openings air tight. The armature of an electromagnet is adapted to roll the ball from one of the openings to the other, and means operable while the electromagnet is energized are provided for preventing the ball from completely closing the opening into which it rolls.

835,951. Signaling on Railways. Charles M. Jacobs and Robert J. Insell, Reading, England. Application filed July 2, 1906.

There are means constituting a normally closed circuit and means constituting a normally open circuit. A separate electrical device is contained in each circuit, and a danger signal is controlled by each electrical device. Means are contained in the first normally open circuit adapted to close the second normally open circuit when a current flows in one direction through the first normally open circuit. Mechanical means open the normally closed circuit to give the danger signal when the train passes a signaling point and means are provided for closing the first normally open circuit to restrain the danger signal. Means are provided for determining the direction in which the current shall flow through the first normally open circuit when it is closed, and a staff instrument controls the last-named means.

835,960. Apparatus Used in Electroplating. Albert J. Leaver, London, England. Application filed June 11, 1906.

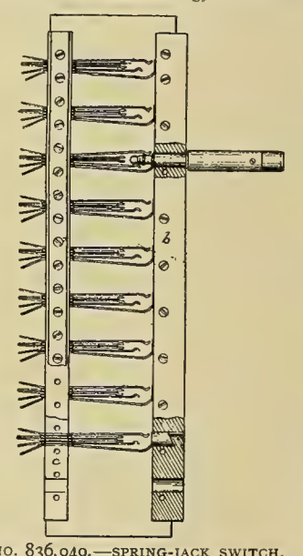
A frame supported by the edge of the vat supports a trunk at a distance above the bottom of the vat. A screw propeller is placed in the trunk and is driven by a motor carried by the frame.

835,982. Device for Regulating the Electric Spark of Gasoline Engines. Herbert O. Phillips, Warwick, R. I. Application filed December 19, 1905.

A cam having a series of flat faces is arranged to contact on a pin so that the pin is moved to make early or late tripping contact with a latch lever which trips the releasing mechanism to make or break the electric spark.

836,015. Aerophone. Lee de Forest, New York, N. Y. Application filed December 11, 1905.

Electric oscillations are developed in an antenna, which have a spark frequency higher than the more essential frequencies accompanying speech. The oscillations are modified between the point at which energy is supplied to the antenna and the earth connection thereof by and in accordance with speech waves, and modified oscillations are converted into electroradiant energy.



NO. 836,049.—SPRING-JACK SWITCH.

836,019. Multi-voltage Speed Controller. Alexander D. Du Bois, Chicago, Ill., assignor to the Western Electric Company, Chicago, Ill. Application filed January 13, 1906.

An armature risistance for the motor has a cotnroller. A field resistance has a controller independent of the starting-resistance controller. The interpolation of the amount of field resistance is determined by the field-resistance controller being governed by the starting-resistance controller. There are a number of sources of current of varying voltage, and means are operated during the manipulation of the field resistance for connecting the motor-armature with each of the sources of current. (See cut on preceding page.)

836,036. Automatic Motor Starter. William F. Hendry, New York, N. Y., assignor to the Western Electric Company, Chicago, Ill. Application filed October 16, 1905.

A resistance and a relay are included in the circuit of the motor armature, and switching means are controlled by the relay for successively cutting out steps of the resistance, and a short circuit for the relay is closed when the resistance is entirely cut out. (See cut.)

836,049. Spring-jack Switch. Charles H. North, Cleveland, Ohio, assignor to the North Electric Company, Cleveland, Ohio. Application filed October 31, 1901.

Long and short line-springs press against inner contact-springs from opposite sides and the connecting plug is inserted through a sleeve to contact with the two line springs in succession. The inner contact springs are stiffened to preserve alignment of the line springs during insertion and withdrawal of the plug. (See cut.)

836,062. Circuit-closer for Trolley Signals. Alexander Bevan, Providence, R. I., assignor to the Record Electric Railway Signal Company, Providence, R. I. Application filed February 6, 1906.

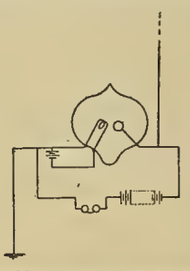
There is a pair of contacts and a pair of contact arms. Means are provided including an actuating lever whereby one of the arms may be positively actuated to close the circuit each time a car passes, and means including a reciprocating cylinder are arranged to limit and control the period of contact and also cause a quick break in the circuit.

836,067. Operator's Ringing and Listening Key. William W. Dean, Chicago, Ill., assignor to the Kellogg Switchboard and Supply Company, Chicago, Ill. Application filed June 20, 1902.

Opposed switching members have their ends transversely offset. An operating device is adapted to operate the members to control the circuit thereof, and separate rollers are carried by the device opposite the offset ends of the members, each of the rollers being adapted to engage one only of the members.

836,070. Oscillation Responsive Device. Lee de Forest, New York, N. Y. Original application filed January 18, 1906. Divided and this application filed May 19, 1906.

Separated electrodes are sealed in a partially exhausted receptacle and means are provided for heating one only of the electrodes. A local circuit including a source of electrical energy and a signal-indicating device is electrically connected to the electrodes. (See cut.)



NO. 836,070.—OSCILLATION RESPONSIVE DEVICE.

836,071. Oscillation Responsive Device. Lee de Forest, New York, N. Y. Original application filed January 18, 1906. Divided and this application filed May 19, 1906.

Two separated electrodes are inclosed within a receptacle, and a circuit including a source of electrical energy and a signal-indicating deivice is connected in series with the electrodes, the source of electrical energy being so adjusted as to render the gaseous medium sensitive to electrical oscillations.

836,072. Aerophone. Lee de Forest, New York, N. Y. Original application filed December 11, 1905. Divided and this application filed December 22, 1905.

Means are provided for producing electrical oscillations in an antenna. A resistance device is placed in the antenna and is located between the earth connection thereof and the point at which energy is supplied thereto whereby the oscillations may be modified in accordance with vocal sounds.

REISSUE.

12,558. Electric Interrupter. Lars G. Nilson, Hoboken, N. J., assignor to Theodore M. Johnson, New York, N. Y. Application filed May 25, 1906. Original No. 714,020, dated November 18, 1902.

A vibratory strip is extended across the poles of an electromagnet and the armatures are arranged on the strip. Contact is made between the strip and a contact point having connection with an induction coil.

PATENTS THAT HAVE EXPIRED.

Following is a list of the electrical patents (issued by the United States Patent Office) that expired on November 19, 1906:

415,190. Dynamo-electric Machine. T. E. Daniels, Jr., Provo City, Utah.
415,252. Electric Arc-lamp Headlight. R. T. McDonald and J. Cain, Fort Wayne, Ind.
415,262. Insulated Conductor. J. A. Wetmore, New York, N. Y.
415,305. Electric-welding Clamp. E. Thomson and J. Tregoning, Lynn, Mass.
415,324 and 415,325. Pole for Electric Wires. L. R. Greene, Boston, Mass.
415,327. Secondary Battery. P. Kennedy and C. J. Diss, Brooklyn, N. Y.
415,329. Electrode for Secondary Batteries. C. Payen, Philadelphia, Pa.
415,330. Process of Manufacturing Porous Metal Plates. C. Payen, Philadelphia, Pa.
415,331. Secondary Battery. C. Payen, Philadelphia, Pa.
415,332. Mold for Casting Plates for Use as Electrodes of Storage Batteries. C. Payen, Philadelphia, Pa.
415,333. Insulator for Electric Batteries. C. Payen, Philadelphia, Pa.
415,335. Incandescent Lamp. J. Reese, Pittsburg, Pa.
415,345. Electromedical Battery. F. Moreton, London, England.
415,347. Process of Producing Crystallized Metal Plates. C. Payen, Philadelphia, Pa.
415,348. Method of Producing Crystallized Metal Plates. C. Payen, Philadelphia, Pa.
415,349. Process of Producing Crystallized Metal Plates. C. Payen, Philadelphia, Pa.
415,350. Electric Motor. H. B. Pullman, Cambridge, Ohio.
415,363. Armature Core for Dynamos and Motors. F. F. Loomis, Akron, Ohio.
415,417. Telegraph Repeater. R. J. McIlhenny, Wilmington, N. C.
415,487. Automatic Electric Switch. G. H. Whittingham, Baltimore, Md.
415,490. Method of Constructing Electrodes for Secondary Batteries. W. H. Allen, Detroit, Mich.
415,491. Electric Meter. P. S. Bates, York, Pa.
415,504. Insulator. G. Fowler, Peckham, County of Surrey, England.
415,571 and 415,572. Arc Lamp. C. E. Scribner, Chicago, Ill.
415,573. Telephone-exchange System. C. E. Scribner, Chicago, Ill.
415,574. Electric Police Signal System. C. E. Scribner, Chicago, Ill.
415,576. Process of Electro-deposition of Metals. W. Siemens, Berlin, Germany.
415,577. Electric Meter. E. W. Siemens, Berlin, Germany.
415,578. Fire-alarm-telegraph Repeater. F. A. Skelton, Newton, Mass.
415,600. Secondary Battery. J. A. Wotton and W. R. Polk, Jr., Atlanta, Ga.
415,641. Governor for Electric Motors. C. L. Jeager, New York, N. Y.

WESTERN ELECTRICIAN

EVERY SATURDAY

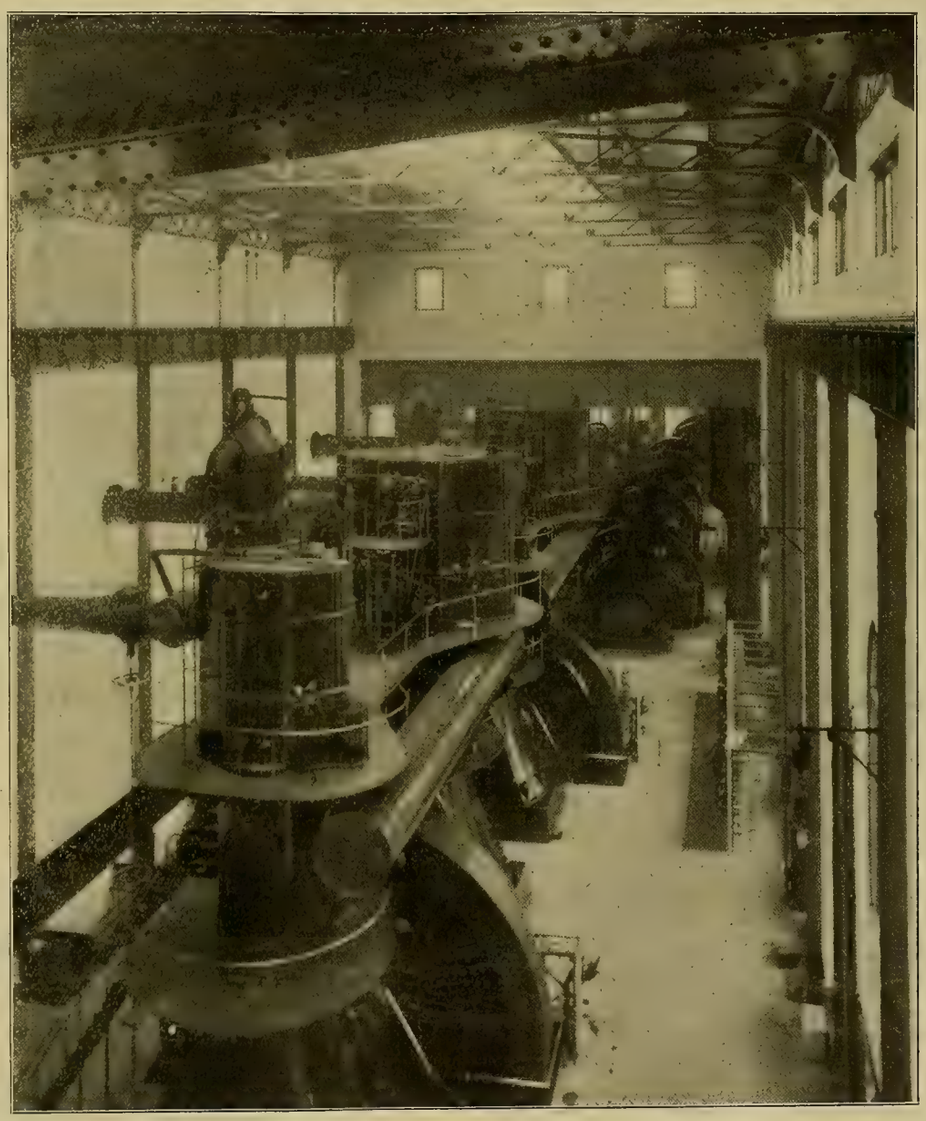
Vol. XXXIX. CHICAGO, DECEMBER 1, 1906 No. 22

Power Plant of the South Side Elevated Railway in Chicago.

Chicago is provided with four radially extending elevated electric railways—one for the North Side, two for the West Side (one of these consisting of three converging routes) and one for the South Side. All enter the central business district and circle the Union Loop, which is used in common. Of these four railways the one on the South Side was the first one to be put in actual service, although the Lake Street road on the West Side was projected and partially built first. The South Side line, then using steam locomotives, was put into actual service in 1892. It extends from the central business district in a general southerly direction in alleys east of State Street (hence the popular name, Alley L) to Sixty-third Street, whence it proceeds east to Jackson Park. This park was the site of the World's Fair of 1893, and at that time the new elevated railway was a material factor in the carrying of the hundreds of thousands of persons who visited the exposition daily.

In April, 1898, the steam locomotives were discarded, and electric motors, placed on each car and operated on the Sprague multiple-unit system, were substituted. The power house was built at State and Fortieth streets, the elevated tracks adjoining it on the east. The plant, in which direct current only is generated, was described at the time in the Western Electrician, but since then, with the growing traffic of the road, it has been enlarged more than once, so that it now bears little resemblance to the original installation and is now said to be the largest reciprocating-engine electric power house in Chicago.

In Fig. 1 is shown a general view of the engine room, the new upright units being shown in the foreground and the horizontal units of the older type appearing in the background. A plan of the station, as now enlarged, is given in Fig. 2 on the next page.



New Vertical Units in the Foreground; Older Horizontal Units in the Rear.

FIG. 1. POWER PLANT OF SOUTH SIDE ELEVATED RAILWAY IN CHICAGO.—VIEW IN ENGINE ROOM.

Recent important improvements have made the need of greater power capacity imperative. These include an express service, for which provision has been made by the laying of an extra track on the main line, making three tracks in all; a branch to the Union Stock Yards, connecting at Fortieth Street and extending in a general westerly direction, and another extension to Englewood, branching off at Fifty-eighth Street and extending west and south.

To provide for this additional service two 2,000-kilowatt units have been added to the plant; and in addition to this important extension a considerable change in the "layout" of the station has been necessary. It is the purpose of this article to show the principal features of this large and interesting plant.

At the outset it may be said that for working efficiency this plant has an enviable record. Since the road was electrically equipped nearly nine years ago current has never been off the bus-bars nor has traffic on the road ever been tied up from any fault of the power house. The plant in all departments is conveniently arranged, and it is exceptionally neat. It is in charge of Mr. A. L. Hadin, chief engineer of the South Side Elevated Railroad Company, who supervised its construction and equipment. Sargent & Lundy of Chicago are the consulting engineers for the company, and Mr. Hadin also took part in planning and designing much of the installation.

The power house is located near the center of distribution. It is 400 feet long by 110 feet wide. The building is of brick and steel construction, divided by a brick wall, running lengthwise of the building, into a boiler room and engine and generator room. Concrete was used extensively for foundations. The floors are all of cement.

Boiler Room.

The boiler room occupies the full length of the east half of the building. It is located directly adjoining the elevated-railway structure and its south end touches the Chicago Junction Railroad. There are 22 Babcock & Wilcox water-tube boilers, having a total maximum capacity of 15,000 boiler horsepower, the normal rated capacity being 10,000 horsepower. They are arranged in batteries of two, 12 of them having 4,000 feet of heating surface each, the other 10 having 5,000 feet each. All the boilers have forged headers, no cast-iron being used. They were tested at a pressure of 300 pounds and carry a steam pressure of 175 pounds.

The boilers are equipped with Babcock & Wilcox chain-grate stokers. These are operated from a line shaft above the boilers run by four six-horsepower oscillating steam engines.

Three steel self-supporting smokestacks take care of the 22 boilers. One is 11 feet 10 inches inside diameter, one 13 feet and the new one 16 feet inside diameter. All are 200 feet high and lined with firebrick to the top.

Coal and Ash Handling.

Labor-saving coal and ash-handling machinery is provided for the boiler plant. Coal is delivered to the plant in cars from the Chicago Junction Railroad. Two Robbins belt conveyors are located along the railroad for taking coal to the main conveyors. The installation for the older part of the plant is equipped with McCaslin conveyors, having a capacity of 60 tons an hour. Serving the newer installation is one main Link Belt bucket conveyor of a capacity of 85 tons an hour. One belt conveyor takes coal from the coal crushers to this main conveyor.

The crushers are so arranged that coal can pass through them without the rollers being in operation. This arrangement was made so that when screenings are used the fuel can pass through the ordinary channels without extra equipment.

A coal bin of 100 tons capacity is provided for each boiler, the bins being located 40 feet above the boilers. From the bunkers the coal passes direct to the stokers through 10-inch iron pipes. Bunkers and stokers are plainly shown in the view of the boiler room, Fig. 3. Ashes are handled by the same conveyors as carry the coal. The ashes fall into hoppers directly beneath the stokers and are let into the conveyor by a gate; then they are elevated to bunkers similar to the coal bunkers, and from there to the cars. A 50-ton car can be loaded in 10 minutes.

Piping and Auxiliaries.

Running along the wall back of the boilers in the boiler room is the main steam header. It is 15 inches in diameter and divided into six sections with a 10-inch U-band for expansion between each section. There is an auxiliary steam header six inches in diameter, which supplies steam to the pumps, stoker engines and condenser engines.

Valves are all of the outside screw type, extra heavy. In the new installation all are electricallly operated. The boiler valves are operated from the engine-room side of the wall and the engine valves from the boiler-room side.

On the boiler-room floor in the first installation are two Smith-Vaile duplex boiler-feed pumps 14 by 10 by 15 inches; also a 10 by 7 by 12-inch pump for washing the boilers. These are shown in the foreground in the boiler-room view, Fig. 4. The new installation has two 20 by 14 by 24-inch

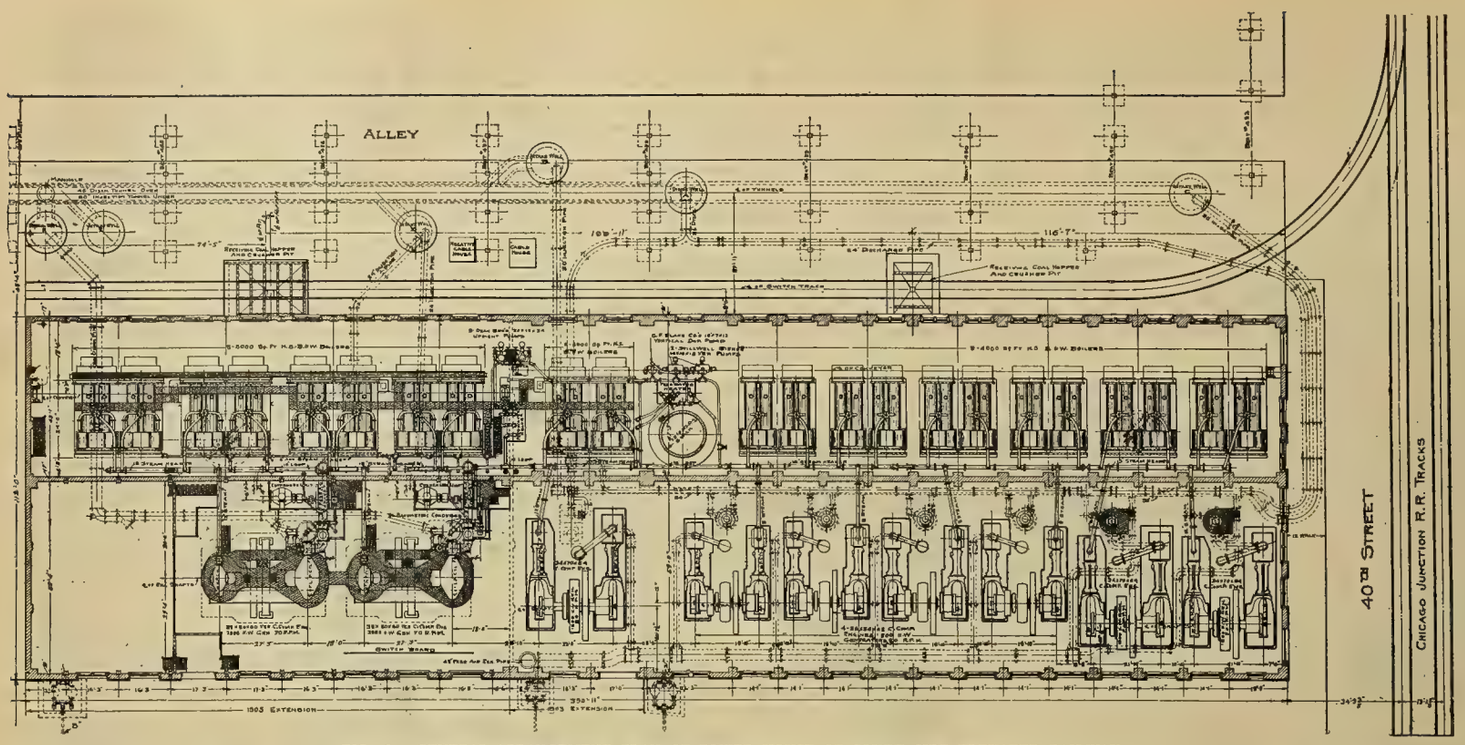


FIG. 2. GENERAL-ARRANGEMENT PLAN OF POWER HOUSE OF SOUTH SIDE ELEVATED RAILWAY.

Dean boiler-feed pumps, shown farther back in Fig. 4. Held in reserve in case of accident to the boiler-feed pumps are three two-inch Hancock

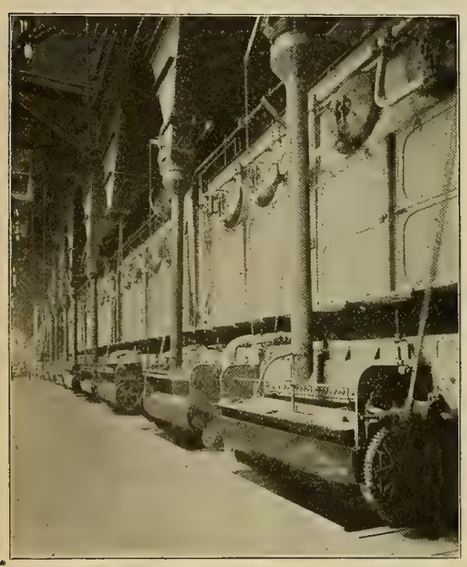


FIG. 3. BOILER ROOM IN POWER PLANT OF SOUTH SIDE ELEVATED RAILWAY, CHICAGO.

injectors and a similar number of two-inch Nathan injectors.

Two 6,000-horsepower Barney-Walnut open feed-water heaters receive the steam from all auxiliaries, such as condenser engines, stoker engines and boiler-feed pumps.

Engines and Generators.

Nine main power engines are now installed in the engine and generator room. Their combined maximum capacity is 32,000 horsepower. All were supplied by the Allis-Chalmers Company, and each one is direct connected to a direct-current generator furnished by the General Electric Company. The arrangement is well shown in the plan, Fig. 2.

The total rated capacity of the nine generators is 11,700 kilowatts. There are four 800-kilowatt machines, three of 1,500 kilowatts each and two of 2,000 kilowatts each. Both engines and generators are capable of a 50 per cent. overload for considerable periods.

Of the above-mentioned units, seven constitute the older installation. The four smaller engines of the group of seven (shown in the background in Fig. 1) are each connected to an 800-kilowatt generator and the other three to 1,500-kilowatt generators, respectively. These seven engines are of the horizontal cross-compound condensing type equipped with Allis-Chalmers flywheel-type condensers.

The two new units, which have just been put in operation and which complete the plant for all present purposes are shown in Fig. 6 The engines are of the vertical cross-compound condensing type, 38 and 80 by 60 inches, 75 revolutions a minute, and equipped with Tomlinson barometric-type condensers. The condensers are located beside the low-pressure cylinder 40 feet above the engine-room floor. One condenser is shown in Fig. 6.

A dry-air pump and a rotary water pump for the condenser are located in the basement. They are driven by an Allis-Chalmers Corliss engine having cylinder dimensions of 12 by 24 inches. This outfit is shown in Fig. 5. Each of the large power engines has its independent condenser unit of this description. The tops of the dry-air pumps are shown through the opening in the floor in the general view of the new section of the power house, Fig. 7.

Condensing and cooling water is obtained from the Thirty-ninth Street intercepting city sewer. It comes through a tunnel 45 feet underground, extending from Thirty-ninth to Fortieth Street. The tunnel is five feet in diameter. Water goes into four distributing valves, which are provided with screens to stop any foreign matter. The screens are raised and lowered by small electric cranes mounted on the elevated structure back of the power house.

A normal rating of 2,000 kilowatts each is given to the two new direct-connected generators. Fig. 6 gives a good view of these generators, which are also shown in the two general views. As stated, these generators were furnished by the

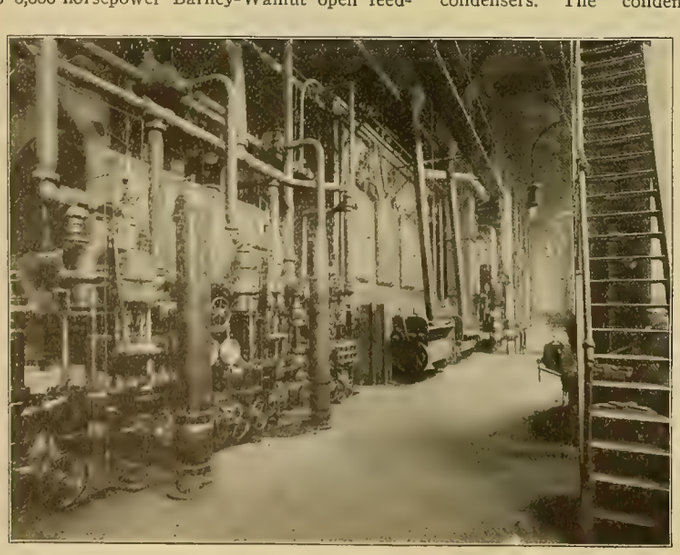


Fig. 4. Boiler Feed Pumps.

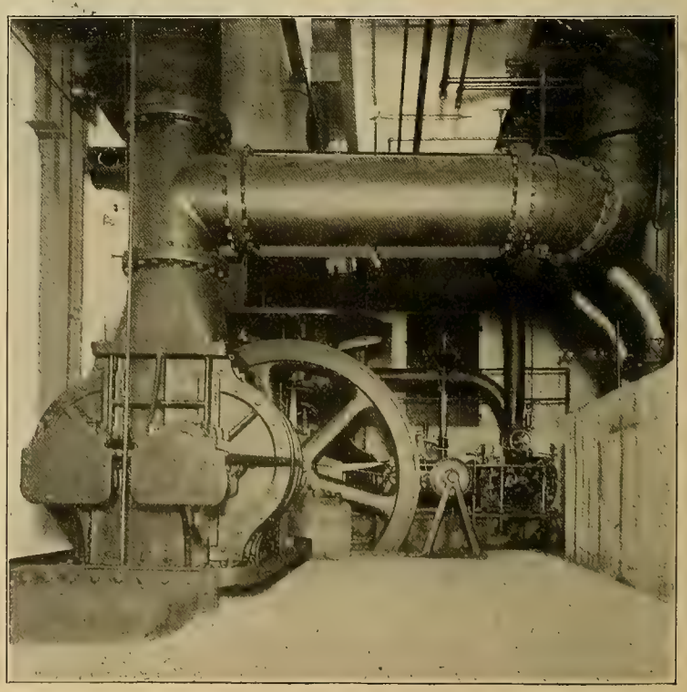


Fig. 5. Condensing Apparatus in Basement.

POWER PLANT OF THE SOUTH SIDE ELEVATED RAILWAY IN CHICAGO.

General Electric Company, being the standard railway type known as MP, 22 poles, wound for 650 volts and operating at 75 revolutions a minute. The poles are solid steel castings and provided with laminated facings to reduce heating. Coils are of the usual form-wound copper-strip type. The armature and commutator of each machine weighs 87,000 pounds, and each generator complete weighs 188,000 pounds.

These machines are guaranteed to run for 24 hours at full rated capacity without increasing the temperature in any part to exceed 30° C. A 50 per cent. overload can be carried for two hours at a temperature rise not to exceed 55° C.

Two switchboard panels are supplied with each generator, the positive panel being mounted on the switchboard and the negative and equalizer panel on the generators, as shown in Fig. 6. The arrangement is for a single polarity, the equalizing being done on the negative side. A circuit-breaker of the carbon-break type is supplied with each panel; also a recording wattmeter with each positive panel.

Switching Apparatus.

A very interesting part of the plant is the switchboard, front and rear views of which are shown in Figs. 8 and 9. The board is of white marble and has 20 panels. The main bus-bar is made up of eight copper bars one-fourth by 10 inches in section. An auxiliary bus-bar is provided for use in case repairs are needed to the circuit-breakers; it is also made of copper bars. Six hundred and fifty volts is carried on the bus-bars.

There are no negative poles on the switchboard, the equalization, as previously stated, being on the negative side of the machines, each of the nine generators being provided with a panel on which are mounted one negative circuit-breaker and one equalizing switch. The generator leads are carried on racks beneath the engine-room floor. Feeder cables leave the power house from the basement and are carried on racks on the elevated-railway structure.

There are nine machine panels on the board, each having mounted upon it one General Electric carbon-break circuit-breaker, one Weston ammeter, a positive quick-break knife switch for the machine and one for station lighting, a rheostat handle and one General Electric wattmeter. The voltmeter panel has two Weston voltmeters, two Bristol recording voltmeters—one for the bus-bar and one for the storage batteries at the Fifteenth Street sub-station—and one station clock. One house-circuit panel carries a General Electric carbon-break circuit-breaker, one Weston ammeter, six quick-break switches and one General Electric wattmeter.

There are nine feeder panels. On each of the first five are one General Electric carbon-break circuit-breaker, one Weston ammeter and a laminated brush toggle lever switch of 6,000 amperes capacity. Each of the other four has a Westinghouse carbon-break circuit-breaker, one Weston ammeter and a General Electric laminated brush toggle lever switch of 9,000 amperes capacity.

The switchboard was installed by the Chicago Edison Company. It was designed by Sargent & Lundy, as consulting engineers, and the chief engineer of the plant.

Conclusion.

Throughout this plant will be found numerous devices and machines, many of them of original

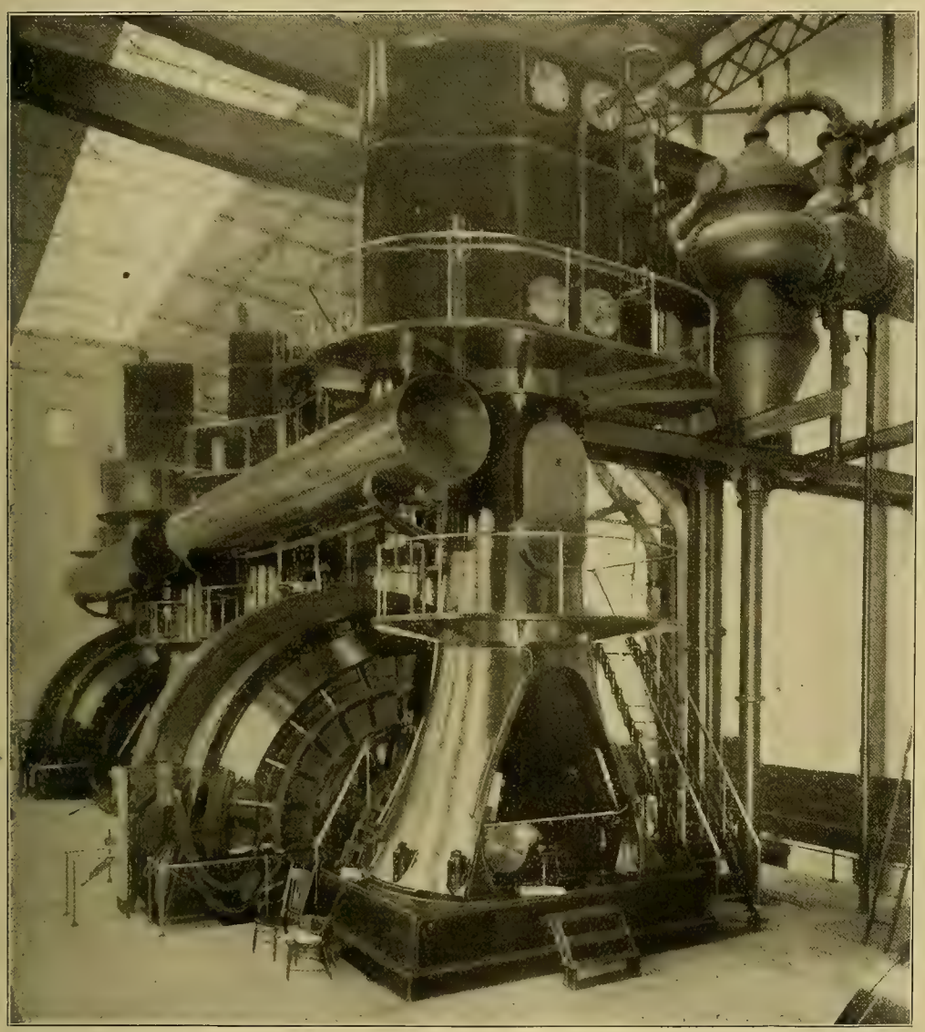


FIG. 6. TWO VERTICAL 2,000-KILOWATT GENERATING UNITS IN POWER PLANT OF SOUTH SIDE ELEVATED RAILWAY.

FIG. 9. REAR OF SWITCHBOARD IN POWER PLANT OF SOUTH SIDE ELEVATED RAILWAY, CHICAGO.

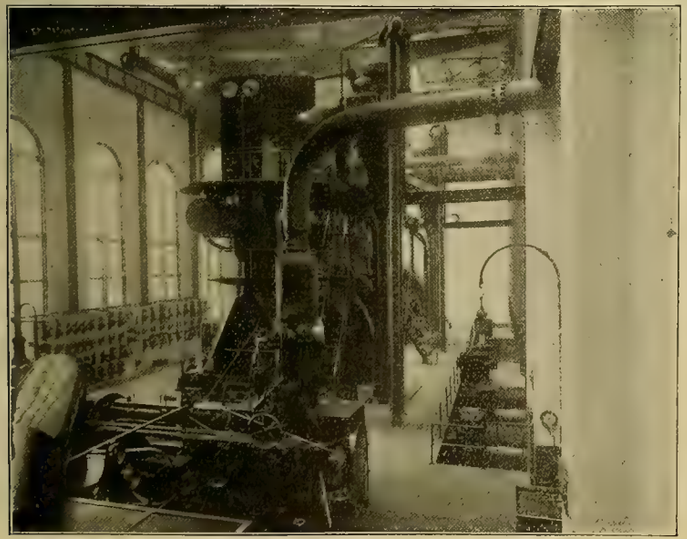


Fig. 7. View in Engine Room, Showing Top of Dry-air Condenser Pumps in Basement.

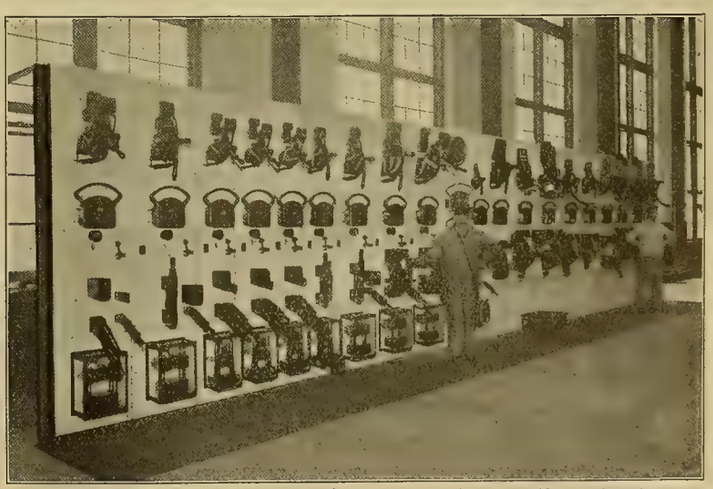


Fig. 8. Switchboard.

POWER PLANT OF THE SOUTH SIDE ELEVATED RAILWAY IN CHICAGO.

design, intended to increase the efficiency of the plant and to provide against accident.

Two Morgan electric cranes are installed, one of 30 tons and the other of 50 tons. There is a complete compressed-air system for cleaning, etc.

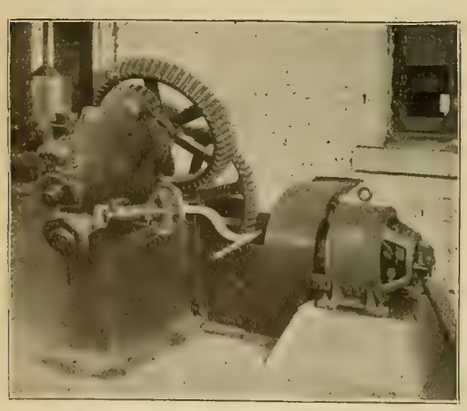
A gravity oiling system for oiling the engines and auxiliaries is provided. The oil tanks are placed near the ceiling, oil being forced up by a 3½ by 4 by 6-inch pump. The filters used in this system were designed by Mr. Hadin.

Two Yeoman electric centrifugal pumps automatically operated by a float and rheostat are provided to remove any surface or waste water which may reach the deep basement.

The capacity of the plant is augmented by two battery sub-stations. One is located at 1457-59 State Street and is termed the Fifteenth Street Station. It consists of two batteries of 1,100 kilowatts each, and one Western Electric booster of 6,000 amperes capacity. The second station is located at Sixty-first Street and Calumet Avenue, and has one battery of 1,100 kilowatts capacity and a 3,000-ampere Western Electric booster.

Electrical Equipment of the Erie Railroad Shops at Hornell (Hornellsville), N. Y.

Railroad shops are particularly well adapted for electric drive, owing to the number and size of the buildings which usually make up the shops, the frequent need of a small amount of power for overtime work and other considerations which make the transmission and application of electric power at once the most economical and the most convenient method of operating the various machines and machine tools. It was these considerations that led the Erie Railroad Company to abandon mechanical transmission of power and adopt the electric drive at its Hornell shops, which now utilize electric power entirely and furnish an excellent example of the expediency and use of both individual and group drive.



BEVEL SHEARS IN ERIE RAILROAD SHOPS DRIVEN BY 7½-HORSEPOWER MOTOR.

When the present management took charge of the Erie Railroad it adopted broad and comprehensive plans for the development of the entire property, which are rapidly making it one of the most modern and efficient railway systems in the country. These plans embraced extensive alterations and additions to the many shops of the system in order to enable them to respond rapidly and efficiently to the increasing demand made upon them by the necessary additions to the rolling equipment.

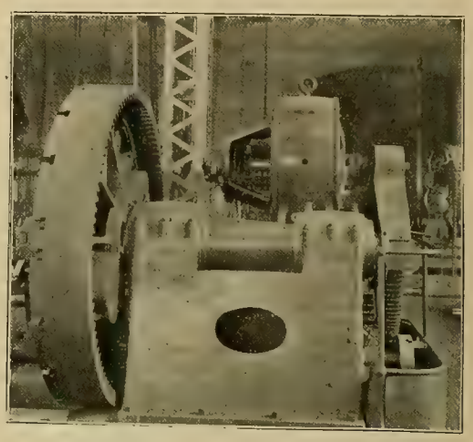
New shop buildings and roundhouses have been constructed, old machines replaced by new, an efficient shop organization effected, and the entire mechanical department brought up to a high standard of efficiency. This work, under the direction of Mr. E. A. Williams, general mechanical superintendent, and Mr. G. W. Wilden, mechanical superintendent, has been carried on at many different points on the system, but the most extensive single installation of modern shop equipment is at the Hornell shops, located at Hornell, N. Y.

After due investigation of the local conditions it was decided to make the installation consist entirely of direct-current apparatus, with the exception of a small generator set, which is used to supply the current necessary for the present yard and depot lights.

The power house is a large brick structure of fireproof construction, with concrete roof and flooring, and has ample provision for light and ventilation. The building is large enough to provide for future extensions. The boiler plant consists of four Babcock & Wilcox units of 400 horsepower, operating at 150 pounds pressure and equipped with chain grates. All live steam mains are provided with the Holley drip system.

Coal handling and stoking are especially interesting, as, from the time the coal is dumped from the cars until it is fed into the furnace, it is conveyed automatically. The coal passes from the car into a chute, which empties into a crusher, and is then conveyed by an endless belt to the top of the power house, where it passes through another chute to the second conveyor that distributes it into the bunkers over the boiler room. From there the coal passes through chutes to hoppers in front of the furnaces, where it is fed into the chain grates. The amount of coal admitted into the hoppers is controlled in the boiler room by means of levers. The conveyors, which were manufactured by the Exeter Machine Company, have a capacity of 60 tons an hour and are operated by a 10-horsepower and a 13½-horsepower electric moter. The coal crusher is operated by a 20-horsepower motor.

Two cross-compound Ball & Wood high-speed condensing engines of 500 horsepower each are directly connected to Westinghouse 300-kilowatt, direct-current, 250-volt, three-wire generators running at 150 revolutions per minute, while another engine is of 400 horsepower directly connected to a similar generator of 200 kilowatts operating at 200 revolutions per minute. The engines run condensing except in cold weather, when the exhaust steam is utilized in heating the shops. Water for condensing purposes is stored in a large well, which derives its supply from a small river near the power house.

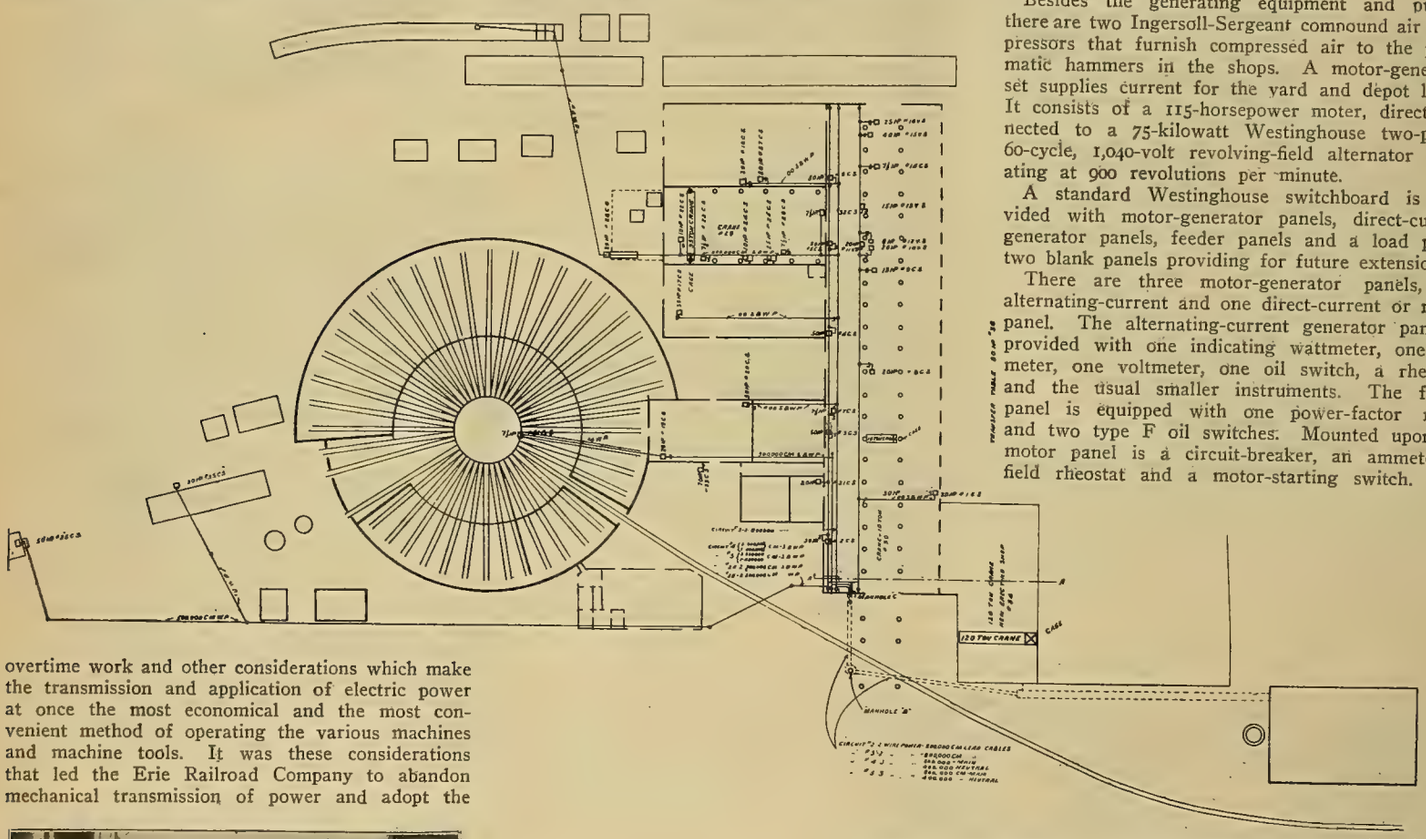


DRIVE-WHEEL LATHE IN ERIE RAILROAD SHOPS OPERATED BY 40-HORSEPOWER MOTOR.

Besides the generating equipment and pumps, there are two Ingersoll-Sergeant compound air compressors that furnish compressed air to the pneumatic hammers in the shops. A motor-generator set supplies current for the yard and depot lights. It consists of a 115-horsepower moter, direct-connected to a 75-kilowatt Westinghouse two-phase, 60-cycle, 1,040-volt revolving-field alternator operating at 900 revolutions per minute.

A standard Westinghouse switchboard is provided with motor-generator panels, direct-current generator panels, feeder panels and a load panel, two blank panels providing for future extensions.

There are three motor-generator panels, two alternating-current and one direct-current or motor panel. The alternating-current generator panel is provided with one indicating wattmeter, one ammeter, one voltmeter, one oil switch, a rheostat, and the usual smaller instruments. The feeder panel is equipped with one power-factor meter and two type F oil switches. Mounted upon the motor panel is a circuit-breaker, an ammeter, a field rheostat and a motor-starting switch. The three generator panels are provided with the usual apparatus for a three-wire installation. The load panel is equipped with two switchboard-type integrating wattmeters, two ammeters and two voltmeters.



GENERAL ARRANGEMENT OF POWER CIRCUITS IN HORNELL (N. Y.) SHOPS, ERIE RAILROAD.

The six feeder panels control six circuits as follows: Circuit No. 1, new erecting-shop, 120-ton crane and transfer table; circuit No. 2, carpenter-shop, blacksmith-shop, new boiler-shop and tank-shop motors; circuit No. 3, roundhouse turntable, machine-shop, coal-pocket and ash-pit motors; circuit No. 4, all line-shaft motors; circuit No. 5, individual-drive motors; circuit No. 6, motors in power house for coal-conveying apparatus. Each feeder panel is also provided with switches for controlling the various lighting circuits.

Current is transmitted by cables through a large tunnel to the new erecting shop and thence through underground conduits to the various buildings. The Westinghouse three-wire system of distribution is used for lighting and power, with an electromotive force of 250 volts between outside wires and 125 volts between each outside wire and neutral. There is a decided advantage in the flexibility of the voltage, as incandescent and Cooper-Hewitt lamps are operated on the 125-volt sides

of the system and constant-speed, 250-volt motors are connected to the main or outside wires, while the variable-speed motors utilize shunt-field control.

The accompanying plan of the shops shows the location of the various motors. It is particularly interesting, as it demonstrates the diversity of motor applications.

The old erecting shop utilizes both group and individual drive, the group-driven machines being divided into five sections and operated by five type S constant-speed motors, two of 30-horsepower capacity and three of 50-horsepower capacity. The machines in the fitting shop, which occupies one wing of the erecting shop, are also group driven by a Westinghouse 30-horsepower, constant-speed, type S motor. The group-driven machine tools operated in these shops include wheel presses, car-wheel borers, lathes, drills, boring mills, slotters, milling machines, shapers, planers, quartering machines, emery grinders, nut tappers, punches, bolt cutters, centering machines, facing and tapping machines, bolt pointers, arbor presses, buffing wheels, polishers and the like.

In addition to the group-driven machines in the erecting shop, there are a number of individually driven machines operated by both constant and variable-speed Westinghouse type S motors, as follows:

Constant-speed Motor-driven Machines: One 20-horsepower motor, driving a planer; one 13-horsepower motor, direct-connected to 600-ton wheel press; one 7½-horsepower motor for moving tail-stock of driving-wheel lathe.

Variable-speed Motor-driven Machines: One 7½-horsepower motor, operating vertical miller for side rods; one 20-horsepower and one 6-horsepower, operating 90-inch boring mill; one 20-horsepower motor, operating driving-axle lathe; one 7½-horsepower motor, operating crank-pin lathe; one 40-horsepower motor, operating 90-inch driving-wheel lathe; one 25-horsepower motor, driving truck-tire lathe.

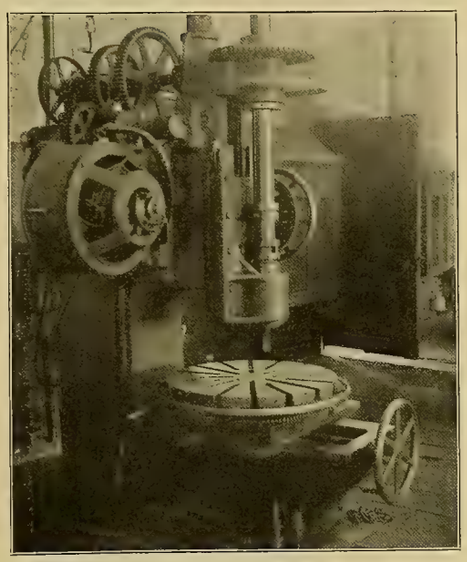
The speed of the variable motors is controlled by varying the field strength, and, as this may be done while the machine is in operation, it affords an easy and convenient method of speed regulation, always under the immediate control of the operator, the controller being conveniently placed within his reach. The variation of field strength is effected by means of a resistance placed in the shunt-field circuit of the motor, which decreases the shunt-field current and causes a decrease in the field strength and an increase in speed, producing an extremely simple and effective means of varying the speed of either a shunt or a compound-wound motor.

One of the most prominent characteristics of this method of control is the simplicity and low cost of control apparatus made possible by the extremely small current which is handled. A second marked characteristic is the increase of speed with decrease of torque, when used as an adjustable speed motor, the horsepower output remaining practically constant throughout the whole speed range, which makes it peculiarly adapted to machine-tool driving.

In the smaller shops there are many electrically driven machine tools. An enumeration cannot be attempted within available limits of space; but there are grinders, milling machines, planers and lathes in the tool room; moulding machines, boring machines, shapers, rip and band saws and tenoning machines in the carpenter shop; power hammers, bolt headers, bar-iron shears, hot saw and exhaust fan in the blacksmith shop; flue-welding machines in the boiler shop; shear and punch in the tank shop, and many other applications.

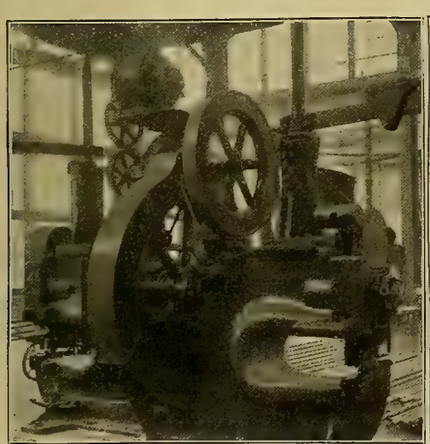
In connection with the boiler-shop equipment there is a flue rattler, which is located outside the building and is operated by a 20-horsepower motor. It is 48 inches in diameter and 22 feet long, and has a capacity of 175-200 flues. An average of five lots per day are cleaned, the exact time for each rattling depending upon the water used in the boilers. The longest flue is 21 feet, and they vary from 1½ to 2½ inches in diameter.

Miscellaneous applications include one 70-horsepower constant-speed motor, driving fan for roundhouse heating system; one 10-horsepower constant-speed motor, driving fan for new erecting-shop heating system; one 7½-horsepower variable-speed motor, operating roundhouse turntable; one 50-horsepower constant-speed motor, operating coal conveyor in locomotive coaling station; one 30-horsepower constant-speed motor, operating ash conveyor for removing ashes from locomotive ash-pit; one 25-horsepower motor, operating transfer table, and one 7½-horsepower Westinghouse motor, operating alligator shears for cutting up sheet scrap. This last installation is located at the scrap bins in the shop yards.

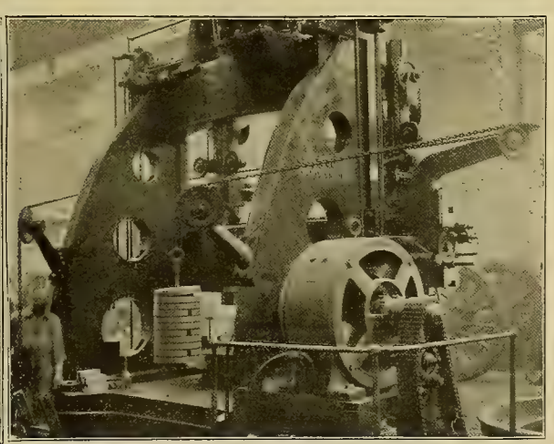


VERTICAL MILLER IN ERIE RAILROAD SHOPS DRIVEN BY TWO MOTORS.

The preliminary studies and final report, showing the benefits which would be the result of electrically equipping these shops, were made by the Westinghouse Electric and Manufacturing Company in conjunction with the motive-power department of the Erie Railroad. The results have more than borne out the promises made to the management. The installation of the new electrical quipment presented many engineering problems, but the work of transformation was carried on without any interruption to the service, and it reflects great credit to the contractors, Westinghouse, Church, Kerr & Co., who installed the plant, and Mr. George T. Depue, master mechanic of the Erie Railroad Company, who has charge of the Hornell shops. The railroad company has, by the electrical equipment, a plant which serves its purpose with increased efficiency.



Combination Punch and Shears Driven by 7½-horsepower Motor.



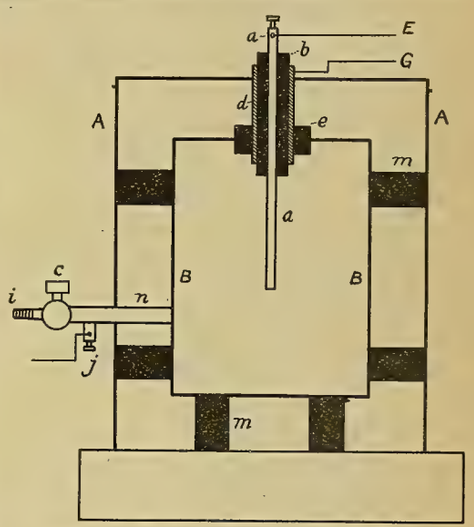
90-inch Boring Mill Operated by Two Variable-speed Motors.

ELECTRICALLY OPERATED MACHINE TOOLS IN ERIE RAILROAD SHOPS.

Apparatus to Detect Radio-activity in Gases.

An instrument which has proved to be of some value in finding the radiation values of gases which may contain radium emanation is illustrated herewith. It is one which the late Professor Curie devised for use in his laboratory, and he found it to give good results, besides being of simple construction. It is in the form of a condenser, and consists of a metallic box of cylindrical shape (B) (B) which is entirely closed. At the upper part it is traversed by a brass rod (a) (a), held in an insulating tube (b). Around the tube is a metal tube (d), which fits tightly upon it so as to give a good joint, and the whole combination is fixed in the top of the metal cylinder by the insulating cork (e). As the cylinder (B) is to contain gas, care is to be taken that there are no leaks in the above part, and the joints are to be filled by insulating cement.

In the cylinder is fitted a tube (n), which has a well-ground stop-cock (C) placed in it and a prolongation (i) for connecting it with the air pump so as to produce a vacuum in the cylinder. It is prudent to use a drying tube between the air pump and the cylinder to dry the gas which is introduced. The condenser effect is produced between the rod (a) (a) and the cylinder (B) (B) in order to observe the action when the cylinder is filled with the gas to be tested. Should an electric charge be given the cylinder (using a binding-post (j) upon the tube), if the enclosed gas is radio-active, a current will pass through the gas and the action is shown upon an electrometer which is connected with the rod at (E). The guard ring (d) is connected to ground.



APPARATUS TO DETECT RADIO-ACTIVITY IN GASES.

A second metal box (A)(A) is placed so as to surround the first one, and it is grounded by the movable top cover as the latter touches the guard ring (d). Blocks of insulating material (m) (m) separate the two metal cylinders in the manner shown here. Ebonite is the best for this purpose. A slot in the outer box enables it to be drawn off the tube (n) when it is desired to remove it from the inner cylinder.

The apparatus is designed so that it can be easily and cheaply made, seeing that, owing to the temporary or permanent induced radio-activity which is given to such an apparatus itself, it must be either discarded or set aside for some days. Therefore it is not desirable to have an expensive or complicated device. The induced action is often very strongly felt in a device of this kind, especially if it is closed, as in the present case, and some of the gases may be highly radio-active, so that afterwards the apparatus cannot be used for testing the weaker gases. When a strong gas is used it is found that part of the effect passes off after some days, but there seems to be always left a fixed residual value which cannot be eliminated. With the above device it is easy to have a new apparatus on hand to begin an experiment.

Alzen is the name given to a new metal which is composed of two parts of aluminum and one part of zinc, writes Consul-general Guenther from Frankfort, Germany. It is said to equal cast iron in strength but is much more elastic. Alzen is superior because it does not rust as easily as does iron and it takes a high polish. Besides being very strong, this new metal is capable of filling out the most delicate lines and figures of forms in casting.

WESTERN ELECTRICIAN

EVERY SATURDAY.

PUBLICATION OFFICES:

507 Marquette Building, - CHICAGO.

TELEPHONE, MAIN 1746.

Eastern Office, 150 Nassau Street, New York.

Telephone, 8220 Beekman.

Trade Supplied by Western News Co.

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SUBSCRIPTION, in advance, postage prepaid, $3.00 for a full year of 52 numbers; in clubs of four or more, $2.50, with free extra copy for eight subscriptions; foreign countries, $5.00 a year; single copies, 10 cents. When change of address is requested, the **old address** as well as the new should be given.

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REMITTANCES.—All checks, drafts and other remittances should be made payable to the order of the publishers, the **Electrician Publishing Company,** and addressed to the offices of publication, Suite 507, Marquette Building (204 Dearborn Street), Chicago, Illinois, U. S. A.

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DATES AHEAD.

American Society of Mechanical Engineers (annual meeting), auditorium of the New York Edison Company, New York City, December 4th to 7th.

Chicago Electrical Show (second annual exhibition), Coliseum, Chicago, January 14 to 26, 1907.

Central Electric Railway Association (annual meeting), Indianapolis, January 17th.

COPPER is now so high in price, Lake being quoted at 22½ and 22¾ cents, that the producers themselves are reported as viewing the situation with disquietude. It is believed that they would prefer to see the price remain in the neighborhood of 20 cents, reasoning, no doubt, that higher figures will result in a strenuous effort to secure a substitute. But the demand for electrical and other purposes is so insistent that the price is constantly advancing. There is hope of an increased supply from Alaska and other new fields, but there seems to be little doubt that copper will be abnormally high for some time to come. One feature of this situation is that scrap metal is correspondingly in demand, and central stations or other electrical concerns having old copper to sell can dispose of it now to great advantage.

IN HIS brief presented at the hearing before Secretary Taft at Washington earlier in the week, Francis Lynde Stetson, representing the power companies, made a significant statement in relation to the use of Niagara power in Canada. He said that the Canadian companies, which have invested large sums of money in the establishment of their works, would find their investments unprofitable except to the extent that they could find consumers of power in Canada. "Can anyone be fatuous enough to suppose," he asked, "that thereupon the companies would not seek to protect their Canadian investments by Canadian development, welcomed and assisted by the Canadian authorities? Such establishment and development in Canada, of course, would involve such concessions in the cost of Canadian power as would afford sufficient inducement to Canadian users. But with sufficient concessions, the cost of Canadian power could be brought so low that no railroad in the province of Ontario could afford to forego the use of electricity from Niagara. Such operation would supply a market for Canadian power vastly in excess of any figures yet suggested." It was also announced that the Canadian Niagara Power Company has extended its line to Fort Erie, opposite Buffalo, and already contemplates considerable development in that vicinity and elsewhere, which ultimately may make it indifferent whether or not Canadian power shall be transmitted into the United States.

FROM several sources there are indications that the scientific and technical people of England were not in entire sympathy with the rather stiff-necked attitude of the representatives of the British government at the Berlin wireless conference. The London Electrician, for instance, in commenting on the work of the conference, says, rather obscurely, that "Latterly the subject of wireless telegraphy has been so contaminated with politics that it has been best left alone." But further on its meaning is perfectly clear: "The whole question is one between private enterprise and international policy. Inasmuch as the Marconi company is a British concern, we should like this company to have as free a field as possible; but when it comes to a case of international communication it is surely impossible to expect that any station should be privileged to refuse messages from any other simply because they are transmitted by some rival system. In telegraphy with wires no such proposition would be entertained for a moment. Why, then, should it be for wireless telegraphy?" Why, indeed! And why was not the original American proposal—that there be unrestricted exchange of messages between ship and ship and ship and shore, regardless of the system used—a perfectly sensible and desirable consummation? The answer to this question, if it could be obtained, or perhaps when it is obtained, should throw a flood of light on the negotiations and the spirit in which they were conducted.

HIGH-EFFICIENCY electric-lighting units are now receiving so much attention that the papers and discussion on the subject at last week's meeting of the American Institute of Electrical Engineers in New York are of especial timeliness and value. Dr. Steinmetz's paper (about half of which is given in this issue) bids fair to become a classic, with its clear, scientific handling of such an important subject as the "Transformation of Electric Power into Light." Dr. Clayton H. Sharp, in his paper on "New Types of Incandescent Lamps," considers concrete examples, examining with care the osmium, tantalum and tungsten lamps, with results of tests. This paper, also, is of a high order of excellence. The writer concludes that "the electric-lighting industry is face to face with a change of almost revolutionary character. The standard of incandescent-lighting efficiency will be brought by the tungsten lamp to a point about three times as high as it is at present." This declaration indicates very forcibly the importance of the subject. Such men as Prof. H. C. Parker, J. W. Howell, P. H. Thomas, J. W. Lieb, Jr., W. J. Hammer and Prof. W. S. Franklin discussed the papers and contributed materially to the stock of knowledge on the subject.

So much useful information was brought out at this important meeting that the Western Electrician will not attempt to present it all in one issue. The first half of Dr. Steinmetz's paper is given this week. The concluding portion will appear in the next number, with Dr. Sharp's paper and portions of the discussion in succeeding issues.

JAPANESE enterprise is well shown in the extensive use which is making of hydraulic power electrically transmitted. Among the largest of the hydraulic plants is the station of Kyoto, which has an intake canal about seven miles long, running from the Biwa Lake. Using a 105-foot head, the plant can furnish some 4,500 horsepower. One of the most important plants in Japan is that for Tokyo, which supplies the city over a 25-mile pole line. The station uses the water of the Tamagawa, and the line voltage is 40,000 volts. Between Kyoto and Osaka a new hydro-electric plant is to be erected in order to furnish current for these two cities, situated about 40 miles apart. Some 32,000 kilowatts is to be secured in this case. In Korea an important enterprise has been undertaken in the shape of a hydro-electric plant which is designed to supply several large mines in the region served. Formerly steam engines were used for the mine plants, with wood as fuel, but it was decided to adopt the electric system. Accordingly a plant was erected which uses a 115-foot head and has a 500-kilowatt turbo-alternator installed at present. This machine works on the 13,000-volt three-phase system. The mines which use the current are situated 35 miles from the Yalu River, of war-time memory.

FOREWARNED is forearmed. The courts have held in more than one instance that the electric-service company is negligent and liable for damages in personal-injury cases where, through the absence of proper grounds on transformer secondaries, the interior wiring becomes accidentally charged with high-potential current and inflicts an injury upon a person coming into contact with a conductor or fitting. The judges have held that the protection to life afforded by the grounding of transformer secondaries is well known and that there is no excuse for neglecting this precautionary measure. Now the fire underwriters, or some of them, are contending that the same liability exists where fire is caused under these circumstances. This significant advice is given by an insurance man:

"In prosecuting suits for damages it is necessary to establish the fact that the secondaries were charged with high-potential current, also how this was brought about. If the rupture of the transformer insulation is the direct cause of the accident, it should be possible to indicate the individual transformer responsible for the trouble, and if the crossing of primary and secondary wires is responsible for introducing high-potential current into building, it is desirable to know where this cross took place. In order to obtain this important information a careful examination must be made as promptly as possible after the accident occurs. Delay in making these investigations permits the service company to remove all evidence as to the cause of the trouble, making it difficult to discover absolute proof of the company's negligence."

Central-station companies will do well to note these explicit instructions and to take such steps that they will not be confronted with the necessity of meeting a situation to which they apply.

WIRELESS OR RADIO-TELEGRAPHY.

By D. McNicol, A. M., A. I. E. E.

Note.—Wireless telegraphy is the popular name for the transmission of intelligible signals through space by Hertzian waves, but the term radio-telegraphy was officially adopted by the Berlin International Wireless Conference and promulgated November 3, 1906.

Introduction.

Nearly 19 years have now elapsed since Heinrich Hertz, professor of physics in the University of Bonn, Germany, verified Clerk Maxwell's electromagnetic theory of the propagation of light rays. This verification established the fact that electric waves exist, and included a determination of their wave-length and period.

Since 1889 scientists and physicists in many lands have experimented with the phenomena of electric waves, and a great many deductions have been made regarding their propagation through space. The most notable application of the knowledge gained is that which has made possible the transference of intelligible signals between distant points, without employing the usual medium of connecting wires.

It is a fact that the extension of wireless telegraphy to commercial requirements has been more rapid and general during the first few years of its application than was the adoption of Morse's wire-line system in the same length of time.

The object of this series of papers is to set before those who seek a knowledge of the subject a non-mathematical presentation of the principles of ethergraphy as it is in operation today. The time of the reader will not be taken up unnecessarily with historical data which does not materially concern any of the practical systems now in operation. I shall endeavor to explain the principles upon which the different systems are operated, and to give a concise and accurate account of the present status of wireless working. It has been deemed advisable to omit descriptions of a number of minor inventions and so-called improvements which have appeared from time to time, but which have so far not been looked upon favorably by those who have in hand the establishing of wireless communication on a commercial scale.

One of the later chapters will give details of the construction of an inexpensive set of instruments for demonstration purposes for the benefit of those students who are sufficiently interested in the subject to go to a little expense in order to study the phenomena at first hand.

CHAPTER I.

Matter.

"Science ought to teach us to see the invisible as well as the visible in nature, to picture to our mind's eye those operations that entirely elude the eye of the body; to look at the very atoms of matter, in motion and in rest, and to follow them forth into the world of the senses." Tyndall.

Matter is that which occupies space. A separate portion of matter is called a body, and a particular kind a substance. A general property of matter belongs to all substances and a specific property to particular kinds.

Matter is composed of minute atoms. A group of atoms form a molecule. Extension, impenetrability, divisibility, porosity, inertia and indestructibilty are general properties of matter. By extension we mean that matter occupies space. A body of matter occupies space according to its size or bulk. The impenetrability of matter prevents two bodies from occupying the same space at the same time. Divisibility permits a body to be divided infinitely. Porosity is caused by the particular structure of a body, for inasmuch as a body of matter is made up of molecules which do not touch each other, it follows that pores are inherent to the constitution of matter. When we say that a body possesses inertia, we mean that matter cannot change its state from motion to rest, and vice versa. Indestructibility prevents the extinction of matter by the act of man, or the action of forces controlling the functions of the universe.

Ductility, malleability, tenacity, elasticity, hardness and brittleness are specific properties of matter. A ductile body can be drawn into wire; a malleable body may be hammered into sheets; a tenacious body resists being pulled apart; an elastic body allows a play of its particles in such a manner that the particles will return to their original position when the disturbing force is removed. A body is known to be hard when it cannot easily be bent or indented. A brittle body, such as glass, may be easily broken at ordinary temperatures.

Mechanical illustrations of the specific properties of bodies are very helpful in enabling us to familiarize ourselves with the various forms of matter. For instance, should I place an apple in a cup, it would be beyond human power to place another apple in the same cup until the first had been removed. Thus we see that no two bodies can occupy the same space at the same time. I pour a quart of water into a quart measure, and thereby displace a quart of atmospheric air. Should the air refuse to leave the vessel, the water could not possibly enter in.

Sir Walter Raleigh, while smoking his pipe in the presence of Queen Elizabeth, offered to wager with Her Majesty that he could tell the weight of the smoke which curled upwards from his pipe. The wager was accepted. Raleigh quietly finished, and then weighed the ashes; he subtracted this amount from the weight of the tobacco he had placed in the pipe, thus apparently finding the weight of the smoke. In the light of later knowledge we learn that the smoke and the ashes really weighed more than the original tobacco, on account of the oxygen of the air having combined with the tobacco in burning.

In addition to what we may learn regarding the properties of matter, we know that matter is discontinuous. In other words, matter is limited. It is made up of atoms, which, according to Professor Dolbear, have dimensions known to be approximately one fifty-millionth of an inch in diameter. Any or all of these atoms may be separated by any distance from each other.

Molecular groups of atoms in common air, though continuously and rapidly changing their relative positions, are on the average approximately 250 times their own diameter apart. Comparatively speaking, this distance is greater than that which separates the earth from the moon.

However, inasmuch as all the matter with which we are likely to have to do is contained in the terrestial world and its atmospheric envelope, matter is limited to a certain extent, and if it should be weighed there would be found to be a definite amount of it in pounds and ounces.

This short chapter on matter is not intended as a comprehensive consideration of this branch of physics, but it is hoped that what has been said regarding the properties of matter will serve to refresh the mind of the reader so that he will be in the proper frame of mind intelligently to compare the limitations of ordinary matter with the vast, unlimited and continuous ether, which is the subject of the second chapter.

CHAPTER II.

Ether.

"Nature is a reservoir of power. Tremendous forces are all about us, but they are not adapted to our use. We need to remold the energy to fit our wants. A waterfall cannot grind corn, nor the winds draw water, yet a machine will gather up these forces and turn a grist mill or work a pump." Emerson.

The term ether was originally applied to a transparent and extremely sparse fluid, supposed to fill celestial space, by the German astronomer Encke about the year 1829, when studying the elements of Pons' comet, discovered in the year A. D. 1818. For many years the world learned little more about ether, and the latter had nothing to show for itself except a name. Of recent years, however, scientists and physicists have concerned themselves in a study of the ether, and to-day we are at least aware of some of that wonderful agent's peculiarities.

In contradistinction to the limitations of matter we learn that the ether is unlimited and is spoken of scientifically as being continuous. As evidence of the fact that the ether is unlimited, we know that light rays which are generated at the sun travel away from their source in all directions at the velocity of 186,000 miles a second. And as the sun is 93,000,000 miles distant from the earth it takes about eight minutes for each ray of light to travel from the sun to the earth.

Light rays from Neptune, the planet farthest away from the earth, take four hours to reach the earth. Light rays from the nearest of the fixed stars take approximately 3½ years to reach us. And astronomers teach that some of the stars which are plainly visible to the unaided eye are so far away that their light traveling at the enormous rate of 186,000 miles a second, takes more than 10,000 years to reach our planet.

Now, we know that the earth's atmosphere extends about 40 miles above our heads, and we must therefore conclude that between the boundary of the atmosphere and the distant stars there exists some continuous unbroken medium which is capable of conducting light rays, else we would not be able to see the shining stars. We know, further, that some of the rays that reach the earth are of a very short wave-length; some of them even as short as the hundred-thousandth part of an inch. It would seem evident that were there at any place in this vast expanse a break or crack in the continuity of the medium of this small dimension, the hundred-thousandth part of an inch, that these short rays would be lost or interrupted and never reach the earth.

Perhaps the principal reason why the ether was not better understood ages ago is because there is no apparent or sensible relation between the ether and the nervous system. Indeed, the necessity for its further employment now is felt only by those who have in hand the problems of signaling and of power transmission. I say "further employment," because it is, of course, due to the existence of the ether that heat rays and light rays reach us, and light rays, in turn, with their different wave-lengths, produce the sensation of color.

Our powers of conception are seriously taxed in attempting to comprehend the infinite extent of the ether. It is almost certain that should one of our scientists be by some means transported to the most distant star, and there make observations and calculations to determine the extent of the ether in the direction away from the earth, he would find that the boundary of that all-pervading fluid was still impossible of confinement. As Dolbear has pointed out, it is highly probable that the sun and the stars have for at least one thousand million years been pouring rays of radiant energy into space in all directions, and that had the rays first radiated somewhere reached a boundary of the ether, they could not have gone beyond, but would have been reflected back into the ether-filled space and the sky would be perpetually bright, so that we would know no such thing as darkness or night. This is equivalent to saying that the ether fills space in every direction, and so far is itself unlimited.

Unlike matter, the ether is not divisible into atoms or molecules, but is one continuous ocean of structureless, formless fluid, devoid of pores or interspaces. Moreover, if the ether were subject to the laws of gravitation we would expect to find it more densely massed in some places than in others—for instance, in the neighborhood of the planets. But astronomical observation shows that light rays are not deflected from their straight path at any point in space above the atmosphere. The fact that the earth's motion in its endless chase through space is not retarded proves that the ether is frictionless. We know, of course, that the earth's atmosphere moves along with the earth as a part of it, and if there were any friction whatever between the atmosphere and the ether there would be serious resultant consequences, which would have a tendency to interfere with the periodical rotation of the globe, and we can hardly believe that the Architect of the Universe would permit of forces working at cross purposes, or so arrange things that there would be a perpetual combat going on between the elements, one interfering with the clearly defined functions of the other.

Now, knowing that the ether is unlimited and that it pervades all space, including that part of space occupied by our atmosphere and our earth, and that it permeates through the interior of our earth as well as through natural and artificial superstructure on the earth's surface, and, assuming that the ether is motionless as a body, its manifestations being made in the form of waves, we arrive at the deduction that probably a means may be devised whereby controllable disturbances may be set up in the ether which will impart wave motion to it, which waves will travel away from their source in all directions and to great distances, and possibly we may devise means of arresting at distant points in space these prearranged wave signals.

These are the problems which confronted the arch-founders of wireless telegraphy.

It might be well here to remind the reader that waves in the ether have no dependent connection with waves in air. Sound is the sensation produced upon the organ of hearing by vibrations in air. By lightly tapping a thin glass vessel we set its sides into vibration, and a musical sound is produced. Should the vessel be a large one we would plainly see the vibratory motion of its sides. We tap a small table bell; its sides are set in motion, which causes condensation and rarefaction of the surrounding air, and our sense

of hearing being acted upon by these waves interprets them as sound.

When we speak we do not shoot the air expelled from our lungs into the ear of the listener; the act of speaking simply condenses the air immediately in front of the mouth and sets it into vibration, thus creating sound waves, which spread out in all directions. If we fasten a needle on one prong of a tuning fork and hold the fork over a piece of smoked glass (Fig. 1) in such a way that when the fork is tapped and set into vibration, by drawing the fork along the glass a sinuous line of marking will show the width or amplitude of the vibrations produced. Sound waves are transmitted by ordinary matter.

Whether the medium be liquid, gaseous or solid,

FIG. 1. EXPERIMENT SHOWING SOUND WAVE.

through which waves are propagated, the inherent elastic forces which are developed by the assumed displacement of molecules will start the wave motion in the medium in all directions from the point of initial disturbance.

As an ever-enlarging volume becomes involved in this disturbance, each molecule takes up a motion exactly similar to that of its predecessor, which it in turn transmits to the next molecule, and so on. This transfer of motion is completed when an individual pulse traverses the medium, and is both complete and continuous when these pulses are successively continuous. In the latter case the exciting cause acts for a definite length of time.

Consider the instance of a file of molecules represented by dots in Fig. 2. The natural position of the file or row is as (a).....(b). The arbitrary displacement of the molecule (m) will result in altering the position of the neighboring molecules, and (cd) and (ef) will represent the relative positions of these molecules at the expiration of a given time (t), equal to the periodic time of vibration; the former, when the displacements are parallel to the direction of disturbance

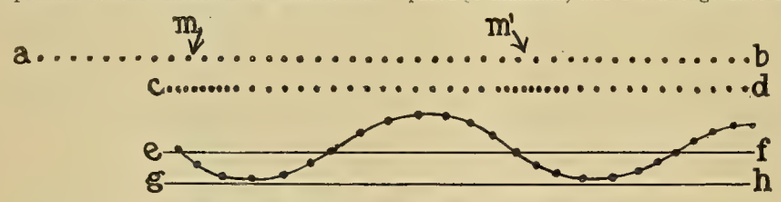


FIG. 2. MOLECULES AFFECTED BY WAVE MOTION.

propagation, and the latter when at right angles to this direction.

It will be seen then that when any molecule (m) describes its orbit, it communicates the disturbance to adjacent molecules, and at the instant the orbit of (m) is completed the disturbance will have progressed to a distant molecule (m') on the same line of direction, which latter will begin to move, and the molecules (m) and (m') will thereafter be at the same relative distance from their origin. Of course, it must be understood that while this wave-like motion is being propagated, other molecules will be located between (m) and (m') with various degrees of displacement, both as to amount and direction of motion consistent with the dimension and shape of their orbits.

If we suppose that the velocity of wave propagation is the same in all directions, the form assumed by the bounding surface containing the molecules so disturbed will be spherical. But, on the other hand, if the velocity vary in different directions, the form assumed will depend upon the law of its variation.

[*To be continued.*]

A report from Indianapolis says that plans for the organization of a big holding company, to include all the Indiana traction lines represented in the state by Hugh J. McGowan, are gradually being developed. The company will include eight interurban main lines. The main lines to be united are those of the Indiana Union Traction, Indianapolis and Western, Indianapolis and Northwestern, Indianapolis and Eastern, Indianapolis and Martinsville, Indianapolis Coal Traction, Wayne and Wabash Valley, and the Richmond Street and Interurban Traction companies. These roads, with the numerous branches controlled by them, will make the largest, or the second largest, traction system in the world.

The Niagara Power Question.

[Special correspondence of the Western Electrician.]

Washington, D. C., November 27.—Yesterday Secretary of War William H. Taft gave a hearing to persons interested in the development and transmission of power at Niagara Falls, the hearing being special on the question of the advisability of allowing the importation of Canadian power into the United States, and to what extent this transmission may be permitted without detriment to the scenic features of the Falls of Niagara, the idea being held by some that to stop the transmission of power from Canada to the States will help save the Falls.

The American Civic Association, of which J. Horace McFarland is president, has been making a campaign against the transmission, but it is asserted that many of the claims of this association have slender foundation in truth.

Among the companies represented at the hearing were the Ontario Power Company, the Canadian Niagara Power Company and the Electrical Development Company of the Canadian side of the river, all developing companies. The transmission companies represented were the Niagara Falls Electrical Transmission Company and the Niagara, Lockport and Ontario Power Company, while the Niagara Falls Hydraulic Power and Manufacturing Company and the Niagara Falls Power Company were represented, the latter desiring a permit to transmit power developed by the Canadian Niagara Power Company, an allied concern. Briefs were submitted by the Canadian Niagara Power Company and the Niagara Falls Power Company, both being represented by Francis Lynde Stetson, their counsel; the Niagara Falls Electrical Transmission Company, represented by Hon. Frank A. Dudley of Niagara Falls; the Ontario Power Company and the Niagara, Lockport and Ontario Power Company. Hon. Frank A. Dudley made an extended address in support of the facts in the brief filed by his company. The arguments made were not closely confined to the briefs, but were based on all the facts that have bearing on the development and transmission of the power of Niagara.

The brief prepared by Francis Lynde Stetson for the Canadian Niagara Power Company and the Niagara Falls Power Company was quite complete. In part he said:

"The suggestions of Mr. McFarland as to a present apparent depletion of Niagara must have been refuted by the personal observation of the secretary upon the day of the hearing at Niagara, July 12, 1906, when the works upon the American side were in full operation. I am not the 'oldest inhabitant,' but after nearly 20 years of continuous observation of the volume and flow at Niagara Falls, I am prepared to maintain, and I challenge successful denial of the proposition, that upon that day there was no diminution of the volume or flow of the Niagara River which was susceptible of observation. Neither is there now any appreciable diminution.

"This is in accordance also with the testimony of the water gauges, which at least three times a day, for more than 15 years, have been maintained and examined by the Niagara Falls Power Company and by the Schoellkopf company. These observations show not only that there has been no observable depletion of the American Falls, but that there has been no material diminution, even when tested by water gauges. The fact is that the draught upon the American side has resulted in the re-establishment of the regimen of the river by contribution from the Canadian side, where the water is deeper.

"And now I repeat, as firmly and comprehensively as I can, that I have nothing but respect for the sincere men and women who by appeals, sometimes as incendiary and erroneous as those of Mr. McFarland, and sometimes more temperate but not founded on investigation, have been stirred to anxiety lest the greatest natural wonder of Northeastern America is to be destroyed or impaired. This anxiety is praiseworthy, and did I believe the peril were real I should stand with those who feel and express this anxiety. If I believed that pioneer companies I represent would have produced any such result, I would cheerfully forego every penny of possible profit rather than further the enterprise. But I do not so believe, nor after their exhaustive investigations did Judge Burton or his committee so believe, for otherwise they would not have reported the bill which invests you with your discretionary powers up to the limit fixed by the law under which we now are proceeding.

"The Niagara Falls Power Company has published its schedule for standard 10-hour meter power at a rate which offers a maximum use of 100 horsepower, and an average use of 75 horsepower for a month of 250 hours, at an aggregate price of $144.17. This compares with the following reported charges in six important northern cities: Boston, $937.50; Philadelphia, $839.25; New York, $699.37; Chicago, $629.43; Cleveland, $559.50; Rochester, $419.62; Niagara Falls, $144.17.

"In the face of such figures who can doubt the beneficent effect of the operations of the Niagara Falls Power Company, furnishing power at not more than one-fourth of the cost in New York, Chicago or Cleveland, and at less than one-fifth of the cost in either Boston or Philadelphia?"

The brief tells that McFarland's statements as to the cost of public lighting in Buffalo are misleading, as the Niagara Falls Power Company and the Cataract Power and Conduit Company have no control over the matter, merely selling and delivering the electric current. It tells how, under the influence of the development, Niagara Falls has advanced from a country village to a prosperous city, ninth in the state in the volume of industrial products, approaching $20,000,000 per annum. It tells of the necessities of the Niagara Falls Power ompany and the Canadian Niagara Power Company, and it is said that the two companies will require the entire output of the American and Canadian plants to supply existing contracts.

The first speaker was J. Horace McFarland, president of the American Civic Association. He argued that the plain intent of Congress was to preserve the Falls of Niagara intact, and he asked that the secretary refuse permits for the transmission of additional power.

Judge A. K. Potter of Lockport, a member of the Niagara Reservation Commission, argued that it was the intention to have things remain as they are until the two controlling countries could agree on a treaty.

F. W. Stevens appeared to represent the New York Chamber of Commerce.

Hon. W. Caryl Ely spoke for the industrial interests of Western New York in general, while men from Buffalo, Tonawanda, Lockport and Niagara Falls were also heard. D.

Advanced Methods of Electric Lighting Discussed by the Institute.

The regular New York meeting of the American Institute of Electrical Engineers was held at the Edison Auditorium, New York city, on the evening of November 23d. President Sheldon was in the chair. Secretary Pope announced the election of 54 new associates and also spoke of the new Engineering Building in New York, the office floors of which are practically completed. The nearby Engineers' Club building is not quite so far advanced. The Institute and also the Mining Engineers and the Mechanical Engineers will move into the new building in the course of a month or two, but no formal meetings will be held in the building until after the dedication in April next. Meanwhile, the Institute will enjoy the courtesy of the New York Edison Company.

Mr. Pope also said that at an informal gathering on November 22d Chairman Thomas Comerford Martin of the building fund committee announced that Mr. George Westinghouse, as representing the various Westinghouse companies, had contributed to the land, building and endowment fund the sum of $50,000, to be equally divided between the three founder societies toward the payment of the land. This was followed by the announcement that the Allis-Chalmers Company had contributed the sum of $3,600, to be similarly divided between the three societies. This brings the amount pledged toward the payment of the Institute's proportion of the land to $155,000, out of $180,000, which is the sum total.

In introducing the topic of the evening President Sheldon said that several months ago a lecture was delivered extempore before the Philadelphia branch of the Institute. The stenographic report of this lecture was received in New York and proved to be so remarkable in character that the editorial board decided to publish it in the monthly Proceedings of the Institute, in order that it might be thrown open to a larger audience, and the committee on papers, appreciating also the high character of this paper, demanded that it be given for presentation before a regular meeting of the Institute. The author consented, and therefore the paper was now presented under the title of "Transformation of Electric Power into Light," by Charles Proteus Steinmetz. Dr. Steinmetz then presented his paper, and he was followed by Dr. Clayton H. Sharp, who outlined his paper on "New Types of Incandescent Lamps." Thereafter followed a valuable discussion, opened by Prof. Herschel C. Parker of Columbia University, who was followed by J. W. Howell, engineer of the lamp works of the General Electric Company, Harrison, N. J.; Percy H. Thomas, Cooper-Hewitt Electric Company; John W. Lieb, Jr., New York Edison Company; Walter G. Clark, Columbia University; William J Hanmer, consulting engineer; John A. Heany, York, Pa.; C. W. Hogan, American Electric Lamp Company, Philadelphia, and Prof. W. S. Franklin, Lehigh University, Bethlehem, Pa. Dr. Steinmetz closed the discussion.

Both of the papers and the discussion were of high character—the most valuable, in fact, that have been brought out at the Institute for some time. In this issue of the Western Electrician the first half of the Steinmetz paper is given. In later issues the conclusion of this paper, the Sharp paper (in whole or in abstract) and an abstract of the discussion will be given. The general subject is particularly important in view of the great interest now taken in high-efficiency units of electric lighting.

Transformation of Electric Power into Light.[1]

By Charles Proteus Steinmetz.

I. General.

Of all the achievements of modern science or engineering the production of light is the least creditable. In the transformation of electric power into mechanical power, as in the electric motor, or the transformation of mechanical power into electric power, as in the dynamo, efficiencies far higher than 90 per cent. have been reached. The transformation is practically complete. All further advance must be expected in the direction of increased reliability of operation, decreased size and cost, etc. Even in the steam engine or steam turbine, 60 per cent. or more of the available energy of the steam as it issues from the boiler is recovered as mechanical work.

In the production of light, the efficiency of the incandescent lamp is measured by a fraction of one per cent., and if we should succeed in increasing the efficiency of light production tenfold—get ten times as much light as we get now from the same power—the efficiency of production of light would still be ridiculously low; and even with a hundred times its present efficiency, it probably would compare unfavorably with efficiencies that are familiar to us in other electrical apparatus. While the incandescent lamp is more efficient than the gas flame or the kerosene lamp—that is, gives less heat with the same light—still its efficiency is extremely low. The main reason for this condition appears to be that in the incandescent lamp or the ordinary carbon-arc lamp the light is really a by-product; that is, the lamp converts electric energy into heat, and only incidentally produces light.

II. Lighting by Incandescence.

If energy is impressed upon a solid or a liquid, as by passing an electric current through a carbon filament, and no other work done, the body is heated. This energy must be given off again; it is given off partly by conduction, but largely by being radiated from the incandescent body. By increasing the power, the amount of radiation increases; and there are changes in the quality of the radiation, too: First appear radiations of very great wave-length or very low frequency; then, with the increasing power, higher frequencies appear; that is, the wave-length of radiation becomes shorter. In other words, in addition to the long waves which appear in the beginning, shorter and shorter waves appear; not only the total amount of radiation increases, but also the variety of waves increases and, ultimately, at a certain amount of heat given to the body or at a certain temperature, waves as short as 750 $\mu\mu$ appear. These are noticeable to the eye as dark-red light. Then still shorter waves appear gradually: orange, yellow, green, blue, lavender, violet. Beyond wavelengths of 400 $\mu\mu$, the waves again become invisible, as so-called ultraviolet waves.

Of the infinite variety of waves radiated by a heated body—from the long heat waves given by liquid air to the shortest ultraviolet waves, many octaves of wave-length in all—somewhat less than one octave is visible to the eye. These wavelengths are useful as light; the rest is wasted energy. A parallel would be found in the case of a musical instrument of six or eight or more octaves, producing less than one audible octave. To this fact is due the very low efficiency of light production by heat; of the total system of radiation only a very narrow range is useful, less than one octave.

Of these useful rays, the visible three-quarters of an octave, none appears until the temperature is fairly high. Below that, only the long waves appear. That means the average wave-length of radiation decreases with the temperature. Or, with increase of temperature, not only the existing waves become intense, but shorter and shorter waves appear, and the intensity maximum moves toward a shorter wave-length. With increase of temperature, the percentage of visible radiation thereby becomes greater and ultimately reaches a maximum, or the efficiency would be the highest when the maximum intensity lies just within the visible octave. Where this maximum may be is unknown, but it is beyond the temperature of the crater of the arc, possibly somewhere between 4,000° or 5,000° C. At that temperature the efficiency of the incandescent light is a maximum, and probably from one-quarter to one-half watt per candlepower. But even then the efficiency is not high, five to 10 per cent., or thereabouts. It follows, however, that even if we could raise the incandescent body to the temperature of maximum efficiency, we would still get only about five to 10 per cent. of all the energy as light. The other 90 per cent. would be ultraviolet, chemical or actinic rays, X-rays, or long heat waves. There is thus an absolute limit to efficiency of lighting by incandescence.

The higher the temperature the greater the light efficiency of an incandescent body. Carbon is apparently the most refractory of all substances—its boiling point being somewhere near 3,500° Cent., so an incandescent body, at the highest possible temperature, and the incandescent crater of the carbon arc are the most efficient sources of light by incandescence. They are still somewhat below the temperature of the efficiency maximum.

Incandescent lighting is effected by the electric current, either by raising the temperature of the light-giving solid body, a lamp filament, by passing a current through it, or by passing the current from it into another body. In the latter case the temperature of the boiling point of the material is reached, and the crater of the carbon-arc lamp is at the highest temperature which can be reached; gives it an incandescent light of maximum efficiency, probably not very far from half a watt per candlepower. But the large amount of energy which is conducted away by air currents, etc., greatly reduces the actual efficiency of the carbon arc below this value.

When producing light by passing an electric current through the conductor, as in the incandescent lamp, no such efficiency can be reached. Here carbon is also chiefly used. The higher the temperature of the incandescent-lamp filament, the greater is the efficiency; but the limit of the temperature is not the boiling point of carbon, 3,500° C., but far below that; it is the temperature where evaporation of the filament becomes so rapid as to limit its life below economical requirements. This is probably not very far from 1,800° C. Far below the boiling point, evaporation takes place; water evaporates at ordinary temperatures; even below the freezing point snow and ice evaporate very noticeably. An incandescent carbon filament evaporates, thereby decreasing in cross-section and increasing in resistance; the current decreases, therefore the temperature decreases and with the temperature the efficiency decreases. As the condensed carbon vapor blackens the globe and obstructs the light, another decrease of light results from absorption. Thus efficiency has to be sacrificed in the incandescent lamp to get good life, and the specific consumption of electric power, instead of being one watt per candlepower (as in the case of the arc lamp) becomes as high as four watts per candlepower.

The arc, then, is the more efficient illuminant. But its efficiency is still low, and here there has been a similar result; to increase the life, the efficiency has been decreased by enclosing the carbon arc, in the present long-burning lamp. Increasing the efficiency of the arc by reducing the conduction of heat by a decrease of the diameter of the carbon has also been tried, with the same result—exchanging efficiency for life.

In the incandescent lamp, the problem of increasing the efficiency can be attacked in two ways. One way is to replace the carbon by a material which has a lower vapor tension at high temperature. While carbon has the highest boiling point, it is not the boiling point which is of importance in a lamp filament, provided that this point is sufficiently high; it is the vapor tension, far below this point.

For instance, the metals osmium, tantalum, wolfram (tungsten) have a lower melting point or boiling point than carbon, but they have at the same high temperature a lower vapor tension, due possibly to the much greater atomic weight and so much greater heaviness per molecule (atomic weight of carbon, 12; osmium, 191; tantalum, 183; wolfram, 184). These metals can be operated at a higher temperature than carbon, and as lamp filaments they give a much greater efficiency than the carbon filament.

The efficiency of the incandescent lamp can be improved by replacing the carbon filament with a material which has a lower vapor tension and a sufficiently high melting point. Tantalum, osmium, wolfram or tungsten, as materials for incandescent-lamp filaments, promise to revolutionize the incandescent lamp, by holding out fair promise of an ultimate efficiency of about two watts per mean spherical candlepower for tantalum, 1.5 watts for osmium, and one watt per mean spherical candlepower for wolfram—compared with about four watts per mean spherical candlepower for the carbon-filament lamp. The objection to these metal filaments obviously is the low resistivity inherent to metals, which restricts their use to relatively larger units or at least makes difficult the production of low-candlepower sizes.

Another way of improving the efficiency of the incandescent lamp is by improving the carbon. The vapor tension depends not only on the chemical constitution, but also on the physical structure. Ice evaporates very much slower than a mass of loose snow. Futhermore, it is possible to produce different forms, possibly allotropic modifications of carbon, of different rates of self-destruction. The product of carbonization of fiber or cellulose cannot be run at as high a temperature with the same length of life as can carbon deposited from hydrocarbons, as benzol or benzine, by high temperature. Experiments with carbon at very high temperatures show probably greater variations in the character of carbon than with any other material. Possibly this is due to the tendency which the carbon atom has, more than any other atom, of polymerization, and especially ring formation, which results in the formation of allotropic modifications of carbon, having the greater stability of such polymerized molecules. So at the boiling point of carbon, the carbon deposited from hydrocarbons converts, under the influence of atoms which can enter and leave the carbon chain, into an allotropic modification having pronounced metallic characteristics, as elasticity, a positive temperature coefficient of resistance, etc., and very great stability, so that as a lamp filament this form of carbon can be run up to a considerably higher efficiency, in the so-called "metallized filament."

III. Selective Radiation of Solids.

Most incandescent bodies give the same or approximately the same law of radiation, that of the so-called "black body;" that is, at the same temperature the intensity of radiation varies with the wave-length or frequency in the same manner, somewhat similar to that shown by Curve I, Fig. 1,[1] with a maximum at a certain wave-length. At higher temperature, Curve II., a similar intensity curve exists, with the maximum at shorter wavelength, or higher frequency, so that the intensity within the visible range, shown shaded in Fig. 1, is a higher percentage of the total radiation; that is, the efficiency of light production is higher.

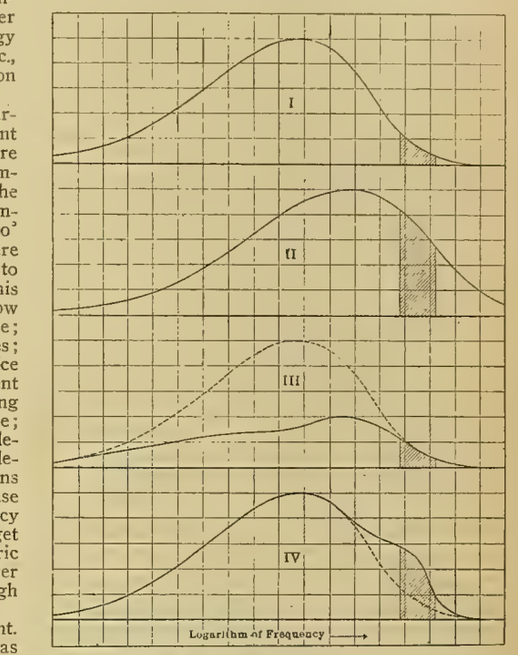


FIG. 1. CURVES SHOWING VARIATION OF INTENSITY OF RADIATION.

If, however, a body could be found which at the temperature corresponding to Curve I. gives an abnormally low radiation outside of the visible range, as illustrated by Curve III., or which with normal radiation in the invisible range gives an abnormally high radiation in the visible range, as illustrated by Curve IV., then in either case the visible radiation would be a greater percentage of the total radiation than corresponds to the temperature; that is, the efficiency of light production would be higher than that of a black body of the same temperature. Theoretically such a body with selective radiation might give an efficiency higher than the absolute maximum of light efficiency of black-body radiation.

Either of the two cases, abnormally high radiation in the visible and abnormally low radiation in the invisible range, may give the same shape of intensity curve, the only difference being that in the first case the total radiation per unit surface is higher, in the last case lower, than that of a black body at the same temperature. That is, with the same amount of light radiation and the same efficiency, in the last case the radiating surface is greater than in the first case, and this may give a criterion to decide between the two alternatives.

With such selective radiation, there is a distribution of intensity throughout the visible range and so the color of the light may differ from that of an incandescent body. With abnormally high radiation in the visible range, the increase of intensity is probably greatest in the middle of the visible spectrum; with abnormally low radiation in the invisible, the decrease of intensity is least in the center of the visible spectrum. In either case the tendency is towards preponderance of the wavelengths in the middle of the visible spectrum; that is, the greenish-yellow, as characteristic of such selective radiation, and apparent in the Welsbach mantle. Typical of such selective radiation is the lime cylinder of the calcium light, and possibly the flame of burning magnesium.

With gas as illuminant, a very great increase of efficiency has resulted from the use of selective radiation, as found in the Welsbach mantle.

In electric lighting the Nernst lamp probably represents the first attempt, on a large scale, of improving the efficiency of light production by selective radiation. It has not been as successful as in gas lighting, since the efficiency of the Nernst lamp

1. This is the first half of a paper presented at the meeting of the American Institute of Electrical Engineers in New York, November 23, 1906.

1. These curves, drawn with the logarithm of the frequency of radiation as abscissas, are only illustrative, and not quantitative nor based on experiment, but merely illustrating the statements made above.

does not differ much from that of the carbon incandescent lamp, while the efficiency of the Welsbach mantle is many times higher than that of the ordinary gas flame. The reason probably is that with a very inefficient illuminant, as the gas flame, the additional light given by selective radiation may increase the total light several fold, while the same amount of additional selective radiation with a relatively far more efficient illuminant, as the incandescent lamp, is a far lower percentage of the total visible radiation. Or, to illustrate, the additional shaded area, between the dotted and the drawn line in Curve IV., Fig. 1, increases the efficiency threefold, while the same additional area, added to the shaded area of Curve II., would not materially increase the efficiency. That is, the increase of efficiency by selective radiation of an incandescent body becomes less with a more efficient illuminant, and selective radiation may greatly increase the efficiency of inefficient illuminants, but not so much that of efficient illuminants, so that the hope of very greatly increasing the efficiency of light production by selective radiation of solids does not appear very strong. However, some of the recent very efficient incandescent-lamp filaments, as tungsten and osmium, may owe their high efficiency partly to selective radiation; that is, they give light not only by incandescence, but also by luminescence.

IV. Electroluminescence of Vapors and Gases.

The problem of efficient light production consists of producing radiations; that is, vibrations of the molecules or atoms of the light-giving body, of frequencies within a limited narrow range, that of a visible radiation, and as few vibrations as possible outside of this range. When heating a solid body, the energy put into it as heat sets the molecules or atoms in motion, in vibration. Where they are close together, as in a solid or liquid, they cannot vibrate freely; each cannot have a period of its own; just as all the different grains in a sand heap cannot vibrate simultaneously as do the molecules of a tuning fork, and the vibration is irregular. All you can get is a mixture of all kinds of vibrations, not a tune, but a noise. To get a tune requires a body which can vibrate freely without restraint; that means a gas; as the gas molecules are free, they can execute free vibration. A vibration of a definite pitch, definite frequency, that is, definite color of light, can be produced only in a gas or vapor. But when heating a gas or vapor, the energy put into it appears not as vibration of the molecules, except perhaps indirectly at extremely high temperature, but as rectilinear motion or pressure. The molecules move faster in their rectilinear paths, and so strike the boundary at higher velocity; the pressure of the gas rises by increasing molecular velocity, that is, increasing temperature, but the vibration of the light radiation does not appear. So heat, while making a solid or liquid incandescent, does not make a gas incandescent or luminous but merely increases its pressure.

There are methods, however, of setting the gas molecules in vibration. By chemical reaction or electric stress, gases become luminescent; that is, the molecules of the gas are set in vibration. For instance, if the gas is used as a conductor of electric current, then the molecules of the gas are set in vibration, and we find a definite period of vibration, or a number of periods or frequencies, in which the gas molecules or atoms can vibrate; that is, gases give line spectra. So in a mercury arc, the molecules vibrate not as those of a solid body, but only with a small number of wave-lengths. Many of these are within the visible range, within the fraction of an octave which is seen by the eye; one is of a greenish yellow; another wave is green; another is dark green; another is blue. Two vibrations appear as violet, and numerous vibrations excited by the mercury arc are, in the ultraviolet, very short.

Here results a definite rate of vibration, practically independent of the temperature. The mercury vapor vibrates at that frequency which gives that particular yellow light and that particular green light, etc., whether the temperature is high or low, and the wave-length does not change as it does with the radiation of a solid incandescent body; it is fixed by the nature of the molecule, so that the temperature has no direct effect. It has an indirect effect in so far as at higher temperature periods of vibrations may become more prominent, while small, or almost non-existing, at low temperatures. For instance, in mercury vapor the lowest frequency is that giving the greenish-yellow line, but no appreciable amount of vibration is so slow as to give red light at ordinary temperature. When you raise the temperature very high (but still below the temperature of the incandescent-lamp filament) then the mercury molecule begins to execute a slow vibration, which gives an intense red light, and red lines appear in the mercury arc; with increasing temperature it gradually changes its color from green to white to red. Here we have a particularly interesting illustration that for luminescent vapors or gases the law of the black-body radiation does not apply. In a solid black body, with increasing temperature, the mean wave-length decreases, shorter waves appear, and the light changes from the red over yellow toward white. Now it happens that with mercury vapor at the higher temperature, a slower vibration, or longer wave, of red light, increases in intensity faster than the short vibrations, and the light changes from green to white and ultimately to reddish pink at high temperature. It is a mere incident, but it shows that temperature has no effect directly, only indirectly, in that particular rates of vibration may appear with change of temperature, may become more or less prominent, depending on the material which luminesces.

As a rule, then, it can be said that such an arc or a luminescent gas or vapor is more efficient as a producer of light, the lower the temperature. This is just the reverse of the solid incandescent body. In a solid body the higher the temperature the larger a percentage of radiation is within the visible range, and the higher the efficiency. In a gas or vapor, a certain definite vibration is impressed directly by the electric energy or the chemical energy which sets up the oscillation; the heat which is produced is incidental, is a by-product and therefore a waste. The lower the temperature the less waste of energy takes place as heat, and the more efficient is the luminescent gas. With a luminescent gas the heat is a by-product which we want to decrease just as in an electric motor or generator; that is, the lower the temperature the better. This is one reason why the mercury arc is extremely efficient; it nas the lowest temperature.

Theoretically, there is no limit to the efficiency of a luminescent vapor. A vapor may be imagined which vibrates only with one particular wave-length, say a yellow line. That means all the energy put into it must be radiated at that particular wave-length, as yellow light, and therefore the conversion of electric energy into light would be 100 per cent., not counting the energy lost by heat convection or conduction. The latter can be made very small by enclosure in a vacuum. Complete conversion of electric power into light would so result, if all the spectrum lines were within the visible range. That is never the case. There is no definite law giving the percentage of energy which appears as radiation in the visible spectrum and which appears outside of the visible range as ultrared and ultraviolet lines; but the position of the lines in the spectrum is an individual characteristic of the gas or vapor. The problem of efficient light production is to find a material having most lines in the visible range of the spectrum.

With mercury vapor which is set in vibration by the current, a very high percentage of the total energy is radiated in the visible range. With carbon vapor, the percentage of energy radiated in the visible range is extremely small. The carbon arc is extremely low in efficiency, practically non-luminous. Silicon also gives a practically non-luminous arc. Others, like calcium, titanium, etc., give a very high percentage of light within the visible range, and so a high efficiency of light production.

The color of light produced by incandescence varies from reddish yellow at low temperature, to yellow, and approaches yellowish white at higher temperature. Selective radiation of solids tends to superpose hereon a preponderance of greenish-yellow rays, without, however, greatly changing the color. With electroluminescence of vapors and gases, however, the color of the light depends on which of the spectrum lines happen to be most prominent.

Electroluminescence makes it possible to produce light of any color. This, however, greatly complicates the question of efficiency, as efficiency can no longer be considered the ratio of the power radiated within the visible range to the total power input, since the different parts of the visible spectrum have entirely different energy equivalents; one candlepower of red light, or of violet light, represents many times more power which issues as radiation than one candlepower of green or of yellow light. That is, the light-equivalent of power is a function of the wave-length. It is obviously zero in the ultrared; it is very low in the dark red; and radually rises to a maximum in the yellow and green, and then decreases again, becoming very low in the violet, and zero in the ultraviolet. One candlepower per watt as red light or as violet light may therefore represent a fairly high efficiency, while 10 candlepower per watt, with green or yellow light, would be a far lower efficiency. That is, the energy radiated in a beam of one candlepower red light probably is greater than the energy of a beam of 10 candlepower of green light.

This feature explains the impossibility of determining efficiencies of light by the measurement of physical quantities. Light is the physiological conception of some wave-lengths of radiation, but no physical quantity.

Where high economy of light production is the only, or the foremost, consideration, spectra in which green or yellow preponderates are therefore selected; for instance (mercury), bluish green in the mercury-arc lamp, or (calcium) yellow in the flame carbon lamp. These two illuminants give high efficiency, but they give it by sacrificing the inefficient colors at the end of the visible range. But, unfortunately, the sun, as an incandescent body, gives the light of solids or liquids, and therefore gives all the radiations, with the red end of the spectrum specially prominent; and, since we call the sun white, the light from the mercury arc appears green, that of the flame carbon arc yellow; not the yellow of the incandescent lamp, but a pronounced monochromatic hue.

The mercury arc and the flame carbon arc are useful for cheap lighting, regardless of color. They also find an application for special effects due to their color. So the mercury arc is eminently suited for outdoor lighting in suburban districts where its effect on foliage and snow makes it superior to illuminants containing red rays and so intensifying the appearance of incipient death in the vegetation, and where the intrinsic brilliancy of illumination can be kept sufficiently low as not to show the objectionable effect of monochromatic light. The flame carbon arc finds its field in advertising, where its intense glare makes it especially suitable.

For general illumination, however, at least in this country, people have become educated to require as close an approach to daylight as possible; that is, to require white light. The problem, then, is to find a vapor which gives spectrum lines over the whole visible range, distributed approximately in the same manner as the intensity in the solar spectrum, and giving as few lines as possible outside of the visible spectrum.

A substance giving spectrum lines uniformly distributed in their intensity over the whole visible range should not give white, but a pronounced green light, due to the higher physiological effect of the radiations in the middle of the spectrum. By the law of probability, amongst the spectra of the chemical elements, the predominant intensity of radiation should be found just as often in one wave-length as in any other. Physiologically, therefore, green should predominate in the colors of metal spectra. To a certain extent this is true. Red metal spectra are rare, green most prominent. Bluish metal snectra, however, are much more frequent than should be expected by probability, and it therefore seems that in molecular vibrations of vapors, shorter wave-lengths or higher frequencies predominate. This may be due to the size and mass of the molecules being such as to have a mean frequency of oscillation higher than the average frequency of visible light.

V. Vacuum-tube Illumination.

Conduction through vapors can be of two distinctly different characters: Sparks or Geissler tube conduction and arc conduction Vapors or gases can be divided into two classes: Conducting vapors and non-conducting vapors. The conducting vapors are all of very high resistance. Hydrogen or air may be called a conducting gas, because a current can be passed through it, especially at a moderately high vacuum, as in the Geissler tube, which is nothing more than a tube containing the gas used as a conductor, at a few millimeters pressure. At this pressure, air becomes a fairly good conductor, but the resistance is very high compared with the resistance of conducting solids or liquid. The passage of current through the conducting gas of the Geissler tube produces light, by some form of luminescence.

The mechanism of this light production does not seem to be known, but the light seems to be somewhat of the character of a by-product. The Geissler tube is extremely efficient when operated with an alternating current of very high frequency. With decrease of frequency, its efficiency decreases and heat is produced; that is, the frequency of radiation from the Geissler tube seems to vary with the frequency of the impressed alternating electromotive force, and have its intensity maximum near the visible range only at very high frequency currents. The production of light in the Geissler tube therefore seems to be connected in some way with the change of electric stress. It is not dependent on it, because even with a steady current the Geissler tube gives light, but its efficiency of light production vastly increases, and the energy is converted more into light and less into heat, with increasing frequency. Herein seems to lie the great difficulty in this method of producing light by using conducting gases at low pressure.

Considerable work has been done in this direction by able investigators, and with some success. The Geissler tube gives a very nice light; and by using a suitable gas it can be made to give any color, only the intrinsic brililancy is very low. Very large tube surfaces must therefore be used for illumination, of a magnitude probably a hundred times as large as with the mercury arc, which latter is already recognized as a luminous source of low intrinsic brilliancy. In the last years, even with a frequency of 60 cycles, good efficiencies seem to have been reached. I do not believe it possible, however, to approach the magnitude of efficiency as given by the mercury, calcium or titanium spectrum.

[*To be concluded.*]

Municipal-lighting Project in Boston.

The Boston City Council's committee on municipal lighting has voted, five to eight, against submitting the question of municipal lighting to the voters of the city. It is said that Mayor Fitzgerald has intimated that he does not want a referendum on this question at this time. At the aldermen's meeting, on November 19th, the committee submitted two reports: A majority report against submitting the matter to the voters, and a minority report, favoring the establishment of a municipal plant. After discussing the matter for three hours, the aldermen substituted the mi-

nority for the majority report by a vote of seven to five. It will require a two-thirds vote of both branches of the city government to pass an order providing for municipal lighting. The order is still on the aldermanic calendar, however.

What is an Engineer-constructor?

At the meeting of the Electrical Section of the Western Society of Engineers in Chicago on November 16th George A. Damon, managing engineer of The Arnold Company, Chicago, presented an interesting paper entitled, "What is an Engineer-constructor?"

Mr. Damon used as a popular comparison the similarity between an ideal engineer-constructor organization and a modern football team. A diagram was used to show the "line-up" of the engineer-constructor team for the building of a railroad repair shop. The different positions in the football team, such as "full-back," "quarter-back" and "end," were shown in the diagram as being filled by the "accounting," "constructing" and "electrical" departments, etc.

Mr. Damon's definition of an engineer-constructor, in his own words, is as follows:

"An engineer-constructor is an organization, and not an individual. It makes possible the most effective combination of technical theory with practical experience, and provides for the use of 'team work' in connection with the designing and building of properties. Its aim is to attain the greatest economy in effort, time and money; its province is to 'do things' in the most effective way.

"In its broadest development such an organization need not be confined to any one class of enterprise. Here is something to be built which requires for its completion a combination of conception, technical knowledge, construction experience and executive ability. Whatever it is, the engineer-constructor should be prepared to carry the proposition through from beginning to end without technical assistance from outside the organization. To be most effective, such an organization should have at its command the technical knowledge and experience of the past; the ability to analyze situations, and discover the truth from conflicting testimony; the imagination to conceive unprecedented results, and courage to overcome obstacles; the ambition to improve existing systems, and the honesty to spend money without favor or graft; and, finally, loyalty to itself and to its client, which will protect in every way the interests of all concerned."

Discussion (in Abstract).

F. M. Davis: The question is, To what extent is it practical for the young engineer-constructor to take up other work to fill in a gap in case of failure of other engineers, or to assist other engineers?

Mr. Damon: Take, for instance, the electrical man. He has been trained particularly along electrical lines, and has been educated in electrical engineering; he has experience as an electrical engineer. The first problem in which he will get away from strictly electrical engineering will be in connection with the steam turbine. It is necessary for him to know something about the mechanical construction of the turbine; something about the economies of the turbine, etc.: and so, naturally, the electrical man begins to pick up those particular problems. Also, the electrical man interested in the application of the motor naturally has to pick up the mechanical problems in connection with the application of motors and tools, and he is liable to become quite a tool expert; so he will become more and more prepared to help out the mechanical man.

The theory is that each man shall be trained along his line of special aptitude. At the same time, while he is a specialist, he should be broad and learn as much as he can about everything else. If he is a mechanical engineer, he wants to be something more than just a mechanical man.

Geo. R. Brandon: Do you expect all your men to be in every game?

Mr. Damon: Yes. If a man is working upon a job we expect him to be interested in the whole work and become familiar with it, even if it should require him to stay up nights to do it. We do not create the impression that a man is to come on and do his little stunt and then go home, but it is well for him to take an interest in the whole proceeding. He never knows what is going to happen in carrying a job through. Any man is liable to be called upon at any time to do a responsible thing, and the better prepared he is to do it, the more valuable he becomes.

G. R. Brandon: That is one of the main things in a manufacturing business—the idea of harmony. You may have one man who is frequently having his feelings hurt; he does not work in with the organization and is a drawback rather than a help.

Mr. Damon: Prepare yourself to do some one thing well; pick out that one thing for which you have some natural aptitude. If a young man is going to prepare himself for a football team, he would start in by excelling in one particular line. He might find that he has a particular aptitude toward kicking a ball, and that he could in some way or another get his boot under the ball just a little better than the other fellow. He would end up on a particular position. He would be a star player some day in that line, and yet he would not forget the other essentials of the game. You would find him noted as a "kicker," but he would be a star in only one line. He would start right in, in the very beginning. The very first time he put on the football clothes he probably developed that aptitude. Do some one thing well, and then add to that the ability to do other things pretty fairly well. That makes a special specialist of a man, and yet it makes a broad man. In carrying that through to technical work, I would say: If a man can draw well, let him learn to draw extra well; let him learn to develop into a "crackerjack" draughtsman. If he is good in mathematics, let him learn to do extra well in that line. So, when he comes to apply for a position, and we ask him what he can do, he will not say, "I do not know what I can do; I have been four years in school and am now looking for experience." Seventy-five per cent. of those who apply for technical work come with that kind of a story. When asked what they can do it would be better for them to say, for instance, "Well, I can draw. Here is some of my drawing. I do not want to draw, but I can draw, and if you care to give me a trial and put me in the draughting room, I will try to work myself out." We can use such a man at once. It is understood, and it is our intention, not to keep that man on the draughting table indefinitely, but to send him out and give him work as a constructing engineer. It is our idea to promote that man so he will be a star builder.

P. Junkersfeld: In my own experience I know of a number of excellent men who started on work with a certain amount of ability, but they did not know where they were strong, and did not find it out until after years, when they gradually drifted into the channels in which they are making a success.

This is a rapid age, and most young men do not want that slow growth, but there is not room for all of the young men in this world to have extremely rapid growth, and it is an open question at the end of a long life as to which of these two young men will have made the most out of life, and is the better satisfied. The young man must embrace the opportunities before him. One young man will have an opportunity to get into a company where he will have a quick growth; another will not. We must all persevere.

D. W. Roper and J. H. Warder also took part in the discussion.

The Human Side of the Engineering Profession.

At a meeting of the New York Electrical Society held in New York city on October 31st Prof. V. Karapetoff of the engineering department of Cornell University delivered an address on "The Human Side of the Engineering Profession."

The first part of the address, in which Professor Karapetoff deals with "Work and Conduct," is substantially the same as the address delivered by him on "Apprenticeship Course as a Preparation for Engineering Activity," before the engineering apprentices of the Allis-Chalmers Company at its Cincinnati works on August 30, 1906, an outline of which appeared in the Western Electrician of September 8th.

The second part of the address before the New York society discusses "Underlying Motives" (a theory of life). The following is the conclusion:

1. Make yourself ready for a broader and higher field of activity; then your opportunity will surely come.

2. The true purpose and value of engineering activity lie in providing better and easier ways for satisfying ordinary human needs. This provides more leisure and opens new possibilities for a higher spiritual and intellectual development of humanity.

3. The engineer's personal satisfaction consists in knowing this high purpose of his vocation, and in giving his service at a maximum efficiency. The other compensation is a result and not the purpose.

Mexican Wire Thieves Are Bold.

The Mexican Light and Power Company, the Canadian concern which owns the electric-light plant and street-railway system in Mexico City and the large electric-power-transmission plant at Necaxa, estimates that thieves have stolen and carried away more than $100,000 worth of its copper wire during the last few months.

A force of detectives at work upon the cases recently discovered some wire in an adobe hut in a squalid part of town. Investigation disclosed that the hut was used to store stolen wire. Primo Vasquez and Andres Carillo were convicted and sentenced to the penitentiary. The confession of these two men led to a number of other arrests. Several junk-shop men were found to be implicated in the conspiracy. It was also discovered that large quantities of the stolen wire were shipped to San Luis Potosi, where it was smelted into bars and shipped to the United States, where it was sold.

On one occasion, several months ago, a mile of copper wire was cut and stolen one night from one point near Mexico City. The company says that it must have required at least 10 mules to carry off the booty. The fact that the wire formed part of a "live" circuit seemed to have caused the thieves no inconvenience.

Time-limit Circuit-breaker.

When there is a momentary great increase in the current carried by a circuit in which there is an automatic overload circuit-breaker the circuit-breaker operates and opens the circuit. Sometimes this increase is not caused by a ground or a continuous demand that really would make the opening of the circuit desirable. For instance, in the case of a large electric-railway system, a number of cars might start at the same time on the same section and all take current from one feeder. This would cause an overload for a short time which the generator or station might safely deal with until the cars acquire speed and the current requirements are cut down. In this case, however, the overload might reach a point for an instant which would cause the automatic circuit-breaker to operate and to become a source of annoyance.

In alternating-current lines of high potential there sometimes occurs what is known as "surging," in which action the current and potential are subject to violent fluctuations or to a sort of harmonic rise and fall. These phenomena are generally of such brief duration that it is highly undesirable to open the circuit when they occur and in this case also the automatic circuit-breaker may prove to be an annoyance.

A patent has just been issued to Edward M. Hewlett of Schenectady, N. Y., for an invention by which he seeks to overcome these difficulties by employing a device which operates only when the overload occurs for a definite time unless the overload is exceptionally great.

Mr. Hewlett uses an ordinary automatic circuit-breaker in which a coil will trip the circuit-breaker positively. In the circuit which actuates the coil he places a clockwork mechanism which is held from rotation by a detent which is actuated by the armature of the series coil. The detent is so arranged in co-operation with a suitable lug on one of the wheels of the clock that the circuit of the relay coil will be completed and the circuit-breaker operated only after the lug has made a complete revolution. If at any time during this revolution the short-circuit is removed the lug will be stopped, and the circuit of the relay being uncompleted the circuit-breaker will not operate.

In case a short-circuit or overload which is dangerous occurs it might be disastrous to allow the circuit to remain closed even for the short time while the clockwork device is in operation. The inventor therefore arranges his apparatus so that if the current rises to a second limit to which the apparatus is adjusted it will immediately operate and open the circuit. He accomplishes this by including in multiple with the tripping coil of the circuit-breaker a resistance so proportioned that a drop across its terminals at the determined second overload limit is sufficient to cause enough current to pass through the tripping coil to operate the circuit-breaker. Thus, for example, if the circuit-breaker is set to open on an overload of 50 per cent. the clock mechanism will operate as soon as the current reaches this amount. If a real short-circuit occurs or an overload of 100 per cent., which would be dangerous, then the drop across the resistance terminals will drive enough current through the tripping coil to open the circuit-breaker at once.

Annual Meeting of American Society of Mechanical Engineers.

The annual meeting of the American Society of Mechanical Engineers will be held in the auditorium of the New York Edison Company, beginning at noon on Tuesday, December 4th, and continuing until December 7th. The address of President Fred W. Taylor of Philadelphia, on "The Art of Cutting Metals," will be delivered on Tuesday evening. It will be followed by a social gathering at which refreshments will be served. There will be morning and afternoon sessions on Wednesday and a morning session on Thursday. On Thursday afternoon there will be an excursion over the new electrically equipped lines of the New York Central Railroad, and in the evening a reception at Sherry's restaurant. The closing session will be held on Friday morning.

In accordance with an arrangement made several months ago, it is expected that Prof. F. R. Hutton will retire as secretary at this meeting, to be succeeded by Mr. Calvin W. Rice.

Among the subjects for papers and discussion are "The Evolution of Gas Power," F. E. Junge of Berlin, Germany; "Producer Gas Power Plant," J. R. Bibbins, Pittsburg; "Steam-turbine Characteristics," Hans Holzwarth, Hamilton, O.; "Ventilation of Boston Subway," H. A. Carson, Boston, and "Improved Transmission Dynamometer," W. F. Durand, Stanford University.

SELLING ELECTRICITY.

Under this heading will appear, from time to time, articles, suggestions and examples which will be of assistance in the constant effort to increase the existing demand for electric current and to create new demands.

The New-business Department of the Central Station.[1]

By James L. Wiltse.

A commercial or business department is a necessity with a central station, or, in other words, it is the life blood of the central station. Its value is twofold: First, that it brings the company into close relations with the public, and, second, that it increases the business of the company. This department will have charge of all present and prospective customers of the company, excepting the collection of bills. The principal object is to increase and hold the business of the company.

The first thing in the organization of this department is the selection of a competent head. He should be a man who has had central-station experience, and one who realizes the necessity of tactful treatment with those with whom he comes in contact. He will be responsible for the acts of his solicitors and will settle questions of rates, guarantees, line extensions, and all the minor matters connected with the wishes and requirements of the public. He should take care of all complaints from customers and should also be capable of taking complete charge of advertising.

Having secured our contract agent, the next important consideration is the selection of solicitors; two will be sufficient to start with. These men should have some experience with central-station work and have a knowledge of light and power engineering. They should be paid a straight salary. This is more advisable than paying them on a commission basis, as better men can be secured by this method of compensation. Each solicitor should be given a certain territory. The contract agent should have an assistant to take charge of the office, see that the solicitors' work and reports are kept up, and take general charge of the details of the office. This man should be capable of taking care of all customers coming into the office.

We have now the organization ready to start the sale of our product. This brings up the question, "How shall we push the sale of electric current?" or "What method will we adopt to secure new business?" There are two channels through which we should go to get business. One is through advertising, the other through the outside representatives, or solicitors. Advertising is essential, because it informs the public that you are after business. Advertising for this purpose simply means the educating of the public to the adaptability of electricity to the everyday needs of the office, the factory and the home. Advertise freely in the local newspapers, as the majority of the people in the small cities read the local papers. Another good form is in mailing literature in the form of pamphlets and circulars relating to the many advantages and uses of electricity. As a means of keeping present customers awake as to the many uses of electricity, a small poster should be attached to their bills, giving a brief description of the articles you wish to advertise or place before them, such as fans, flat-irons, heating and cooking utensils, etc.

Another good scheme is to erect an attractive electric sign outside of the office. This shows that the company believes in the efficiency of electric signs. An attractive office, fitted up with fixtures, shades, etc., giving ideas regarding illumination and also an exhibition of electric cooking, heating and other electrical devices, will prove a very good advertisement.

The next and the best method of getting business is through the solicitors. With all central stations the peak load is generally in the early part of the evening, and it is therefore an important item for the company to secure business which will even up the load. To do this it is necessary for the business department to work on installations, such as power and heating. In order to develop the power business, the solicitors should be familiar with the other forms of power, and state their comparative disadvantage. They should also be able to lay out power installations in the most economical way, and see that customers follow suggestions and get the desired results. Small users of power who cannot afford to lay out the money for a new electric equipment should be allowed to pay in monthly installments.

Of the revenue-producing heating devices, the electric flat-iron has already begun to show results to central-station companies, which have had the foresight to actively push its use. There are also heating and cooking devices, which, while not great revenue producers, are good advertisers, and help to swell the gross receipts. The best method of increasing this business is to deliver these heating and cooking devices on 30 days' trial, and if the same are satisfactory, they should be sold at practically cost.

Besides the many advantages of electricity over the other forms of illumination there is one especially important point to bear in mind in securing this business, and that is, the proper layout of the lights. It is, therefore, needful that the solicitors have a knowledge of illuminating engineering, as in some cases it is only by this method that customers may be secured and satisfied.

The electric-sign business should be given attention, and the company should furnish and install signs on the premises of customers free of charge. The usual form is that customers are required to sign a contract with a minimum charge per month. The company could furnish clock switches for signs where customers desire the sign to burn after the closing hours. It is to their interests to do this, as it not only means increased current consumption, but induces other merchants on the street to make their places attractive by night as well.

In a new department of this kind we must initiate an accurate system of keeping records and following up new business. To do this the solicitors should be provided with a small card index file in which they should keep a record of all prospective business and see that it is followed up properly. They shall note the date and result of every call. In addition to this they should make a separate report to the office of every call. Agents should be furnished with blank forms for this purpose. These should be of three kinds, each a different color; one form to be used when a customer's application is secured, another form for prospective business, where a customer will consider the use of current, and the other form for holding present business or other miscellaneous reports. In this way the solicitor's work can be checked up, and every month a report can be made up of the number of calls and the amount and kind of business secured by him.

A card of all customers should be kept. This card can be used to keep a complete record of the customer's installations, etc., and any other records necessary can be entered on the other side of the card.

Two card catalogues should be kept, one for connected and the other for disconnected customers. The solicitors should make out the working orders for the business secured by them. After being checked and recorded in the office, the order should then be approved by the credit department. After it has been properly approved it is forwarded to the installation department to do the work.

The office is to keep a record of all business secured, and this can be done by keeping a report showing each day's business.

These sheets can be totaled up each day, and at the end of the month a report can be readily made showing the business secured during the month.

To operate a department such as outlined here the cost per year will be approximately as follows: Salary of contract agent, $1,800; two solicitors, each $18 per week, $1,872; one clerk, $12 per week, $624; for advertising, $2,000; total, $6,296.

1. Abstract of a paper which received honorable mention in the prize contest inaugurated by the Co-operative Electrical Development Association on the subject, "Organization and Conduct of a New-business Department Suitable for Central Stations in Cities of 50,000 Population and Under." The author is chief clerk in the contract department of the Brooklyn Edison Company.

Pneumatic Cannon and Suspended Cannon-ball.

An attention-arresting show-window advertising device in which use is made of an electric fan is displayed in the window of a Madison Street store in Chicago. A large black "cannon" occupies a prominent place in the window and a round shot seems to have been just fired from its mouth. The feature that attracts attention is that the ball is evidently not attached to anything, but is held oscillating in the air about three feet from the muzzle of the cannon. The trick is accomplished by an electric fan, which drives a column of air from the muzzle of the cannon. The air column is of such shape that the ball is held in its center and there is a sufficient force of air to hold the ball, which is of light inflated material, away from the gun and continuously in the air.

New-business Notes.

The London correspondent of the Western Electrician remarks that the St. Pancras Borough Council leads the way in power supply in London, both in relation to its already existing load and its methods of securing new business. Electric signs on lamp posts calling attention to the electrical department forms one method, while printed advertisements on the local water carts form another.

Park resorts are usually closed during the winter, but gradually the managers of many of these places are arranging for winter attractions. Where parks are not owned by street-railway companies, who furnish their own current, central-station men might do well to arrange with the park owners for winter attractions, and thus open up a good field for the sale of current. Announcement has been made, for example, that The Oaks, Portland's beautiful park resort on the Willamette River, is to keep open a big skating rink. The managers announce the most modern electric-heated and lighted roller skating rink on the Coast. A covered walk has been built from the car line to the rink. Good illumination is to be one of the features.

Cost of Electric Cooking.

Prospective customers in some localities no doubt hesitate to close a contract for electric heating and cooking devices because the exact cost of current for various utensils is sometimes not clearly stated. Helpful statements of the local dollars-and-cents cost of operating electric heating and cooking appliances are given in the Bulletin of the Portland (Ore.) General Electric Company. In Portland current is generated by waterpower, and the kilowatt-hour prices range from 1¾ to seven cents an hour for power and from five to 20 cents for incandescent lights. The following is taken from the Bulletin:

An electric teakettle costs to operate for 15 minutes two cents.

The electric heating pad, which takes the place of the old-style hot-water bottle, uses about one cent's worth of current for one hour's service.

An electric chafing-dish costs approximately 2¼ cents to operate for 15 minutes—considerably less than for alcohol, and all of the bother and danger eliminated.

Electric curling-iron heaters can be used 15 minutes for three-tenths of a cent.

To heat water at a moment's notice, day or night, by means of the electric hot-water heater, requires an expenditure of 1¼ cents. This allows for 15 minutes' use of the heater.

A four-hole electric waffle-iron costs 2½ cents for 15 minutes' use.

With two electric stoves a breakfast consisting of fruit, creamed wheat flakes, boiled eggs, creamed potatoes, toast and French coffee may be cooked at a cost of about five cents for current.

An electric broiler will cook a steak in 10 minutes at a cost of three cents. The broiler may also be used for the cooking of chops, oysters, fowl, for baking potatoes, toasting bread, etc.

With an outfit consisting of an electric stove, an electric chafing-dish and an electric coffee percolator or a teakettle, a family of two or three can keep house with comfort and reasonable economy.

Various Uses to Which an Electric Fan May Be Put.

Don't get the erroneous idea that an electric fan is only useful in hot weather, then must be put away to rust and decay. A good electric fan will last for years, and the more it is used the better.

Many times, both winter and summer, the sun refuses to shine, the weather is otherwise disagreeable and milady is in a quandary as to how she can quickly dry her hair after the shampoo. Nothing, not even "Old Sol" himself, accomplishes this so well as a gentle, steady breeze from the electric fan.

The electric fan is almost a necessity to the average storekeeper. It makes the soda fountain irresistible, makes any restaurant inviting and is useful in many ways for attractive window displays. In the winter it provides a most effectual way of keeping the show windows free from frost and steam. And if one is possessed of any considerable degree of ingenuity, there is no end to the usefulness of the electric fan.—Electric City.

Keep Your Lamps Clean!

The Wisconsin Light and Power Company of La Crosse, Wis., of which C. H. Williams is general manager, is sending to its customers, with its compliments, an envelope enclosing a piece of white cloth and a piece of gray cloth, both of which are to be used in cleaning electric-light bulbs. The directions printed on the envelope are headed by the name "Electro Shino," and read as follows:

"The enclosed cleaner is impregnated with 'Shino' for cleaning and polishing electric lamp bulbs. When lamps are coated with dust and dirt the light cannot find its way out. Dip the white cloth in warm water and remove the dirt. Polish the bulb with the dry 'Shino' cloth. Try a lamp before and after using, and note the result."

Central stations often are blamed for poor light, when a simple cleaning of accumulated dust from the lamps will remedy the trouble. The La Crosse plan may be worth imitating.

General Electric Stock Issue.

This is from the New York Times of November 24th: An issue of $10,861,200 of new stock of the General Electric Company was formally announced yesterday, in keeping with the announcement made some weeks ago that a 20 per cent. increase in the stock was to be arranged in the near future. The stockholders this week raised the authorized amount of the company's stock from $60,000,000 to $80,000,000. About half of the stock now to be issued will come out of this recent increase, the balance representing stock which was still in the treasury when the $20,000,000 increase was authorized. The privilege of subscribing to the new stock is to be given to the holders of record on December 8th.

On January 31, 1906, the total capital stock outstanding was $54,286,750, and the total capital authorized $60,000,000, as shown by the annual report of the company.

Paul Van Ackeren will install a complete electric plant in Lindsay, Neb.

Polyphase Systems of Generation, Transmission and Distribution.[1]

By M. A. Sammett, A. M. Can. Soc. C. E.

Every electrical development possesses some typical peculiarities which should be the determining factors in the selection of the frequency of the system as a whole, as well as the selection of the generating and distributing systems as to phases, that is, whether it should be two or three phase.

These are the problems with which we will concern ourselves in the discussion of polyphase systems, with a transmission line of 100 miles or less and pressures up to and including 50,000 volts at the receiving end. While the paper is limited to these two considerations alone, the ground to be covered is rather wide, requiring therefore a concise treatment of various characteristics.

Every system is influenced in its design by the nature of the load, and while a purely railway system will prove most economical and satisfactory with a given frequency, and two-phase synchronous converters at the sub-stations, lighting and power companies will require a different frequency and strictly three-phase system. To compare the advantages of the three-phase as against the two-phase systems and of the two principal frequencies is the aim of this paper.

We shall take up first the question of phases.

Whatever the generation and distribution, the transmission of power is always accomplished by three-phase. This arrangement allows of most economical transmission of power with a given drop in the line. While the transmission of power is invariably accomplished by three-phase, the generation and distribution is often by two-phase.

Modern engineering practice shows, however, the abandonment of the two-phase generator in connection with hydro-electric power houses, where power is to be transmitted, and consequently transformed from two to three phase.

It must be admitted that a two-phase system for distribution purposes is somewhat simpler to operate than a three-phase system. The two phases may be controlled independently for single-phase lighting circuits without any appreciable effect of one phase on the other.

Two-phase or Three-phase?

Let us take up the generating plant first and see which of the two systems, three or two-phase, is more efficient as well as more economical.

Power House.—It is pretty well known that for a given capacity, speed and voltage, at a given frequency, the three-phase generator will prove the more efficient machine. Manufacturers standardizing apparatus use the same frames and punchings for the two different types. This enables the manufacturer to turn out a better three-phase generator as to efficiency and heating, retaining the same core loss.

Switchboard.—Taking up next the switchboard, we will find that the only advantage the two-phase board has in comparison with the three-phase is the saving of one ammeter. It is standard practice to use an ammeter in each leg, therefore the three-phase board will require three ammeters.

All bus-bars, oil-switch contacts and switch compartments, all cables from generators to switchboard and from the board to the transformers are reduced in the ratio of 4:3, and while 15.6 per cent. larger cross-section of copper is required in the instance of the three-phase installation, maintaining the same current density, the 25 per cent. saving in the number of individual parts necessary for the installation will be in favor of the three-phase board.

Transformers.—The use of two transformers for a given load allows a greater individual transformer capacity, and therefore a more efficient transformer. This would have been a decided advantage favoring the two-phase system, were it not for the fact that the transmission of power is to be by three-phase. To accomplish this phase transformation by the well-known Scott connections, unless all transformers are provided with a heavier high-tension winding, the transformer capacity would of necessity be reduced, due to a higher current in the three-phase winding, namely, that of 115.6 per cent. of the normal current. Should, however, the transformers be designed with provision made for this higher current, it would necessitate larger transformers, or, in other words, a more expensive installation. Besides this increased transformer capacity, another disadvantage must be added, that of a possible resonance with T-connected transformers for two-phase-three-phase transformers. Whenever one of the phases is open, due to a failure of making proper contact of various switches or any of the auxiliary connections, the high reactance of the high-voltage transformer will get in series with the capacity of the transmission line, and a resonance is likely to take place, with the consequent disastrous results.

Distributing System. The considerations which held true in the discussion of the transmission line will also hold true in the distributing system. Three-phase delta connections should be made use of, since, on motor service, a complete shutdown due to a failure of one transformer must be carefully guarded against. Again, three-wire three-phase distribution will result in a saving of 25 per cent. of copper and insulators. It will reduce the maintenance expense by the same percentage.

The advantages thus enumerated show clearly the desirability of three-phase distribution from the purely commercial standpoint and still more so from the point of view of reliability and permanency of supply.

It is imperative for the success of any central station to build up a good load and to broaden out the peak. This means to secure a considerable motor load. Let us see, therefore, what are the relative advantages, comparing two and three-phase motors. The induction motor is the one upon which to base our comparison, as it is the motor in general use.

The comparison can best be made from a summary of a convention paper by Mr. Bradley McCormick, read recently before the American Institute of Electrical Engineers. Given two similar frames without windings, how shall the two-phase and three-phase windings differ in order to secure proper operation? What will be the comparative losses if the two machines are given the same rating?

1. A two-phase machine should have 22 per cent. more conductors per slot than the corresponding three-phase Y-connected machine, designed for the same voltage and flux per pole.

2. The magnetizing current is the same in both the two and three-phase machines when expressed in percentage of the current, which corresponds to the full-load output.

3. The copper loss of the two-phase machine is 12 per cent. higher than that of the three-phase.

4. The leakage factor of the two-phase machine averages 25 per cent. greater than that of a three-phase machine, therefore the power factor is lower.

Actual results show from one to three per cent. lower power factors.

These considerations show that the two-phase machine will have a higher temperature rise as a result of the higher copper loss. For the same reason the efficiency of the two-phase motor will be lower. The slip of the two-phase machine will also be greater. Tests and theoretical calculations show 20 per cent. greater slip.

Thus we see that the two-phase induction motor is a poorer motor for the central-station company, due to a poorer power factor. It is also less advantageous to the power user, as a smaller efficiency means a larger motor input for a given output.

Frequency.

We will take up now the discussion under the heading of frequency. The frequencies most widely used on this continent are those of 60 and 25 cycles. While other frequencies are made use of, these are the predominating ones. Let us, therefore, analyze them with a view of determining their adaptability for such developments as are under discussion in our paper. We shall make our analysis, not from the transmission point of view alone, but analyze the generating and distributing systems as well.

As far as the transmission line is concerned, the lower the frequency, the less the induction drop, the smaller the charging current and the better the regulation. It is a foregone conclusion that, as a purely transmission problem, we will have to adopt the 25-cycle frequency. Our problem, however, is more complicated. The transmission line is only a chain in the link, and, important as it is, it should not overrule the advantages of a higher frequency as applied to the distributing end of the system. In our composite problem the various advantages and disadvantages should be carefully weighed, and the selection made on the merits of advantages of the entire system, taken in its totality.

Power House.—A table of speeds of generators at 60 and 25 cycles shows a wider range of speeds, and hence a greater flexibility, when laying out a 60-cycle hydro-electric power house. Thus:

R. P. M. at 25 cycles—300, 250, 214, 187, 166, 150.

R. P. M. at 60 cycles—327-300-277, 256-240-225, 212-200, 190-180, 172-164, 156-150.

The speeds of turbine-generator units are limited by the number of wheels, type, head and output. Therefore, a wider range of speeds permissible with a 60-cycle system will enable the selection of the most efficient generator-wheel combination. Inasmuch as increased peripheral velocities will result in a decrease in active material, the selection of higher speeds will enable us to choose cheaper hydro-electric sets. The above conclusions hold true except when higher speeds call for special construction, which will rapidly increase the cost.

Switchboard.—The switchboard under the two frequencies is unaffected. All meters and potential and current transformers are designed for satisfactory operation on frequencies from 25 to 125 cycles.

Transformers.—Transformers built for 25 cycles are a much more expensive piece of apparatus as well as less efficient than when built for 60 cycles.

Incandescent Lighting, Arc Lighting, Power Service by Induction or Synchronous Motor and Railway Load.—With incandescent lighting, while 30 cycles is the limiting frequency, 40 cycles is unsatisfactory when moving objects are viewed by it. On this continent 60 cycles is the standard frequency for such a service, while 50 cycles is European practice. For arc lighting, 40 cycles is the limiting frequency. Lower frequencies are made use of in the application of the recently developed mercury-vapor converter and magnetite lamps. This new system, however, will probably have to go through a process of further experimenting. The conservative investor will still select the higher-frequency series alternating enclosed arc lamps.

Induction Motors.—From the commercial standpoint, the 60-cycle motors have a decided advantage, namely, a somewhat higher speed. Speed and cost are inversely proprtional, hence the 60-cycle motor will prove the cheaper of the two. Of course, the low-frequency motors have advantages of their own, such as better starting torque, higher instantaneous, but not continuous, overload capacity and lower speeds. Unless the motors of the lower frequency are standardized for best and most efficient design the high-frequency motors are more satisfactory.

The principal factors in favor of the 60-cycle motors are better continuous overload capacity and also a cheaper product commercially as a result of higher speeds. Therefore, with equally good performance as to efficiency and heating, the 60-cycle motor will still be ahead of the 25-cycle motor.

Railway Load.—The suitability of low-frequency synchronous converters for railway work is a well-established fact. While 60-cycle synchronous converters are used for such purposes, they are rather an exception, and their operation is less satisfactory. What should then, under the circumstances, be a desirable way of supplying street-railway loads without resort to frequency changers? The latter are out of the question, due to excessive cost, besides the great reduction in the efficiency of the systems, resultant from their use.

Motor-generator sets may be and are advantageously used in this connection, and, while not possessing the advantages of 25-cycle synchronous converters, have features which make them particularly suitable for use on long-distance transmission systems, permitting of a partial or complete control of the power factor of the system, depending as to whether induction motors or synchronous motor sets are used.

Wherever large capacity is present, due to long transmission lines, induction motor-generator sets of large size can be used to great advantage. For perfect control of the power factor of the transmitted power, synchronous motors should be employed, as in this case the regulating of the field excitation allows of a close control of the power factor of the transmitted energy, allowing the maximum energy for a given current, and under certain conditions will permit of carrying the load at unity power factor in the generating and transforming apparatus and transmission line.

While the synchronous converter is the most efficient of the three means of supplying railway loads, whenever this load constitutes only the minor portion of the total output of the plant, the interests of the lighting and power load cannot be sacrificed for a most efficient conversion of the alternating current to direct current for railway purposes.

In our discussion of frequency we may conclude that for a mixed load of lighting and power, with a railway load not exceeding one-third of the total power generated, 60 cycles will be the frequency to select.

Charging Current and Regulation of the Line.—We are to take up now two more questions. These are charging current and the regulation of the line.

Let us see how the two frequencies affect our case. What will be the relative magnitude of the charging current and regulation?

Line, 100 miles long.
Load, 10,000 horsepower for each transmission circuit.
Conductor, No. 0000.
Voltage at receiving end, 50,000.
Space between conductors, 60 inches.
Charging current at 60 cycles, 23 amperes.
Charging current at 25 cycles, 9.6 amperes.
Regulation at 60 cycles—
100% power factor, full load 9.0%.
80% power factor, full-load current 23.0%.
(Step-up and step-down transformers included in this calculation.)
Regulation at 25 cycles (including transformer)—
100% power factor. full load 5.5%.
80% power factor, full-load current 10%.

The regulation and capacity or charging current are decidedly in favor of the 25-cycle transmission. The results for the 60-cycle system, while considerably in excess of those at 25 cycles, are considered quite normal for commercial purposes and, inasmuch as the increase and decrease in the load is gradual, the regulation is well within control of the central-station operators or automatic devices.

As to the railway load, this had better be carried on a separate circuit whenever a multiplicity of circuits is used in transmitting the power. In our case there are three transmission circuits.

Considering the successful operation of one of the long-distance transmission lines of 150 miles in California, where the charging current forms 40 per cent. of full-load current, and where the regulation is 40 per cent. at full load, 80 per cent. power factor, we need not hesitate to operate our line with a regulation of 23 per cent., 80 per cent. power factor.

The power factor of the system, however, is to

1. Abstract of a paper read before the Electrical Section of the Canadian Society of Civil Engineers, November 15, 1906.

a large extent within the control of the operating company, as it may recommend to power users such apparatus as will best answer the purposes of the system as a whole. Besides this, by employing synchronous motors, running as rotary condensers, it will be enabled to regulate the power factor of the system and keep it, if necessary, at unity. These synchronous motors, running idle, used supplementary to the synchronous motor-generator sets, will allow of a perfect control of the power factor of the system, reducing the regulation to nine per cent. under full-load condition.

In conclusion, we will say that, under the conditions as stated, for a mixed lighting and power load, with a railway load not exceeding 33 per cent. of the total output, a three-phase 60-cycle system should be employed throughout, and all transformation should be accomplished by Δ to Δ connections.

Diesel Engines for Interurban Railway Service.

By Norman McCarty.

The statement that high-tension transmission for electric-railway service is made necessary because of the necessity of installing a steam plant in a few larger units centrally located will probably not be questioned.

In other words, if a steam plant could be subdivided into a number of small units located at intervals in independent stations within the limit of low-tension, direct-current transmission, the transformer station would probably be discarded and low-tension direct current substituted.

This, however, is impossible with steam units without sacrificing the operating economy, and if a low-tension system is adopted for long-distance operation it must be by installing some internal-combustion engine having high fuel economy in small units without a corresponding increase in the cost of operating labor.

It does not require any argument to convince the operator of electric-railway properties of the greater simplicity and reliability of the direct-current system as compared with any method of alternating-current transmission.

The adoption of the alternating-current system (for either single phase or with rotaries), as stated above, was necessary because of the difficulty and expense of transmitting a current of large volume and low tension over a long distance from a central generating plant, and is never used where transmission distance is within economical limits of a direct-current system.

The records of the Diesel oil engine in this country and abroad have demonstrated:

First, the consumption of fuel per brake horsepower in the smallest engine is not 15 per cent. greater than that of the largest units, and in every case is within the builder's guarantee of 12½ gallons of oil for each 100 kilowatt-hours delivered on the switchboard under the operating conditions of the system as proposed in this article. The actual fuel consumption of a 225-brake-horsepower unit at full load is 10¼ gallons for each 100 kilowatt-hours at 90 per cent. efficiency of generator.

Second, that the consumption of fuel per brake-horsepower is practically constant from one-half load to the rated capacity of the engine.

With the above facts established, as they have been by the records of many plants in actual operation, there should be no objection to the installation of Diesel oil engines for the work in so far as relates to fuel economy. It has also been safe to assume that the actual labor required to operate a number of Diesel primary stations will be less than that required for a central steam station, together with that needed for the necessary transformer stations.

The only objections to be raised would refer to the continuity of service, the extreme variation in the load and small overload capacity of internal-combustion engines; but the installation of a small storage battery in each station successfully meets all of these objections. The desirability of the installation of Diesel engines and low-tension direct current as a substitute for steam equipment and high-tension current, either with transformers or single-phase motors, becomes merely a question of first cost and future operating economy. The following is afforded as a close estimate of the comparative cost for installation and operation of a 50-mile road with 50-ton cars operating at 30 miles an hour on one-hour headway and for 18 hours a day.

Diesel Engines with Direct-current Low-tension Transmission.

Length of road, 50 miles.

Number of cars, five. Maximum speed of cars, 30 miles an hour. Weight of cars loaded, 50 tons. Average kilowatts per car, 100 (70 watts per ton-mile on low-tension bus-bars).

Number of power stations, four. Equipment of each station, one 150-kilowatt, direct-current, 650-volt unit and one 240-ampere-hour battery.

Four engines deliver a total of 600 kilowatts per hour, and 16 hours of actual operation at full load would be sufficient for engine service, making a total output of 9,600 kilowatt-hours a day. The storage batteries would operate the road for the balance of the day, including owl cars and light and power for car barns when engines were idle. One 240-ampere-hour battery per station would be absolutely safe for the purpose.

Total oil fuel required = 96 × 12½ = 1,200 gals. × 3 cents = $36.00.

The labor required for operating four stations would be as follows, divided into two shifts of 10 hours each:

One chief engineer and electrician	$ 5.00 a day
Eight assistant engineers at $3.00 per day	24.00
Total labor per day	$29.00

Supplies (lubrication and waste), $1.50 per day each station, or for four stations, $6.00 per day.

Operating expenses:

Fuel	$36.00
Labor	29.00
Supplies (engine)	6.00
Total	$71.00

Cost per kilowatt-hour (fuel, labor and supplies), $71 divided by 9,600, or 7.4 mills. Cost per car-mile (fuel, labor and supplies), 2.65 cents. Cost per ton-mile (fuel, labor and supplies), 0.53 of a mill.

The Diesel engine station, however, would deliver to the low-tension feeders all of the current generated, while the steam plant operating through high-tension lines with transformers and rotaries would probably not do better than 65 per cent., so that a steam plant must deliver current on the switchboard at the central power house at not to exceed five mills (one-half a cent) per kilowatt for fuel, labor and supplies to equal the economy of the Diesel engine for current delivered to the low-tension feeders.

A discussion of the cost of operating a steam plant is perhaps unnecessary, as this cost will vary with the type of engine installed and the peculiarities of the installation, but in order to make a comparison we will assume that a fair coal consumption for a steam plant of this size, operating under the described conditions, would be not less than 3½ pounds per kilowatt-hour, as shown by wattmeter reading on the primary station switchboard, and at $2.50 per ton of 2,000 pounds would represent a cost of 4.375 mills for coal alone, to which must be added labor and supplies at the primary station and labor at the sub-station, which would probably represent three mills additional per kilowatt-hour, based upon 10,000 kilowatt-hours per day of 18 hours, or a total of 7.375 for fuel, labor and supplies. Now, if we add 35 per cent. for losses, we have 9.955 mills per kilowatt-hour delivered at low-tension feeders, against 7.4 mills for the Diesel, a saving in favor of the Diesel system of about 25 per cent. of the steam cost. Furthermore, the fuel cost per kilowatt-hour as shown for the Diesel installation is at least 20 per cent. higher than actual records show for this type of service, and can be guaranteed, while no one will guarantee the fuel consumption of a steam plant. However, it must be left to the experience of the operator to decide for himself whether or not his steam plant can deliver one kilowatt-hour on the primary-station switchboard at a cost of five mills under the varying conditions of an electric-railway load, this cost to include every item of expense connected with the main and sub-stations except interest and depreciation.

Cost of Installation.

As the amount of low-tension copper would be exactly the same regardless of the system installed, this cost can be eliminated from the comparison of the two systems, so also the cost of the track and bonding.

The cost of each rotary-station building would about equal the cost of building for each Diesel station, and we have only to compare the cost of the steam plant, electrical equipment and building, plus the high-tension line and transformer-station equipments against the cost of the Diesel engines, with generators and storage batteries, as follows:

Each Diesel station consists of one 225-brake-horsepower engine, one 150-kilowatt, direct-current generator and switchboard, one 240-ampere-hour, 650-bolt battery, all completely installed, including foundation, $35,000, or four stations, $140,000.

The Diesel system contemplates an installation capable of delivering a total of 600 kilowatts on the bus bars with practically no losses between switchboard and low-tension feeders, but with losses of 35 per cent. for high-tension system between these points we must install at least 750 kilowatts in the steam station to include these losses and peak loads in order to get a corresponding average output of 600 kilowatts on the low-tension side of the sub-stations.

A steam-driven plant for a road of this character, however, would usually install in the power house two 600-kilowatt units, one of which would act as a reserve under usual operating conditions. Each sub-station would in all probability be equipped with two 300-kilowatt rotary equipments, including step-down transformers and devices necessary for their operation. One of the 300-kilowatt units would be relied on as reserve capacity. A fair average cost of this equipment, using rotary sub-stations, would be about as follows:

A 1,200-kilowatt steam station, including engines, boilers, stack, generators, step-up transformers, switchboards and auxiliaries, at $95 per kilowatt, completely installed, $114,000; building and foundations, $15,000; 50 miles three-phase, high-tension line at $650 a mile, $32,500; four transformer stations, equipment complete, $64,000; total, $225,000.

This shows a saving on first cost of $85,000, or about 60 per cent., of the cost of the Diesel system.

The installation of the storage battery in connection with the Diesel engine would eliminate any necessity for reserve generating apparatus, as the combined capacity of the generating equipment and storage reserves in each station would be equal to the demand for intervals long enough to meet the extreme operating conditions for peak loads.

The items of interest and depreciation (repairs) are in favor of Diesel installations, as the first cost is less than that of a high-tension system, consequently less interest charges, even if we assume, to avoid argument, that the repairs on the Diesel engines are equal to the combined repairs of steam-engine and boiler installations. The expense of maintaining the high-tension line and transformer stations would greatly exceed the expense of maintaining the storage batteries connected with the Diesel system.

The above statement as presented is exceedingly conservative and probably more favorable to a steam-driven, high-tension system than the average figures for actual operation on a system of this size would show.

Summary.

The advantages of the Diesel low-tension system as compared with any type of high tension are:

The greater safety of the low-tension system.

A saving of at least 35 per cent. in first cost.

The elimination of all troubles peculiar to high-tension current due to the transmission-line transformers.

The storage batteries furnish an absolute guarantee for continuous service.

The engine can be operated for a specified fixed time at full load and highest fuel economy and can be shut down for short periods without affecting the car service.

A saving of at least 33 per cent. in actual operating expense.

A saving in the interest charges because of the smaller first cost.

A saving in repairs and depreciation by eliminating the principal causes for this expense connected with a high-tension system.

Perhaps the strongest argument to be presented in favor of the system proposed, next to its simplicity and operating economy, is shown in the economy, reliability or flexibility of the line as future extensions become necessary or additional service is added to existing lines.

Each section having its own power equipment, additional sections can be added from time to time and equipped as though they were separate properties, which additional engine units can be added to each station as the service develops and demand for power increases.

The investment can be limited to the immediate necessities without any thought as to future extensions or heavier traffic, with the advantage of decreased interest charges and a much higher operating economy, because the generating units installed are always properly proportioned to the service as it exists at that time.

The smallest system representing a small amount of capital invested can be used as a nucleus for unlimited extension or branches and for the heaviest service without sacrificing the original investment, nor in any way reducing the operating economy or efficiency of the original installation.

Alaska-Yukon-Pacific Exposition.

Much interest is shown in Seattle, Wash., in the work of creating the Alaska-Yukon-Pacific Exposition, which is to be opened June 1, 1909. The people of that city have already subscribed $650,000 for the purpose. John C. Olmsted, the noted landscape artist, is now engaged in designing the grounds. The primary purpose of the fair is to exploit the resources and potentialities of Alaska-Yukon and the Pacific Northwest, and to make known and foster the importance of the trade of the Pacific Ocean and of the countries bordering upon it. Different from other fairs, the Alaska-Yukon-Pacific Exposition will not celebrate any particular event.

The exposition site comprises 255 acres of the campus of the Washington University. The grounds border for more than a mile and a half on Lake Union and Lake Washington. The Olympic and Cascade mountains are in plain sight, and an unobstructed view of the perpetual snowpeaks of Mount Rainier and Mount Baker may be obtained. Many of the large buildings will be substantially erected and they will remain as the property of the university after the fair closes, to be used for educational purposes. The states and nations will be invited to erect buildings of a permanent character, which will give them an opportunity to install lasting memorials of their progressiveness.

R. A. Bushnell contemplates installing an electric-light plant in Wessington Springs, S. D.

QUESTIONS AND ANSWERS.

Induction Coil for Three-inch Spark.

W. K., Leon, Iowa: In a three-inch spark coil having an outside diameter of 6¼ inches and a core diameter of 2 3/16 inches, and which is to be sectionally wound, how many feet of No. 34 single silk-covered wire can be put in a section one-eighth inch long?

Can part of the sections be made of No. 34 double cotton-covered wire and the rest of No. 34 single silk-covered wire?

Is it of advantage to have the aperture of the sections larger near the end of the coil?

What thickness of paper should be used in making the condenser, and should one or two thicknesses be used?

If mica is used, how much smaller may the total foil area be?

How much current should I let the coil use?

ANSWERS.

It will take about 4,000 feet of No. 34 single silk-insulated wire to fill the section described. No. 34 double cotton-covered wire can be used, but some of the efficiency of the coil will be sacrificed, because fewer ampere-turns can be placed in the sections. It is of no advantage to have the aperture of the sections larger near the end of the coil.

For the condenser one good thin sheet of paper, such as that used by typewriters, may be used. Especial care must be taken to see that the paper is free from pin holes and flaws, and it must be paraffined.

There is not enough advantage to be gained from the use of mica to justify the expense of procuring sheets of the proper size.

If No. 16 double or single cotton-covered wire is used, you can safely allow from 5½ to six amperes to flow through it steadily. For short periods 10 to 12 amperes can be used.

Rewinding Direct-current Dynamo.

W. E. M., Chicago Heights: I desire to rewind a 25-kilowatt bipolar direct-current compound-wound 110-volt Edison dynamo to convert it into a 220-volt motor. The present size of the wire on the armature is No. 5. How can I get twice as many No. 5 conductors on the armature, which is apparently already filled, without adjusting the magnetic field strength?

ANSWER.

If the present armature is wound with a given size of wire for 110 volts, when rewound for 220 volts the current necessary to operate the machine at 25 kilowatts will be reduced one-half, and therefore it will be possible to reduce the size of wire in the armature correspondingly.

Copper Market.

The advancing tendency in copper has resulted in market quotations of 22 to 22½ for electrolytic wire bars, and at these figures considerable business is reported. The most conspicuous recent transactions were the large sales early in the current month of Lake copper by the Calumet and Hecla company at 22½ cents for deliveries up to the end of next March. There was a good deal of shrewdness shown in disposing of such a large quantity of copper at the high prices realized. The sellers of this particular brand remained out of the market for several weeks previous to closing the transactions referred to, and in the meantime prices continued to harden until the company bagged the big orders stated. By the exercise of patience and the withholding of offers during a period of several weeks the leading Lake Superior interests were able to secure 22½ cents against 19½ in the latter part of September.

Of course the present high price of copper tends to make manufacturers conservative, and at the present level of values we are not inclined to advise our customers to anticipate their requirements any further ahead than they are absolutely sure that they can work up stock bought on the basis of present prices. It is not a time to do any pyramiding on the top prices recorded in more than 20 years. There is no desire to deny the remarkably healthy trade conditions which have marked 1906 as a year of exceptional prosperity, but we submit that there is a limit beyond which prices ought not to be forced, even though temporary conditions might contribute to the success of the operation.

It is well known that production is on a heavy scale, and with 36,356 tons less exported in the first 10 months of this year than during the first 10 months of 1905, there ought to be copper to meet a large increase in domestic consumption. There is no doubt but the high prices of 1906 will stimulate the quest for new copper fields, and, if reports are correct, Utah, Nevada and California are getting ready to increase production. It is possible that good business may absorb the additional supply, and we hope conditions will permit of the maintenance of sound markets and a healthy business situation, but under any and every circumstance domestic manufacturers should have no difficulty in procuring the necessary quantity of raw material the year round for the continuance of legitimate operations in full force.—From "Copper Gossip," issued by the National Conduit and Cable Company, New York city, November 20, 1906.

BOOK TABLE.

QUASI-PUBLIC CORPORATION ACCOUNTING AND MANAGEMENT. By John F. J. Mulhall. Boston: Corporation Publishing Company. 1906. Pp. (6 by 9¼ inches), 200.

This book presents books, forms and methods necessary for the proper organization and management of the business and the recording of essential details of revenue, operation, maintenance and construction; also statements as to profit and loss and assets and liabilities. In view of the diversity and comparative scarcity of material data bearing upon the subject, the book should be of interest to the accounting departments of public-service corporations and also to the similar departments of municipal plants. It covers waterworks, telephone exchanges, electric-light plants, electric-railway systems, etc.

PROCEEDINGS OF THE TWENTY-NINTH CONVENTION OF THE NATIONAL ELECTRIC LIGHT ASSOCIATION. Compiled and arranged by W. C. L. Eglin, secretary and treasurer, and H. Billings, assistant secretary and treasurer. In three volumes. New York: Published by the association. 1906. Pp. (6 by 9 inches), lxviii., 662; 573; 240.

Now issued in three volumes, the official reports of the conventions of the National Electric Light Association are a veritable storehouse of valuable information relating to the science, art and business of electric lighting. The twenty-ninth convention was held in Atlantic City, N. J., June 5-8, 1906, and the Proceedings are now available in book form. Volume I. contains the general papers, reports and discussions presented at the convention, together with synopses of papers, a general index, names of members, etc. Volume II. contains the valuable "Question Box," edited by Paul Lüpke. The third volume is for "Class A" members only. Its 240 pages are devoted to reports of executive sessions. In it are Mr. Gardiner's paper on the London sliding scale, the report of the committee on rates and costs, and the report on theft of current. These volumes show much care in their preparation and are a credit to the association, indicating clearly the importance and usefulness of the organization. A good portrait of the retiring president, W. H. Blood, Jr., forms the frontispiece.

ALTERNATING-CURRENT MOTORS. By A. S. McAllister, Ph. D. New York: McGraw Publishing Company. 1906. Pp. (6 by 9 inches), ix., 278, with 122 diagrams. Price, $3.

During his experience in instructing engineering students in alternating-current phenomena the author became convinced that the difficulties encountered in endeavoring to ascertain the causes for various effects described in available electrical literature were due largely to vague, confusing and inconsistent use of technical terms. With this idea in mind he has prepared a work in which the electromagnetic phenomena of alternating-current motors are dealt with in as simple a manner as is consistent with accuracy. Much attention is given to graphical diagrams and examination of the facts upon which they are based.

The first chapter treats of single and polyphase currents and economy of conducting material. The induction motor is then discussed, especial attention being given to its use as a generator and its transforming features. The magnetic field in induction motors is dealt with, and especial attention is given to the magnetic field of polyphase motors. Synchronous motors and converters, with the distribution of heat loss in armature coils and characteristic performances, are then treated, and a short discussion is given of the relative advantages of delta and star-connected primaries. The chapter on repulsion motors treats of them, both graphically and algebraically, and in the same way series motors are dealt with. The book concludes with a short chapter on sparking in commutator motors.

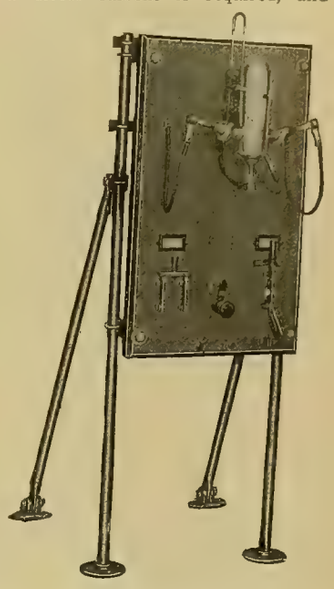
The author uses care and discrimination in using such words as "field," "power," etc., and it is surprising how much clearer the explanations of alternating-current phenomena are when "field" means one definite thing, and not at one time magnetism, at another iron and at still another copper. In giving unusual attention to these minor but important points the book becomes a source of information that is valuable and easily understood by anyone familiar with the fundamental facts of electricity and magnetism and who has some knowledge of the lower branches of mathematics.

The Argenta Light and Power Company of Argenta, Ark., has been incorporated with a capital stock of $60,000.

Mercury Arc Rectifier Panel for Charging Ignition Batteries.

The mercury arc rectifier, as a substitute for the motor-generator set for charging vehicles, has already become familiar to the owners of electric automobiles. A smaller size of this form of apparatus for changing the alternating current of the ordinary city lighting circuits to direct current for charging ignition batteries will be of particular interest to owners of gasoline machines.

Storage cells are admittedly superior to any form of primary battery, either wet or dry, for ignition work, but are not as widely used as they might be, owing to the inconvenient and somewhat expensive methods of charging. For storage batteries a direct current is required, and on city



MERCURY ARC RECTIFIER PANEL FOR CHARGING IGNITION BATTERIES.

lighting circuits this is usually not generally available, alternating current being generally used for electric lighting. Even where direct current is available, the voltage is higher than that necessary in charging two to six cells of an ignition battery, and it is necessary to introduce a greater or less length of wasteful resistance in series with batteries while they are charging. This is, of course, very uneconomical; in fact, 85 per cent. of the current may be wasted in heating the resistance.

The mercury arc rectifier, developed by the General Electric Company to met these conditions, consists of a mercury-arc-rectifier tube having a sufficient capacity to charge five cells of the ordinary ignition type. This tube is mounted compactly with switches and rheostat upon a slate panel 16 inches wide and 28 inches high. Referring to the illustration, in the lower right-hand corner of the panel can be seen the starting switch, at the opposite side the load switch, while between the two is a small rheostat arranged in series with the load so as to adjust the voltage between the limits necessary for charging from two to five cells of battery.

Such a mercury-arc-rectifier outfit will charge a five-cell ignition battery in eight hours. At ordinary rates for electric current, this means an expenditure of about 25 cents a week for keeping the batteries in first-class order. The outfit comes all set up on the panel, with the exception of the tube, which can easily be hung in its supporting frame and connected.

The rectifier method of charging is well adapted for private as well as public garages because of its convenience, simplicity and economy. In the public garage it will pay for itself in six months, while the convenience and reliability with which the owner can charge his ignition batteries make this method equally well suited to the private garage.

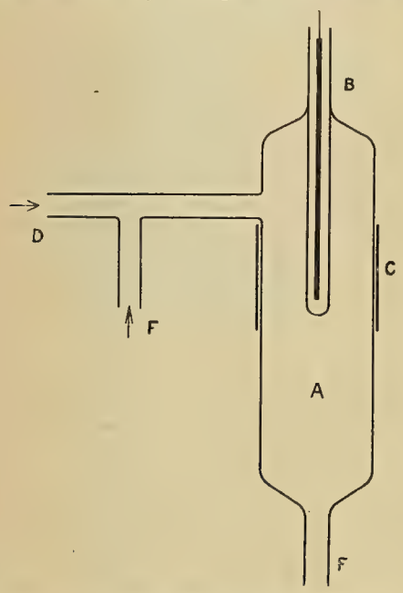
Interurbans Under Hepburn Rate Law.

At the bi-monthly meeting of the Central Electric Railway Association held at Dayton, Ohio, on November 22d, it was declared by members of the Ohio Railroad Commission that the interurban roads are in reality common carriers, and will undoubtedly be governed by the Hepburn rate law the same as the steam roads. The commissioners said that the electric roads should be required to file their tariffs with the Interstate Commerce Commission, and should be prevented, the same as steam roads, from issuing passes or free transportation, or accepting anything but money for transportation.

The attendance at the meeting was large, and the interest manifested good. The subjects discussed were: "Free Transportation; to What Limit Shall Same Be Issued?" "Impressions from the Columbus Convention," "Limited Service, and Does It Pay?" "Automatic Couplers." The annual meeting of the association will be held in Indianapolis on January 17th.

Combinations of Gases by High-tension Discharge.

That different gases can be made to combine under the action of the Tesla high-tension and high-frequency discharge seems to have been proved by a European scientist, A. Findlay, who says that he has succeeded in producing hydroxyl by a direct combination of hydrogen with oxygen, in spite of the fact that as good an authority as Professor Nernst thought that such an effect could not be obtained from the Tesla discharge. In the accompanying diagram is shown the most effective apparatus which was employed for making the combination of any two gases when under the



APPARATUS FOR THE COMBINATION OF GASES BY DISCHARGES OF HIGH FREQUENCY.

influence of the discharge. A large glass tube (A) has inserted in the top a tube of smaller diameter (B), which closes it at the upper part, while in the lower part is placed the outlet tube (F). The small tube (B) serves to contain one of the electrodes, and it is surrounded by a copper-sulphate solution. Around the outside of the main tube is mounted a metal band (C), which serves as the second electrode, so that the discharge is made to pass across the free space of the tube between the two electrodes. The tubes (D) and (E) serve to bring in the gases to the main cylinder.

For the hydroxyl combination, for instance, Mr. Findlay sends in oxygen (or air) through one opening and pure hydrogen through the second. After the mixture of the two gases has been acted upon by the Tesla discharge, the resulting product (hydroxyl in the present case) is condensed in the cold tube and runs down into a receiving vessel by the lower tube (F). Using such an apparatus, the investigator was able to collect some 10 or 12 cubic centimeters of hydroxyl, which he identified by the proper reactions. Other gases are easily combined in the same way. For instance, using a mixture of nitrogen and oxygen, Mr. Findlay obtains nitric acid, while nitrogen and hydrogen give ammonia.

Blast-furnace Gas Used for Electric Drive in Milwaukee.

The merchant mills of the Illinois Steel Company at Bay View, in the southern portion of the city of Milwaukee, have been undergoing extensive alterations and additions during the summer, without interfering in any way with the regular operation of the plant, the annual output of which is 300,000 tons. The new facilities are comprised in electrically operated traveling carriers and rebuilt roll trains, in addition to the compounding of the present mill engines and the placing of orders for an Allis-Chalmers gas-engine-driven electric generating unit which will operate on blast-furnace gas at a very low cost. The works comprise six plants, employing altogether from 1,700 to 2,000 men.

With blast-furnace gas available, it was decided to install, as an additional unit, a horizontal tandem, double-acting Allis-Chalmers gas engine, direct connected to a 500-kilowatt 240-volt generator of Allis-Chalmers design. This unit is to be used for general power service, having sufficient capacity to care for the entire load. For years the waste gases from the blast furnaces have been burned under the steam boilers, with good economy, so that with the old arrangement the power plant was operated at minimum expense. When the need for additional power became apparent, it was obtained through the compounding of the steam blowing engines now in use, instead of putting in extra boilers and steam engines and using coal for fuel. By this plan, a saving of gas is accomplished. If this extra gas were used under a boiler, it would be entirely insufficient for the purpose, but if used in a gas engine, it gives a considerable increase in power, due to the much higher economy of the gas engine over the combination of steam engine and a gas-fired boiler.

Line Construction.

From the Question Box of the American Street and Interurban Railway Engineering Association, presented at the Columbus convention, October 17, 1906.]

Where feeder wires are partly underground and partly overhead (same circuit) have you experienced much trouble from lightning injuring underground cables, and how do you arrange lightning arrests?

Answer.—Place lightning arresters at each end of the cable, that is, one at the station and one at terminal end; then install lightning arresters on the line every 500 feet.

What do you find to be the most reliable lightning protection for stations on 550-volt direct-current service, also on 11,000-volt transmission lines?

First Answer.—For 550-volt direct-current stations a lightning arrester at the station on each feeder and one on each machine gives good protection, provided the line is also properly taken care of with arresters spaced from 500 to 1,000 feet apart.

Second Answer.—A water resistance thrown in at the station whenever a storm is approaching is a good protection.

What is the best spacing for interurban trolley poles?

First Answer.—This depends somewhat on the type of overhead to be constructed. For the ordinary direct-current trolley line with No. 00 or No. 000 wire, from 100 to 110 feet seems to give entire satisfaction.

Second Answer.—Poles should be spaced on interurban lines 100 feet apart on straight lines and 50 feet on curves.

What are the advantages and disadvantages of bracket-arm or center-pole construction and suspension as against side-pole construction on interurban lines?

Answer.—Bracket line is cheaper construction, if properly built, and poles are better for carrying transmission lines. Side construction is not so rigid.

What do you consider is the proper height for trolley wire above the rail?

First Answer.—I consider the proper height for trolley wire above the rail at 20 feet or 22 feet maximum, and not less than 16 feet under any condition.

Second Answer.—Eighteen feet on straight line, increased to the height required by law over railway crossings.

Third Answer.—An average height of 19 feet six inches gives good results.

On lines where speeds do not exceed 25 miles an hour should the trolley wire be kept as tight as it can be with safety, or should it be somewhat slack? Which condition will give the wire the longer life?

First Answer.—Do not think it advisable to keep the trolley wire too tight under any conditions.

Second Answer.—On lines where speed does not exceed 25 miles an hour the trolley wire should be kept as tight as safety will permit. Tight wire gives longer life.

Electrical Pumping Stations for Mexico City.

The largest electric motors ever built for use in the republic of Mexico are now being constructed at the works of the Westinghouse Electric and Manufacturing Company, at Pittsburg, Pa., for use in connection with Morris centrifugal pumps to pump water from Xochimilco to Mexico City. This project will give Mexico one of the most modern water systems in use in any city today.

The contract for these pumping stations is being handled through the Mexican Light and Power Company, which will supply the electrical power from its Necaxa power plant. Five stations will be provided with electric motors direct coupled to their respective pumps and have a total normal capacity of 3,060 horsepower, capable of a maximum of 5,222 horsepower providing for overload capacity.

The water will be pumped to reservoirs near to and above the city level. In the first pumping station, "Condesa," will be placed three large Westinghouse synchronous motors of 1,200 horsepower each, pumping 850 liters of water per second. Two motor-generator sets will supply the direct current for exciting the fields of the three motors, and all necessary switchboard and lighting-arrester equipment is also being furnished. To reduce the voltage from the Mexican Light and Power circuits at 18,000 volts to that required by the motors, 3,000 volts, the Westinghouse company is supplying nine 400-kilowatt, oil-insulated transformers, three to each motor, capable of 25 per cent. overload.

Station No. 2, "La Noria," will have two 60-horsepower motors pumping 300 liters of water per second. Station No. 3, "Nativitas," will have two 160-horsepower motors pumping 600 liters of water per second. Station No. 4, "Santa Cruz," will have two 120-horsepower motors pumping 700 liters per second. Station No. 5, "San Luis," will have two 356-horsepower motors, pumping 800 liters per second.

The pumps, as made by the Morris Machine Works of New Work, will be of the single-impeller centrifugal type. The layout of the stations is most complete, the pumps with their motors being set in special masonry tanks below the water level, so that the pumps are always primed. A traveling crane traverses each station.

Indiana Telephone Items.

The Chalmers Telephone Company of White County has filed articles of incorporation. The capital is $10,000.

The Indiana Telephone and Telegraph Company of Clinton has decided to make improvements involving the investment of $40,000. The separate wires will be taken down and cables will be substituted. A new central office will be constructed and equipped with modern equipment.

The Harrison County Farmers' Telephone Company has been incorporated to build a telephone system in Harrison County, with its principal exchange in Crandall. Thos. J. Stevens, C. B. Anderson and David H. Hurn are the directors.

The authorities of Indianapolis have ordered all electric service wires of local companies, whether of high or low tension, to be placed underground in the "mile square," immediately.

The Hamilton Trust Company of Noblesville has been appointed receiver of the Union and Carmel telephone companies of Carmel. The two companies control the telephone business at Carmel, and own several country lines in that vicinity. The purpose is to effect a new organization under one head.

The Lafayette Telephone Company has awarded a $65,000 contract for a new switchboard and complete telephone system to the Sterling Electric Works of Lafayette. This means that the Independent telephone system in Lafayette will be entirely rebuilt. There were six bidders. The company recently awarded a $15,000 contract for underground conduits.

The managers, agents and inspectors of the Central Union Telephone Company of Northern Indiana held a meeting last week at South Bend for the purpose of promoting the interests of the company in Northern Indiana. J. L. Putnam, superintendent at South Bend, presided. The meeting was not open to the public.

Agents of the New Long-distance Telephone Company of Indianapolis are at work in Frankfort and throughout Clinton County making contracts with the co-operating companies to connect with an exchange which the company proposes to establish in Frankfort in competition with the Bell Company. In the event that a franchise can be had, and all the co-operative companies in the county agree to connect with it, the Indianapolis company will, it is said, put in a complete local and long-distance exchange in Frankfort. If the co-operative companies refuse to cut loose from the Bell, the Indianapolis company will put in a long-distance board only. The company has already obtained contracts with the co-operative companies at Colfax, Manson, Geetingville, Mulberry, Rossville, Kirklin, Michigantown and other points. S.

Ohio Telephone Notes.

Work on the construction of the new building for the Glen exchange of the Cleveland Telephone Company will be begun shortly. The building and equipment means an outlay of about $150,000. The switchboard will have a capacity of 9,600 lines and will supply the northeastern section of the city and the village of Collinwood. The East exchange building will be ready within a short time and plans are being prepared for a new Marlo exchange on the West Side. The completion of these three buildings will give the company 10 modern fireproof buildings.

The secretary of state has been notified of an increase in capital stock from $125,000 to $200,000 by the Citizens' Telephone Company of Delaware.

According to an announcement made last week the Cuyahoga Telephone Company of Cleveland will begin work at once upon a building that is to house the East End exchange. It will be located on Eighty-first Street and will supply a large section of the city. The switchboard capacity will be 7,000 telephones. With the equipment the plant will cost about $200,000.

Seventy-four telephone companies were incorporated in the state last year, with an authorized capital stock of $1,257,075. Old companies increased their capital stock $3,831,700. C.

Telephone News from the Northwest.

The Griggs County Telephone Company has succeeded to the ownership of the local exchange at Cooperstown, N. D.

The Tri-State Telephone and Telegraph Company of Minneapolis expects to secure toll-line access to Chicago by means of the automatic system.

The First Farmers' Telephone Association of

Lansford, N. D., has been incorporated with $14,000 capital.

The Nebraska Telephone Company is changing its exchange at Columbus, Neb., into a central-energy system. The improvements will cost $20,000.

Articles of incorporation have been filed for the Comstock Independent Telephone Company of Sargent, Neb.; capital, $10,000.

Although the new exchange building at Burlington, Iowa, is practically completed, the Bell Telephone Company will not be able to move into it for about six months, owing to delay in getting its new cables from the manufacturers.

The Farmers' and Traders' Telephone Company has been voted a franchise at Fremont, Iowa.

The Dayton (Iowa) Mutual Telephone Company has filed articles of incorporation with a capital of $25,000. E. M. Lundien heads the list of stockholders. The company has bought out the Farmers' Mutual Telephone Company.

C. L. Wilcox has sold his telephone exchange at Alton, Iowa, to J. Dykstra. R.

Telephone and Telegraph Business in Massachusetts.

Under the law passed at the last session of the State Legislature, the Massachusetts Highway Commission has begun the work of supervising telephone and telegraph companies. The commissioners found that there were 60 telephone and 33 telegraph companies under their supervision. The cost of this supervision must be borne by the companies under the jurisdiction of the commission, the amount paid by each company to be in proportion to its gross receipts. The commission called for sworn statements of last year's gross receipts, and, up to November 15th, seven telephone and nine telegraph companies had not responded. Twenty-two telephone and 13 telegraph companies reported no gross earnings. Thirty-one telephone companies reported gross earnings of $7,132,545, exclusive of interstate business, and 33 telegraph companies reported gross earnings of $308,029, exclusive of interstate business. The New England Telephone and Telegraph Company reported $6,179,565, the Southern Massachusetts Telephone Company reported $496,010, the Western Union Telegraph Company $94,540, the United Telegram Company, controlling a stock-quotation service, $52,805, the Massachusetts District Messenger Company $45,821, the Commercial Cable Company $37,371, and the Postal Telegraph-cable Company reported $21,537. It has not yet been decided whether a portion of the interstate receipts should not be included in the amounts to be assessed.

GENERAL TELEPHONE NEWS.

At the recent election the voters of Denver, Colo., decided in favor of an Independent telephone franchise.

The Norfolk County (Ontario) Telephone Company has been organized with a capital stock of $40,00, the head office being at Waterford, Ont.

The People's Home Telephone Company of Leavenworth, Kan., is constructing a modern plant. The company is putting up a $20,000 building and the exchange will be first class in every respect.

The Southeastern Iowa Telephone Association held its annual meeting at Washington, Iowa, recently, about 40 delegates being in attendance. E. E. England of Mt. Pleasant was elected president and W. H. Fowler of Pella re-elected secretary. Fred Dupuis of Sigourney is vice-president.

The Independent Telephone Company has awarded the contract for the construction of its new system at Omaha, Neb., to the Crescent Construction Company, the contract amounting to over $1,500,000. The contract includes the entire equipment for an automatic system, the equipment being furnished by the Automatic Electric Company of Chicago.

A permit to engage in the telephone business in Milwaukee has been granted to the Milwaukee Independent Telephone Company by the Common Council. The mayor immediately approved the ordinance. An agreement was reached between the successful company and the Milwaukee Automatic Telephone Company, by which the Automatic company retired from the field and the Independent company agreed to use automatic apparatus.

National Electrical Code.

A Supplement to the National Electrical Code, dated October, 1906, has been issued by the Underwriters' National Electric Association. It contains the changes and additions to the edition of 1905. Important changes are announced in the following rules: (1) Generators, (8) motors, (13) grounding low-potential circuits, (14) wires, (17) switches, cut-outs, circuit-breakers, etc., (24) wires, (26) fixtures, (27) sockets, (42) slow-burning weatherproof wire, (45) flexible cord, (50) moldings, flexible tubing, (64) signaling systems.

There is also a list of devices and materials from various makers tested as up to "National Electrical Code standard."

CORRESPONDENCE.

Continental Europe.

Paris, November 14.—As steam traction is not working to the best advantage on the lines which run within the city of Vienna, the government is considering the question of substituting one of the modern electric-locomotive systems to take the place of the steam locomotives. As a considerable portion of the lines run in subways, the smoke caused by the locomotives has been considered for some time past as a serious drawback to the good operation of the lines, and there are many other reasons why electric locomotives would be much better. With clean and airy tunnels and handsome trains of modern build, it is certain that the road would be better patronized by the public. Electric trains would no doubt run at 2½-minute intervals, instead of three minutes, as before. A project for an electric system has been submitted to the department of railroads by the Fr. Krizik firm, one of the leading Austrian companies. The locomotives use the direct-current system, with two motors mounted in series. It is proposed to use a line voltage of 1,000 to 2,000 volts, taking the current from an overhead wire by means of two parallelogram trolleys placed on the roof of the locomotive. The total power given by the two motors would be 400 horsepower, and the locomotive weighs about 33 tons.

Among the new steam turbines which have recently appeared in Germany, I may mention one which is built by the General Turbine Company of Nuremberg. It has three wheel-chambers and is designed to give 180 horsepower when running at a speed of 2,500 revolutions per minute. Such a turbine is adapted for running dynamos, and a direct-coupled group is designed with a direct-current machine of 550 volts and 230 amperes. The steam consumption of the turbine is stated to be about 2,000 pounds per hour. The unit has a spray condenser which takes some 10,000 gallons of cooling water per hour. Another steam turbine is brought out by Sulzer Brothers, of Ludwigshafen, which gives 1,300 horsepower, running at 1,500 revolutions per minute. The turbine is direct-coupled to an alternator of 3,000 volts and 130 amperes. Here the consumption of steam is 15,000 pounds per hour.

Two new extensions are proposed for the Paris Subway. One of the branches will continue the Opera-Villiers section, upon which there is a large traffic, and run it as far as the northeastern suburb of Levallois-Perret. The other extension will take place upon the new No. 7 line, which is under way at present, and is to run from Place Du Danube to the Palais Royal. By adding the proposed section, the line will run to the Villette Gate in the northeastern limits of the city.

At Fribourg, Switzerland, a new company has been formed to construct an improved type of industrial condenser brought out by Moscicki. It is known as the Société Générale Des Condensateurs Electriques. The inventor says that most of the difficulty in making a practical condenser lies in the use of a plane surface. Experiments showed that the electric density is much greater near the edges of the plate, so that most of them break down at this point. But as the proposed remedy, namely, to thicken the glass, is not very practical with a plate, he constructs a glass tube form in which the glass is much thicker at the top and at the same time the tube is narrower. In the main part the glass is thinner than usual. The outer coating is of silver and the inside coating is formed of mercury. Such a condenser stands a high tension and does not break down easily, it is asserted. At the Milan Exposition appeared a battery of such condensers having 96 tubes in parallel.

Following the experiments made on the German railroads with a space telegraphy system for train signaling, the Gesellschaft für Drahtlose Telegraphie decided to continue these on a larger scale on the Berlin-Heilstätten section, and they have been successful. A mast wire erected at the side of the track was connected with instruments placed in an adjoining station. The wire was stretched between two telegraph poles, keeping well away from the other wires, and was some 60 yards long. On one of the cars of the train is placed the receiving station. A simple turn of wire around a set of insulators on the roof formed the mast wire. All the instruments in the car are contained in a portable case suspended upon springs. It appears that the signals are well received up to a distance of eight miles. Following these experiments, the Bavarian Railroad Administration is to have similar ones carried out in the neighborhood of Munich. A. de C.

Great Britain.

London, November 14.—The London County Council, in full meeting, has authorized the highways committee to proceed with the electric power bill, referred to in my notes last week. At this meeting it was decided to apply for parliamentary powers to acquire land sites at Barking and Erith, for the purposes of generating stations. Both these places are in the eastern portion of the area, one being on the north of the River Thames, and the other on the south.

The reconstruction of the northern tramway system of the London County Council is being rapidly pushed forward. It was only on May 1st of this year that the horse lines were acquired from the companies, but already one section from Islington to Highbury is completed. It will thus be possible soon to get a through tramway communication with the South of London, for the cars from Highbury run into the subway which connects up with the Embankment tramways, and these latter will be opened very shortly.

One of the most troublesome details of the National Telephone Company's service in Great Britain has been the maintenance of its overhead system. For many years the company has endeavored, at any rate in the towns, to place the wires underground, and although in some instances its wishes have been met, on conditions, in others there has been an unconditional refusal. A new condition of affairs, however, has arisen under the agreement between the Post Office and the National Telephone, for whereas the company will work the system until 1910, the postmaster-general in the meantime is the nominal owner of the undertaking, and has a good deal of supervision with regard to the maintenance of the system. The postmaster-general, through his engineers, being also in favor of underground wires on the score of greater safety of working, it comes about that town councils which have hitherto held undisputed sway over the company now find themselves in antagonism to the government, much to their discomfiture. Under his statutory rights granted by the telegraph acts, the postmaster-general may bring sufficient pressure to bear to gain the desired end, where the request is reasonable, and more than one instance of this kind has occurred since the agreement referred to above was entered into. A case in point is at Grimsby, where an uncompromising refusal to the company has given place to a "sweet reasonableness" toward the postmaster-general, after the receipt of a communication very much to the point.

As was generally predicted, Dr. Glazebrook's presidential address to the Institution of Electrical Engineers contained a good deal of reference to the question of units. There was a lot of history, and although there is not space to make a lengthy reference to the other portions, it may just be pointed out that the address makes the remark that the whole question is about to be subject to revision. The balance made by Professor Ayrton and Mr. Mather, in collaboration with the late Prof. V. Jones, has proved to be a great success.

One of the earliest, if not the earliest, advocates of single-phase traction as the real solution of the railway problem, has been Mr. W. M. Mordey, in conjunction with his partner, Mr. B. M. Jenkin. These two gentlemen read a paper enunciating these principles in 1902, since when there has been a gradual justification for the views then put forth. Hence it is not surprising that in a paper last week on this same subject by the same authors, some little satisfaction was expressed at the present trend of events in this particular branch of the industry. A point was made, too, as to the comparatively small advance made meanwhile in continuous-current working.

Particulars are published of a patent which has been granted in Great Britain which embodies the principle of the well-known Heilmann locomotive, which made its appearance on the Continent some years ago. In this, it will be remembered, there was a small generating station carried on the locomotive. The present locomotive differs in the respect that a steam turbine instead of a reciprocating engine is made use of. Each truck is carried upon eight wheels, four of which are each driven by electric motors, the current for which is supplied by a dynamo direct coupled to a steam turbine. A locomotive boiler supplies the necessary steam.

Quite a number of cable makers are notifying increases of prices in consequence of the upward tendency of the price of copper and other raw materials.

An installation of wireless telegraphy on the De Forest system has just been completed between the Norfolk and Lincolnshire coasts of the Wash. The Postoffice has acquired the installation, but it is not clear for what purpose it will be used, for it is stated that the public will not be allowed the use of the service, but that the works will be in charge of men belonging to the coastguard. G.

Dominion of Canada.

Ottawa, Ont., November 24.—The town of Amherst, N. S., is an important industrial center of Canada, and it is believed that with the impetus given by cheap electric power from the mouth of the Chignecto coal mines it will soon become one of the greatest manufacturing cities in the Dominion. The pole line from Chignecto mines to Amherst is completed and the power stations at each end are well under way, so that it is anticipated by the first of February next the whole plant will be in operation.

The Ontario government's hydro-electric power commission has so far received applications from various municipalities for power to the extent of 120,000 horsepower. It is stated that Toronto's requirements can be supplied at $20 to $23 per

horsepower. The question is being asked whether the Electrical Development Company will furnish this power to the government or will some rival company have to be asked to do so, or, in the alternative, will the company's plant have to be expropriated? The company has secured two long-term customers who will pay $35 per horsepower for their energy. They are the Toronto Railway Company and the Toronto Electric Light Company, the latter being also the distributing agent of the Electrical Development Company. Forty-six cities and towns in Ontario have applied to the commission for assistance to get electric power. The demand is double what was expected.

Toronto has at last received electric power from Niagara Falls. It was sent over the wires of the Toronto and Niagara Power Company, on November 19th, and the officers of that company had the satisfaction of witnessing the achievement of their ambition. The spacious transforming station on Davenport Road was illuminated with electric current generated by the turbine at the Electrical Development Company's works at Niagara Falls. There was no formal ceremony to mark this most important event in the history of Toronto's industrial development. The intention to make an experimental test of the line was not made known to any but the officers of the company and a few of those more immediately interested.

The Light and Power Company of Peterboro, Ont., has offered to dispose of its business to the city at cost, free from all incumbrances. If the city will purchase, the company agrees to furnish the city with power at $15 per horsepower per year, sufficient to provide for the present lighting business and extensions for three years. The company also agrees to provide the corporation with 500 additional horsepower for manufacturing purposes at $15 per horsepower as part of the offer. The overture also includes the gas house and business of the company, but does not take in the power generating plant. It is estimated that it will require about $250,000 to take full advantage of the proposition, which is now under consideration of the City Council. W.

New England.

Boston, November 23.—The Consolidated Railway Company has bought control of the Bennington and Hoosick Valley Electric Railroad Company, which operates an electric railway between Bennington, Vt., and Hoosick Falls, N. Y. The road will be extended to Troy, N. Y., and will enter that city over the Union Traction Company's tracks.

The Hartford (Conn.) Court of Common Council has enacted an ordinance providing that all electrical apparatus and wires, whether permanent or temporary, in any building used for theatrical or public assemblies and with a seating capacity for 1,000 persons, shall be under the direct supervision and control of a competent electrician who is approved by the city fire marshal. This ordinance pleases the fire underwriters and may lead to a reduction in fire insurance rates on such buildings.

The Atlantic Insulated Wire and Cable Company suffered a loss of $225,000 by a recent fire in its factory at Stamford, Conn. It leased the property, but it will now build a plant on a site it had recently bought.

The Massachusetts gas and electric-light commissioners are preparing a pamphlet giving in systematic form all the existing laws relating to gas and electric lighting.

Massachusetts Railroad Commissioner Clinton White has returned from a trip to Buffalo, N. Y., Toronto, Ont., Detroit, Mich., Indianapolis, Ind., and Washington, D. C., where he inspected fenders and safety devices in use on street cars. He was accompanied by Allan Brooks, assistant clerk for the commission.

The Edison Electric Illuminating Company of Boston pays taxes amounting to $2,694 in Dedham, Mass., this year.

Two General Electric 7½-kilowatt rotating-field generators of special construction for laboratory work have been bought for the new laboratory of the Worcester Polytechnic Institute. The Institute's branch of the American Institute of Electrical Engineers held a meeting on Monday evening at which five members gave accounts of their last summer's practical experiences with the Westinghouse Electric and Manufacturing Company, the American Telephone and Telegraph Company and the Boston and Northern Street Railway Company.

The Boston Elevated Railway Company has announced that on January 1st it will increase the wages of 5,300 men, adding $160,000 per year to its payrolls. B.

New York.

New York, November 24.—Arrangements are practically completed so that the full electrical current may be put into the third rails of the New York Central lines down as far as the Grand Central Station. Experimental electrically operated trains have been running on the line near High Bridge and have been used for switching purposes. The use of the trains has been more for the practice of the railroad men than anything else. It cannot be said yet when the electric passenger service over the New York Central to and from the suburbs will be put on, but it will be within a short time.

The New York Central and the New Haven lines have obtained a rental for an annex station in the basement of the Grand Central Palace, on Lexington Avenue, for a period of three years. The new station is practically ready, and a large force is working on the tracks, switches and electrical connections. Before the public uses the new stations dummy trains will have to be run into and out of it to prove that everything is in working order. The engineers have been working on the plans for the diversion of traffic for two months. There are to be 14 tracks in the new stations, 10 of which are to be equipped with the third rail. These run from the switching yards into the basement of the Grand Central Palace.

The Broadway subway express trains to One-hundred-and-thirty-seventh Street were started on November 19th, and it is said that they are operated at such a slow speed that the service is not as yet satisfactory.

A suit has been instituted against the Interborough Rapid Transit Company and the New York City Interborough Railway Company by the Rapid Transit Commission to restrain the Interborough company from selling electric power to the City Railway Company. The latter corporation maintains a surface railroad between Manhattan and the Bronx in One-hundred-and-eighty-first Street, and obtains all its power from the subway company. It is contended by the plaintiff that this is in violation of the contract with the city, made when the subway was built.

In a statement given out by him on November 22d, General Manager John F. Calderwood of the Brooklyn Rapid Transit Company expressed the opinion that traffic conditions on the Brooklyn bridge were becoming dangerous, and hinted that there might be a serious straining of the structure some day, if not a breakdown, unless improvements were made.

It is said that nearly 300 surface cars an hour are operated on the bridge, and about 90 six-car elevated trains are run around the terminal in Brooklyn. This is said to be the limit of the terminal operation under the present conditions, and no improvement can be expected unless needed terminal and other facilities are provided or the Manhattan bridge rushed to completion.

The Atlantic Telephone Company sent to the Board of Estimate a letter on November 19th in which it set forth the rates it would afford New Yorkers if granted a franchise. Among other things, the letter said that the company proposed to give an unlimited business service covering all the boroughs of Greater New York at $120 a year, an unlimited residence service covering all the boroughs of Greater New York at $60 a year. For subscribers who do not wish to contract to the above prices, there will be a charge of five cents per message between all of the boroughs of Greater New York, the subscriber to guarantee a minimum of $30 a year per telephone.

The Hudson Tunnel Company has given up its plan of building a power house for the tunnel from Cortlandt Street, New York city, to Jersey City, N. J., and the 15,000 tons of steel and iron girders unloaded there last summer for use in the proposed power house is being removed. It has been said the company intended to spend $2,000,000 on the power house. Work on the foundations was stopped by a strike soon after it began, and has not been resumed. C. I. C.

Ohio.

Cleveland, November 24.—Arguments in the blanket-injunction case of the Cleveland Electric Railway Company against the Forest City Railway Company were heard in Common Pleas Court this week. The attorneys for the Cleveland Electric contended that the franchise granted the new company are void, because the mayor is financially interested in the company. He has admitted that he guaranteed the stock of the company and stood good for purchases of material and any damage that might be done. The Forest City people claim that this is not a financial interest in the sense intended by the laws. The franchises that were granted through him are valuable, and might not have been obtained had he not been mayor. The case has assumed an interesting phase, as it hinges on an old statute requiring that no member of the City Council shall have any profit from contracts awarded or by any action taken by that body.

Articles of incorporation have been issued to the Cleveland and Sharon Traction Company, capitalized at $2,500,000. Francis Morgan, president of the Cleveland and Sharon Electric Railway Company, and associates are interested in the new company, which is believed to be a reorganization. The original plan was to build a road from Leavittsburg to Sharon, Pa., forming a continuation of the Eastern Ohio lines, which reach Leavittsburg.

Forty-eight electric-railway companies have been incorporated within the last year, with an aggregate capital stock of $9,340,000 authorized. During the same period existing roads increased their capital stock $56,676,000. These figures are from the advance sheet of the report of the secretary of state.

Bids for construction work on the new line of the Cleveland, Brooklyn and Elyria are being received.

A temporary restraining order has been issued against the city of Cleveland to prevent the awarding of a contract for a police signal system. One of the unsuccessful bidders brought the suit and claims that the specifications were such that other companies could not bid.

A committee has been appointed by the Village Council of Lakewood to ascertain the price the Cleveland Electric Illuminating Company is willing to pay for the municipal plant. Several attempts have been made to get the consent of the people to the issue of bonds to enlarge and improve the plant, but each time the vote has been against it.

The Rocky River Water, Light and Power Company of Cleveland has increased its capital stock from $75,000 to $100,000.

Thomas L. Childs of Akron has been granted a franchise to build an electric railway through Portage County.

The report that the Everett-Moore syndicate is negotiating for the Pennsylvania and Ohio lines and some others about Ashtabula has been denied by E. W. Moore.

Business men of Chillicothe and Hillsboro are endeavoring to organize a company to build an electric railway between the two points. O. M. C.

Indiana.

Indianapolis, November 24.—It is reported that on January 1st the Indiana Union Traction Company and the Ft. Wayne and Wabash Valley Traction Company will be merged. For the last year the companies have been closely affiliated. If this merger is completed, it will give the Union Traction Company an outlet into Ohio, the Wabash Valley line having an extension to Lima, Ohio. The merger would make the largest interurban system in the world.

Following the retirement of General Manager William Cummings of the Muncie and Portland Traction Company, Fred W. Woodcock, auditor, has been succeeded by E. J. Skehan, formerly with the Chicago and Milwaukee Electric Railroad Company. Fred Meeker, local agent, has been succeeded by E. B. Lincoln and Robt. Matson has taken a position in the new auditor's office.

The people of Marion are trying to keep the Electric Company of America from buying the municipal plant. The people are resenting what they call the invasion of a trust. The Electric Company of America is an incorporation formed under the laws of New Jersey for the purpose of buying and operating electric, gas and water plants. It owns the Marion Electric and Heating Company, the Muncie Electric Light Company, and is said to be laying plans to secure control of such plants in numerous other cities.

The question as to whether municipal ownership and operation of electric-light plants is a success is now being discussed in Crawfordsville, Richmond, Muncie, Marion, Anderson and other Indiana cities. The advocates of the municipal plants insist that a trust is trying to step in and stifle all competition in electric lighting in these cities. The charge has been made that the trust has induced employes of city plants to shut down and otherwise depreciate the service under an alleged report of inefficient machinery, etc., in order to disgust the people wth municipal operation. The conditions of municipal lighting in several cities are such as to demand an investigation.

The Light, Heat and Power Company of Connersville is installing a 900-horsepower turbo-generator, which was ordered nearly a year ago.

The municipal electric-light plant of Greenfield is greatly overloaded and is in need of a general overhauling and installation of new machinery. Frequent breakdowns recently have left the city in darkness. The installation of new machinery is now being considered.

A series of lectures by users of electric machinery in Indianapolis are being given at the Y. M. C. A. each week. The first lecture will be given by Paul G. Winter, electrical engineer for the Jenney Electric Manufacturing Company, on the subject, "Electric Motor and Generator Troubles and Their Remedies."

S. P. Shultz and many other farmers are interested in a plan to build a dam across the Mississinewa River at Pearson's Mill, in Wabash County, and the construction of a power house to generate electricity for the purpose of furnishing light and power to the farmers in that community, as well as several enterprising villages. The promotors brought engineers to the site, who declared the plan feasible.

The Western Lime Company of Huntington, which is operating a large number of lime kilns, has decided to electrify all of its kilns, crushers, compressors and all other machinery operated in about 30 different plants. President Martin says that he is confident that electricity is the cheapest power they can secure.

E. A. Bergquest of Hammond has been notified from Washington that he has been appointed an

electrical engineer in the United States Signal Corps service.

The Muncie, Hartford and Bluffton Electric line is claiming the distinction of being the only road in the county maintaining gates at crossings with a steam line where the steam-line crews are obliged to stop and open the gates across the right-of-way.

The Indianapolis and Cincinnati Traction Company has turned its high-tension current into the Shelbyville division from the Rushville power plant, and put four new cars into service. The company has also remodeled a commodious and convenient passenger station at Connersville.

During the last week the Indianapolis and Northwestern Traction Company began accepting freight shipments at Crawfordsville, the extreme western point of the interurban system, for points touched by traction lines in Indiana and Ohio, insuring quick service to extreme points in the eastern part of Ohio and to a few points in adjoining states.

S. S.

Illinois.

Peoria, November 24.—Incorporation papers were filed today for the Peoria and Canton Railway Company. The directors are S. L. Nelson, W. M. McKinley, George M. Mattox, Charles Zilly and R. H. Watson, Jr. Mr. Nelson, who is manager of the Peoria Railway Company, stated that men will be placed at work at once on the preliminary surveys. This makes another road in the Illinois Traction Company's system.

The St. Louis Terminal Electric Railway has purchased 25 acres at a cost of about $700,000 at Salisbury and Hall streets for terminal facilities. This is in anticipation of the completion of the Illinois Traction Company's system which will connect with the East St. Louis and Suburban Railway at Granite City, and from there to East St. Louis. The completion of the Peoria and Ottawa will make another link in the St. Louis-Chicago route. The Chicago terminal has not been announced as yet, but the officials say that all will be completed before the end of 1907.

The Peoria Railway and Terminal Company has been incorporated with a capital of $1,000,000, to take over the Peoria and Pekin Terminal Railway, which is now in a receiver's hands. The company will also ask the City Council for a franchise to operate a local street-railway line in Pekin. The plan is now to double-track the road between Peoria and Pekin, thus giving terminal facilities for steam roads.

The Tri-City Railway and Light Company of Davenport has announced a reduction in fares, and also cut the price of gas from $1.25 to $1.10 per thousand feet.

Peoria merchants have framed an ordinance for the Peoria Gas and Electric Company, wherein they set the price of gas, steam and electricity for a period of eight years. No action has been taken on it, as the rates are considered to be too low by the company. The company has compiled a statement showing the population and price of gas in 56 cities in Illinois.

The Interurban Terminal Company, the consolidation of the Springfield Consolidated Railway Company and the Springfield and Eastern Company, has submitted a proposition to the City Council of Springfield to furnish terminal facilities to all interurban roads that are granted admission to the city of Springfield.

Lyman Call, who had charge of the electric-light plant at Cuba, Ill., has moved to Joliet. He has been succeeded by S. Walters of Astoria.

V. N.

Pacific Slope.

San Francisco, November 22.—The Southern Pacific Railroad Company has sent the approved plans to General Manager E. E. Calvin at San Francisco, with the announcement that $1,126,925 has been set aside for electrically equipping the company's local steam lines, extending from Alameda Mole to High Street, Alameda. The Alameda broad-gauge system, extending from that city to Oakland Mole, via Fruitvale, the tracks on First Street, Oakland, and the narrow-gauge line extending from Alameda Mole to the corner of Fourteenth and Webster streets, in Oakland, are also to be included in the proposed electric-car system. Fifteen miles or more of double tracks are included in the district to be covered in this manner. A steam-power electric generating station is to be installed at Alameda Point. It is also reported that the Southern Pacific company is preparing to extend its present local lines, and will operate large electric cars on them. The cars will be provided with direct-current motors operating on 500 volts. High-tension alternating current will be generated and distributed to sub-stations, where it will be stepped down for trolley use.

In the matter of the new Home Telephone Company's franchise, the town trustees of Berkeley, Cal., recently reversed their previous action in cutting down the life of the franchise from 50 years to 35 and in reserving the right to fix telephone rates. The ordinance has just been passed to print, with 50 years fixed as the life of the franchise and without restriction of rates. The franchise will be sold to the highest bidder on December 24th.

The Western Power Company has opened an office in Oroville, Cal., in addition to its Eastern and San Francisco offices. M. A. Viele of the New York engineering firm of Viele, Cooper & Blackwell, who is to supervise the construction of the power-transmission plant at the Big Bend of the Feather River, is now on the coast. About 300 men are now employed on the hydraulic work, and the force will be increased during the winter. Considerable road-building will have to be done in connection with the project, which contemplates the construction, later, of several other plants, besides the initial installation of 50,000 horsepower near the Big Bend. Large generating units will be installed, probably of 15,000 kilowatts each. An available head of 525 feet of water will be utilized. Electric power will be sold in the mountains for mining and in Oroville and elsewhere for manufacturing purposes before the 180-mile pole line is completed to San Francisco.

The Postal Telegraph Company has decided to enter the state of Nevada. The company's telegraph lines will probably follow the rails of the Western Pacific Railway Company, now being laid westward from Salt Lake City through Nevada. There will also be lateral telegraph lines off the main line of the railway, including a 30-mile line to Reno and a line to Carson, Nev.

The Seattle Electric Company, which is now installing the equipment in its new power station in Georgetown, a suburb of Seattle, Wash., has been granted building permits for the erection of five additional structures of reinforced concrete. The work will be done under the direction of F. B. Gilbreth, who had the contract for the main power station, now nearly completed. This building is of reinforced concrete and the total cost of the plant is nearly $500,000. The proposed new buildings, which will cover 130,000 square feet of the 18-acre tract of land owned by the company, include a storeroom, costing $25,000; car barn, $14,000; machine shop, $20,000; erecting shop, $15,000, and a paint shop, $18,000. The new station building was undamaged by the recent floods which inundated the surrounding country, as the concrete foundation is carried on heavy piling.

A.

Northwestern States.

Minneapolis, November 24.—The Twin City Rapid Transit Company has acquired the trolley line to Robinsdale from the North Side Street Railway Company. The line will be added to the system known as the Minneapolis and St. Paul Suburban railway. This is the last of the independent trolley lines in the vicinity of the twin cities. A trolley line from Minneapolis to Anoka may be built at an early date.

The new electric-light plant at Auburndale, Wis., has been completed.

Hamilton Browne is negotiating for the purchase of the street-railway system at Marshalltown, Iowa, and if successful will build an interurban line to Ferguson to connect with the C., M. and St. P. railroad.

The Walker electric railway from Minneapolis to St. Louis Park and Hopkins has been formally turned over to the Twin City Rapid Transit Company, the purchase having been made some time ago. No change in the service is contemplated for the present.

The Commercial Club at Grand Forks, N. D., is trying to interest capital to establish a street-railway system in that city.

A municipal electric-light plant will be constructed at Washburn, Wis., the result of the recent election having been in favor of such a move.

The R. E. Jones Company is completely reconstructing its electric-light system at Wabasha, Minn.

The Milwaukee Western Electric Railroad Company has been incorporated by William Ross of the Milwaukee Engineering Company and others for the purpose of building trolley lines to Juneau, Wauwatosa, Hartford, Beaver Dam and Oconomowoc, Wis. It is temporarily capitalized at $5,000.

R.

PERSONAL

Madame Curie, who on the death of her husband was appointed to succeed him in his Paris professorship, has delivered her first lecture at the Sorbonne (on the subject of the theory of electrons). There was a very large audience, but anything of the nature of a public demonstration afterward was avoided.

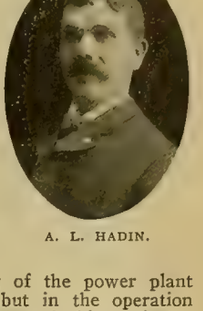
The citizens of Brantford, Ont., are now engaged in the pleasant task of raising $40,000 for a monument to Prof. Alexander Graham Bell, who invented the telephone while a resident of the outskirts of that city. Professor Bell will be 60 years of age in March next, having been born in Scotland in 1847. He accompanied his family to Canada in 1870. The first telephone patent was granted on February 14, 1876.

Dr. William H. Chandler, emeritus professor of chemistry at Lehigh University, died at his home in Bethlehem, Pa., on November 23d. He was 65 years of age. Dr. Chandler was born at New Bedford, Mass. He was graduated from Union College and later taught there as a professor of chemistry. For three years Mr. Chandler was instructor at the Columbia Mining School. With his brother, Charles Frederick Chandler, the professor of chemistry at Columbia University, he established and edited for seven years The American Chemist.

Mr. Robert McF. Doble of Colorado Springs, formerly of San Francisco, has been retained as consulting and supervising engineer by Messrs. Curtis & Hine, general managers of the recently organized Central Colorado Power Company, in the development of their large hydro-electric power projects on the Grand River, Colorado.

James T. Hanford, who joined the service of the Western Union Telegraph Company in 1862, has been appointed manager of the office at Cleveland, Ohio, to succeed Frank C. Hackett, who resigned to engage in another line of business. Mr. Hanford has been operator, wire chief, night chief operator and city solicitor for the company and comes to the new position well prepared.

To the ingenuity of Mr. A. L. Hadin, chief engineer of the South Side Elevated Railroad Company, Chicago, are due many of the features which make the power house of the South Side company a model for efficiency. Mr. Hadin has been in charge of the company's power houses and equipment since the motive power was changed from steam to electricity, nearly nine years ago, and during this time the plant, which is described and illustrated in this issue, has never once failed to perform its function of supplying current to the rolling stock. Mr. Hadin is a man of resourcefulness and energy, and not only in the building of the power plant with which he is identified, but in the operation of the large transportation system, is his engineering skill evident. His engineering education was gained in practice. Born in Sweden, 46 years ago, he came to America in 1880, going to Clay Center, Kan., where he eventually was put in charge of the waterworks. In 1886 he went to Hutchinson, Kan., for the same company, to take charge of its water, light and gas plant there. Next he removed to Aurora, Ill., where he was chief engineer and master mechanic for the Aurora Street Railway Company for six years. On December 1, 1897, Mr. Hadin was called to Chicago and was made chief engineer of the South Side Elevated Railroad Company, which position he still holds. Mr. Hadin has the entire confidence of the officials of his company, and his pleasant disposition and generous nature have won for him many friends wherever he is known.



A. L. HADIN.

ELECTRIC LIGHTING

The citizens of Vedelia, Ga., have voted to issue $14,000 in bonds for the purpose of operating a water and light plant.

It is said that the Minneapolis General Electric Company will build a large new sub-station in Minneapolis, Minn.

The Texarkana (Texas) Gas and Electric Company has purchased the plant of the Texargana Light and Traction Company.

The Hagerstown (Md.) Spoke and Bending Company is in the market for an electric-light plant of about 250-light capacity.

The Omaha (Neb.) Electric Light and Power Company has purchased a site on Auburn Hill, Neb., for the purpose of building a $10,000 power station.

The Pacific Coast Development and Security Company of San Diego, Cal., has been organized with a capital stock of $1,000,000 for the purpose of developing power for lighting and other purposes. John Campbell, Arthur Small and Frank Turnbull are incorporators.

ELECTRIC RAILWAYS

The Tecumseh and Norman Traction Company of Tecumseh, Okla., has been organized with a capital stock of $1,000,000 by S. P. Mitchell, M. H. Tennison and others.

The Prosser Traction Company of Prosser, Wash., has been incorporated with a capital stock of $150,000 by Fred Finn, G. A. Tobb and others. The company proposes to secure power from the Yakima River.

W. H. Patterson, promoter of the Grand Rapids and Kalamazoo Valley Electric Railroad Company, has announced that the bonds have been sold and the building of the road is assured. The contract is also let for the building of the road, which is to begin March 1st, and to be completed within a year.

Grading of the Jackson, Ann Arbor and Detroit Railway, the Boland road, has begun near Dearborn. The road takes over the Detroit, Plymouth and Northern and the old Boland road. The latter has tracks laid from Jackson to within eight miles of Ann Arbor. The third-rail system will be used. C. A. Osborne of New York is president

of the company, George W. Meecham of Battle Creek, secretary; N. S. Potter, treasurer, and W. A. Boland, vice-president.

Henry M. Richards, president of the Washington Water Power Company of Spokane, says that the company expects to have the interurban car service running into Cheney, Wash., 118 miles, by next July. The company has taken over the Spokane, Cheney and Southwestern Company, formed to build a line from Cheney to Hayford to connect with its Medical Lake line.

The Suburban Railway Company, with headquarters in East St. Louis, is to spend $20,000 for the improvement of the city service in Belleville, Ill. The company has bought a 60-foot lot, on which a sub-station will be established. Storage batteries will be installed. The system is calculated to equalize the power distribution for the city lines and to supply power at all times for the proper operation of the local cars.

The Coeur d'Alene and Spokane Electric Railway Company, part of the Spokane and Inland system, has placed a contract at Philadelphia for additional rolling stock and equipment. The order calls for an electric freight locomotive, six passenger cars and two parlor observation cars, which will be operated between Spokane and Coeur d'Alene, 34 miles, which is made in an hour. R. F. Blackwell is manager of the road.

The purchase of the Nevada Transit Company from Messrs. Fleishhacker, Waller, Buck and Martin by Senators Newlands and Nixon of Nevada, who are the principal stockholders in the Reno Development Company, is expected to be closed soon. The price has been stated as $250,000. The Transit company has a three-mile electric railway in operation between Reno and Sparks, Nev. It is said that several hundred thousand dollars will be expended by the new owners in extending the road westward to Laughton Springs, southward to Moana Springs, and, possibly, to Lake Tahoe, later on.

POWER TRANSMISSION.

L. L. Nunn has made application to use the waterpower in the West Fork of Rock Creek in Wasata County, Utah, for the purpose of operating an electrical plant.

The Board of Aldermen of Sanford, N. C., has granted a franchise to the Buckhorn Power Company to enter the town. The lighting plant in Sanford was entirely destroyed by fire recently, leaving the town in darkness.

The Little River Power Company of Blanche, Ala., has been incorporated with a capital stock of $100,000 for the development of the waterpower of the Little River. One hundred and twenty horsepower will be developed. R. A. Mitchell of Alabama City is president.

The Fremont Power Company is installing an electric-power plant at Granite, Ore., the power for which is generated from Olive Lake and Lost Creek, south of Spokane. Olive Lake, 100 acres, will be the reservoir during the dry season. To increase the capacity of the reservoir a large dam has been built across the outlet from the lake, till now they have a reservoir capable of holding 200,000,000 cubic feet of water. The power house is built of concrete blocks. It is intended to house three 100-kilowatt generators, which are connected to Pelton wheels. The power house is on Congo Creek. A transmission line is being constructed from the power house to Bourne, 20 miles. There will be six large copper wires in this line, strung on poles set 120 feet apart.

PUBLICATIONS.

The Electric City Publishing Company of Chicago has been granted incorporation papers. The incorporators are Herbert A. Seymour, John F. Gilchrist and Wm. A. Fox, all of the Chicago Edison Company.

Regulations and instructions concerning denatured alcohol, under the act of Congress of June 7, 1906, have been published in pamphlet form by the commissioner of internal revenue, Washington, D. C. They are designated as Regulations No. 30.

The Cutler-Hammer Manufacturing Company of Milwaukee, Wis., has issued a large number of new bulletin pages, prepared for filing, giving the latest data concerning its well-known self-starters, controllers of all kinds, speed regulators, resistances, etc. Engineers will find the data and general information valuable for reference.

A new catalogue, No. 44, from the Bristol Company, Waterbury, Conn., is devoted to Bristol recording gauges. Many new range gauges have been made and some of the old charts have been replaced by new ones which are easier to read and accurate to a marked degree. Furthermore, the Bristol company catalogues for the first time its portable recording pressure gauges. This company's catalogues cover recording voltmeters, recording ammeters, recording wattmeters, recording thermometers, recording water level gauges, mechanical time recorders, electrical time recorders, thermometer-thermostats, and patent steel belt lacing.

The Cataract Power and Conduit Company of Buffalo, N. Y., is sending out a neat booklet in which are reproduced a long list of testimonials from users of Niagara power. Almost every class of manufacturing is represented among the letters shown and all pronounce Niagara Falls power an unqualified success as utilized in their industries.

In the "stuffing" of a bag attached to an attractive card befitting the turkey season is a statement from the Phoenix Glass Company, 15 Murray Street, New York city, that its inner-globe proposition is a cause for thanksgiving to all who accept it. The company also furnishes outer globes for all lighting systems. Its glassware—electric, gas and oil—all systems—combines design and quality. Catalogues will be sent upon request.

The American Wire Rope News is a publication which is issued every three months in the interests of the American Steel and Wire Company, which has its Chicago office in the Rookery Building. The paper is brought out to assist users of wire rope in securing the size, quality and construction of wire rope most suitable for their needs. The issue for October, 1906, contains much valuable information about the company's products, including full-size views of the standard wire ropes and the methods of making calculations for derrick ropes. The paper is attractively illustrated, and on the front page there is a fine picture of a tiger's head entitled "Extra Flexible."

The Benjamin Electric Manufacturing Company, 42 West Jackson Boulevard, Chicago, has just issued a handsome catalogue—B-17—which is full of valuable material. It describes and illustrates wireless clusters and lighting specialties and forms a book of 104 pages, profusely and clearly illustrated. The catalogue is divided into eight parts, relating to cluster bodies, ceiling, pendant and weatherproof forms, arc-bursts, and a large variety of sockets, plugs, receptacles, wall brackets, lamp guards, canopies, bushings, shade-holders, reflectors and the like. The pamphlet gives evidence of careful, intelligent preparation; the material in it is clearly arranged and attractively presented. The book does credit alike to the goods it represents and its compiler. It will be valuable to all engaged in the electric-lighting industry.

SOCIETIES AND SCHOOLS.

A meeting of the Electrical Salesmen's Association will be held at 3 p. m., December 4th, at the Chicago Engineers' Club, 171 East Washington Street, Chicago. A large attendance is requested. George H. Erich, 358 Dearborn Street, Chicago, is secretary.

The Western Society of Engineers held an extra meeting on Monday evening, November 26th, in the society rooms. Mr. R. S. Whipple, vice-president of the Cambridge Scientific Instrument Company, Cambridge, England, addressed the society on "Practical Pyrometry."

The Chicago Section of the Illuminating Engineering Society will hold its next regular meeting on December 6th, taking dinner at White's restaurant, 124 Adams Street, at 6 p. m., and proceeding immediately to discussion after the conclusion of the dinner. Questions left over from the last meeting and papers read at the latest New York meeting will be discussed.

The engineering experiment station coal-testing plant located in the mechanical-engineering laboratory of the University of Illinois is rapidly undergoing extensive improvements. Platforms are being erected, instruments and apparatus permanently located, and every facility for the efficient handling of coal, ashes, etc., installed. The plant, as is already known, is for the testing of Illinois coals, and it is expected that the results obtained will be of great value to both large and small consumers. Mr. C. S. McGoveng is the assistant in charge of the tests.

On November 17th Mr. F. A. Sager of The Arnold Company, Chicago, lectured before the engineering students of the University of Minnesota on "What is an Engineer-constructor?" He said that in an engineering office loyalty is of the greatest importance, common sense and skill coming next. On November 22d Mr. C. H. Harris, engineer with the Minneapolis General Electric Company, lectured to the engineering students on "The Taylors Falls Development." Mr. Harris is the resident engineer in charge of the hydro-electric development at Taylors Falls, which is to furnish 12,000 horsepower at 50,000 volts to Minneapolis, a distance of 50 miles, the ultimate capacity being 24,000 horsepower.

C. Edward Magnusson, professor of electrical engineering of the University of Washington, Seattle, Wash., announces a course of special evening lectures to be given by the department of electric engineering during 1906-07. Albert G. Allen, M. S., chief electrical engineer of the Seattle Electric Company, will give five lectures under the head of Electric Traction. Central-station practice will be divided into five subjects and handled by James D. Ross, chief electrical engineer of the Seattle municipal electric-light and power system. Three lectures on telephones will be given by C. E. Flaeger, B. S. in E. E., superintendent of inside plant of the Sunset Telephone Company. Electric-power transmission will be the general subject of five lectures by John Harisberger, general superintendent of the Seattle-Tacoma Power Company. Everyone interested in the subjects is invited to attend.

SPACE TELEGRAPHY.

A newspaper dispatch from Omaha, Neb., dated November 20th, says that the chief signal officers of the United States Army at Fort Omaha received a cablegram from the Philippines saying that wireless telegraphy had been installed between Jolo and Zamboango, 100 miles apart. This is believed to be the first wireless system to be installed in the tropics, and a weight is lifted off the minds of the signal corps by the knowledge that space telegraphy is a success in the hot country.

It was reported recently that a "wireless" combination had been formed. According to the New York Times, Abraham White has announced that the new company will be called the United Wireless Telegraph Company, and has been incorporated at Augusta, Me., with a capital stock of $20,000,000. The formation of the company, it was said, meant the merger of the Marconi and De Forest companies. But officials of the Marconi company say that nothing is known by them of the combination.

MISCELLANEOUS.

Following its annual custom, the National Fire Protection Association reminds its members of the hazards of Christmas decorations and displays and urges them to call the attention of the public to the dangers to life and property from the use of Christmas greens, harvest specimens, cotton to represent snow and other inflammable materials in churches, mercantile establishments and especially department stores.

The Rhode Island Worsted Company of Indian Orchard, Mass., is the latest addition to the list of New England worsted mills and cloth-printing establishments to install electrical drive. This company's new mill at Stafford Springs, Conn., will be equipped with a 20 by 36-inch Allis-Chalmers Corliss engine and a 225-kilowatt Allis-Chalmers belt-driven alternator, with belted exciter; also a 150-kilowatt belt-driven alternator and exciter of the same make, the latter machine to be driven by means of a waterwheel. The complete outfit includes full switchboard equipment and three 50-horsepower and one 15-horsepower Allis-Chalmers induction motors, used in the weave shed and other parts of the mill.

Nearly all of the space for the January Electrical Show of the Chicago Electrical Trades Exposition Company is sold, aggregating nearly 30,000 square feet. So great has been the demand that the Coliseum annex will be used for exhibitors. A feature of the exposition will be an attempt to make a long-distance test of the Cahill telharmonic system, by which an effort will be made to transmit music from the New York central station to the Coliseum during the show. This will require the co-operation of the Chicago Telephone Company and the American Telephone and Telegraph Company, which controls the long-distance circuit. The longest test yet made of the Cahill system was from Holyoke, Mass., to New Haven, Conn., about 100 miles.

TRADE NEWS.

The supervising architect of the United States Treasury Department, Washington, D. C., will receive sealed proposals until 3 p. m. on December 11th, for an electric passenger elevator and hydraulic freight lift for the United States Postoffice at St. Joseph, Mo., in accordance with drawings and specifications on file at the office of James Knox Taylor, supervising architect.

The Blake Signal and Manufacturing Company, 246 Summer Street, Boston, Mass., has taken over from the Climax Manufacturing Company all patent rights, good-will, etc., so far as the Climax soldering flux tube is concerned, and will put this product out in connection with other Blake patents as the Blake tube flux. The Blake company has improved slightly the quality of the tube, and is prepared to fill all orders promptly. The Blake tube flux for soldering is a fitting associate for Blake insulated staples and Blake compressed cleats, with the excellence of which the trade and the consumer are well acquainted.

The Cleveland Gas and Electric Fixture Company of Cleveland, Ohio, manufacturer of a general line of lighting fixtures, with sales departments in Cleveland and Pittsburg, is completing the erection of a new factory in Conneaut, Ohio, with about 75,000 square feet of floor space and a full equipment of improved machinery. The company has formulated a policy of increasing its output of gas and electric-lighting appliances, particularly with reference to the requirements of electric-supply dealers in the United States and Canada. It will manufacture a staple line of what it calls its "C" line of box fixtures, which will comprehend all requirements in low and medium-priced fixtures; and it is to manufacture this line that the new

factory is provided. A portion of the new factory is already in operation, and the company expects to meet all demands upon it with prompt shipments by January 1st and thereafter.

There is said to be an opening for an electrician in the town of Bartlesville, Cherokee Nation County, Indian Territory. The town is on the Atchison, Topeka and Santa Fe and Missouri, Kansas and Texas railroads, 30 miles from Coffeyville, Kan. It has a population of 3,500 and has waterworks, electric-light and gas plant, telephone system and a paid fire department. There is no one engaged in the business of electrician in the town. This information comes from Wesley Merritt, industrial commissioner of the A., T. and S. F. Ry., 9 Jackson Boulevard, Chicago.

"The most marked features of Japanese life since the close of the war has been in the organization and development of various industries," writes Consul-general Miller from Yokohama. "Heretofore the industrial expansion of Japan has been seriously retarded by lack of capital and high rates of interest. One of the strangest features of Japan's life is the fact that the entire country emerges from a great war with an enormous debt and a serious burden of taxes, but at the same time a wonderful improvement in her national, commercial and industrial credit. From all quarters of the world capital seems anxious to enter Japan." The greatest activity is noted in the organization of new electrical works. Japan has a wonderful amount of waterpower, and this is rapidly being utilized for electrical purposes. No less than 51 new electrical companies have been organized, with an aggregate capital stock of $55,000,000 gold, since the war.

The International Jury of the Milan Exposition has just announced the award of a diploma d'onore to the "Long Arm" system of electrically operated bulkhead doors. The award takes higher rank than the gold medal granted by the jury in some cases. The "Long Arm" System Company of Cleveland, Ohio, had an elaborate installation of its watertight doors at the exposition, and much attention was attracted by it. The great advantage gained is that the electrical control makes closure of the doors possible under all circumstances, even in the event of a hull puncture below the water line, or when the conditions would make it impracticable to close bulkhead doors by hand against inrushing water.

BUSINESS.

M. W. Dunton & Co., Providence, R. I., say that they are the largest producers in this country of braided cotton sleevings for insulating purposes. They announce that an inventory taken last week shows a stock on hand of 7,244 pounds of regular sizes, in addition to a large quantity of special sleevings, which they are making constantly for some of the large manufacturers. When one stops to think that it requires from 300 to 1,500 feet, according to size, to make a single pound, he will appreciate the large stock carried by this firm.

The Haller Machine Company, 127 Fulton Street, Chicago, calls attention to its facilities for executing electric-sign work at the coming electrical show in the Coliseum, Chicago.

The long list of recent orders for air-brake equipments received by the National Brake and Electric Company of Milwaukee includes an order for six equipments for the Everett Railway, Light and Power Company of Everett, Wash.

One of the dangers in air compression is the liability to explosion in air-compressor cylinders when the heat of compression is caused to exceed the flashing point of the oil used for cylinder lubrication. Therefore, the Joseph Dixon Crucible Company, Jersey City, N. J., draws attention to the many advantages of Dixon's Ticonderoga flake graphite as a cylinder lubricant for air compressors. It says: "Ticonderoga flake graphite is unaffected by high temperatures. It cannot be 'carbonized' or ignited. It cannot possibly give off explosive vapors. It will not accumulate dust or grit. It does not clog discharge valves. It allows a great reduction of oil supply. It avoids the danger of receiver explosions. It improves piston fit and lowers friction. It saves oil, repairs, trouble and money." A 24-page pamphlet is sent free of charge to all who are interested in the subject.

ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued (United States Patent Office) November 20, 1906.

836,088. Letter for Electric Signs. Horace B. Camp, Akron, Ohio. Application filed July 3, 1905.

A body portion is formed with a recess and is provided with depending sockets for the reception of electric lamps. The sockets are provided at their upper end with a circular bead-ring projecting beyond the bottom wall of the recess.

836,093. Ignition Device for Explosion Engines. Adolphe Clément, Levallois-Perret, France. Application filed October 2, 1902.

Testers are included in the ignition circuits for the several cylinders and springs tend to hold them in position to maintain the circuits complete. The testers are independently operable to break their several circuits and thereby permitting of determining, by operating all but one of the testers, which, if any, cylinder is defective.

836,107. Secondary Battery. Louis H. Flanders, Wilkinsburg, Pa., assignor to the Westinghouse Machine Company, Pittsburg, Pa. Application filed April 15, 1905.

An encircling insulating-ring is provided with a downwardly extending lug arranged to co-operate with a recess formed in the electrode.

836,121. Molding or Electric Wire Conductor. William H. G. Kirkpatrick, Philadelphia, Pa. Application filed May 5, 1905.

The grooves are in the base and are inclined. The capping abuts against the base and covers the grooves.

836,122. High-potential Insulator. Fred M. Locke, Victor, N. Y. Application filed March 23, 1903.

The porcelain center piece is formed with a central tapering opening which is smaller at the bottom than at the top. A tapering bolt is in the opening and has its upper end smaller than the upper end, but larger than the lower end of the opening, so that the bolt is removable from one end only of the opening and wedges in the opposite end. (See cut on next page.)

836,151. Dry-cell Battery. George L. Tarver, Greenfield, Ind. Application filed March 5, 1906.

The dry cell comprises a positive cup or electrode, with an inner lining of paper. A negative carbon electrode rests on the lining. A surrounding bottom layer of sand envelops the carbon electrode. A layer of carbon and manganese dioxide is placed over the bottom layer and a second layer of sand is over the carbon and manganese layer, and a layer of wax is placed on top. The sand and carbon and manganese dioxide are mixed in form of paste with salammóniac and sulphuric acid.

836,153. Signaling System for Electric Railways. Louis H. Thullen, Edgewood Park, Pa., assignor to the Union Switch and Signal Company, Swissvale, Pa. Application filed June 9, 1906.

A railway signal is placed in each block-section, and there is a track-circuit for each block-section, each track-circuit includes a source of direct current, a relay-coil responsive to the direct current, a relay-coil responsive to the alternating current used for the cars, and a means operated by one of the coils for establishing a short circuit across the track-rails of a block-section.

836,155. Electrical Conductor and Joint Therefor. Frank J. Tone, Niagara Falls, N. Y. Application filed November 11, 1905.

A metal connecting member or holder and an electrode have a layer of electrically produced graphite between their contacting surfaces.

836,166. Street Indicator. John W. Willson, Granite City, Ill. Application filed February 7, 1906.

Means operated by an electromagnet are provided for rolling an indicating device into a position in front of an aperture in the casing.

836,177. Art of Producing Pigments by Electrolysis. Edwin D. Chaplin, Boston, Mass. Application filed February 3, 1906.

For producing white lead by electrolysis, the process consists in electrolytically producing a soluble acid salt of lead, withdrawing the same and precipitating lead hydrate therefrom, and then carbonating the lead hydrate to produce white lead.

836,202. Telephone-Receiver Switch. James McMahon, Oakdale, Cal. Application filed July 24, 1905.

A telephone receiver has a plurality of flexible blades between the legs of its magnet. Insulating material is placed between the blades and the legs of the magnet respectively, part of the points being normally in contact and part of them out of contact. Means upon the exterior of the case are provided for automatically separating the closed contacts and closing the separated ones. (See cut on next page.)

836,204. Telephone System. Frederick R. Parker, Lafayette, Ind. Application filed July 27, 1903.

The feature of the system is that means are provided at the central station whereby the circuit of the telephone line and signaling device is changed from a metallic circuit of the line to a grounded return circuit of the line.

836,243. Electrically Operated Railway Signal and Gate. James G. O. Combs and Isaac D. Combs, Harold, Mo. Application filed April 20, 1906.

There is a gate, a signal, an alarm and a setting mechanism. Operative mechanisms for the several parts include independent electric actuators and corresponding circuits. Two sets of circuit closers for the respective circuits are arranged upon opposite sides of the crossing so that they are actuated by a train approaching from either direction.

836,261. Manufacturing Electrodes for Electrical Accumulators by Means of Continually Working Machines. Ernst W. Jungner, Kneippbaden, Sweden, assignor to Nya Ackumulator-Aktiebolaget Jungner, Stockholm, Sweden, a company. Application filed September 11, 1905.

Continuous metallic ribbons are fed toward each other, perforated and electroplated, and an active mass is fed between them. They are then united and the electrode thus formed is severed from the remaining ribbon.

836,274. Controller for Use in Connection with the Ignition of Gas Burners. Victor C. J. Nightingall, Melbourne, Victoria, Australia. Application filed October 30, 1905.

An electromagnetically operated valve controls the gas flow to a gas burner.

836,279. Means for Controlling the Supply of Electric Currents. Friedrich W. Schneider, Frankfort-on-the-Main-Bockenheim, Germany. Assignor to the firm of Voigt & Haeffner Aktiengesellschaft, Frankfort-on-the-Main-Bockenheim, Germany. Application filed December 17, 1903.

Two contact making and breaking devices are adapted to close the circuit through a translating device. Both of the devices are normally closed and each is adapted to automatically close after being opened. Means are provided for opening one of the devices upon the passage of a current in excess of a certain value and for opening the other of the devices upon the opening of the first.

836,280. Switch for Electric Circuits. Burton G. Seavey and Walter G. Millen, Keene, N. H. Application filed September 22, 1905.

Terminal pieces are provided to which the ends of the circuit conductors are attached, and two conducting strips are pivotally attached to diagonally opposite terminal pieces each of which is adjustable to connect its terminals to either a laterally or a longitudinally opposite terminal piece.

836,282. Electric Heating Pad. Luella W. Shellhamer, Los Angeles, Cal. Application filed April 2, 1906.

A resistance wire in the heating pad has a break therein. Means operatable by the weight of the user are provided to close the break. Means are also provided to re-establish the break when the weight of the user is removed from the pad.

836,295. Device for Lighting by Electricity Reversed Gas Burners. Paul Benard, Epernay, France. Application filed November 21, 1905.

Two conductors are carried by a plate beneath the Bunsen, which is surrounded by a wire gauze. A platinum coil attached to the conductors is placed in the gauze.

836,307. Circuit-controlling Keyboard Apparatus. Patrick B. Delany, South Orange, N. J. Application filed March 29, 1904.

The method operates to send electric impulses at a rate which will operate an electromagnet instrument and to repeat the impulses reversely at a rate which will not operate the instrument.

836,314. Charging System for Storage Cells or Batteries. Jacob de S. Freund, Edgewood Park, Pa., assignor to the Union Switch and Signal Company, Swissvale, Pa. Application filed June 10, 1905.

Two feed wires extend from the charging generator. Storage cells or batteries are included in each feed wire, and arranged in pairs. Magnet coils in each feed wire are arranged in pairs, one pair of magnet coils being provided for each pair of storage cells or batteries. A pivoted lever is provided for each pair of magnet coils and is alternately moved on its pivot by them. Contacts are opened and closed by the movement of each lever. A supply circuit is provided for each pair of storage cells or batteries which is controlled by the movements of the pivoted lever of the magnet coils provided for the pair of storage cells or batteries.

836,339. Magnetizable Body for the Magnetic Record of Speech, etc. Peder O. Pedersen, Copenhagen, Denmark, assignor to the American Telegraphone Company. Application filed June 21, 1901.

For use with telegraphones, a suitable core or base has an electrodeposited even surface of magnetic material adapted to record magnetic impressions representing sounds or signals.

836,352. Switch Box. Charles E. Youmans, Yonkers, N. Y., assignor to Julia Hall Youmans, Yonkers, N. Y. Application filed June 13, 1904.

This is a water-tight switch-box. A plug is connected with a switch inside the box and makes a water-tight connection with the cover extending through it.

836,359. Method and Apparatus for Testing Alternators. Bernard A. Behrend, Norwood, Ohio, assignor to the Bullock Electric Manufacturing Company and Allis-Chalmers Company. Application filed July 11, 1904.

This method consists in dividing the field winding into two parts having an equal number of poles, and supplying current to the field-winding parts, so that when the machine is operated one part acts as a motor while the other part acts as a generator, and then regulating the current in the parts of the field winding, so that a perfect magnetic balance of the machine is obtained.

836,377. Automatic Alarm. Ira Filson, Springfield, Ohio. Application filed February 8, 1905.

An arm is pivotally mounted on the outlet pipe of a stove or furnace, extending through the wall thereof and provided with a vane within the pipe. A bracket is mounted on the pipe and has arms. A wire of conducting material is stretched between the bracket arms in the path of the vane-bearing arm. An electric circuit comprising a source of electricity and an alarm has its ends respectively connected to the wire and vane-bearing arm.

836,396. Electric Outlet Insulator. John E. Moore, Davenport, Iowa. Application filed October 27, 1902.

A central gas-pipe tube has a plurality of wiring tubes secured thereto and extending alongside thereof, the gas-pipe tube projecting at each end beyond the ends of the wiring tubes, and the upper ends of the wiring tubes curving outwardly from the gas-pipe tube.

836,405. Elevated Electric Tramway. George G. Schroeder, Washington, D. C., assignor to the Industrial Motor Company. Application filed August 7, 1906.

Isosceles supports have their upper ends provided with sockets, rails having depending webs being fitted within the sockets and lateral flanges rest upon the top edges of the sockets. Supplemental rails are secured to opposite sides of the supports below the first-mentioned rails, and current wires extend parallel with the rails.

836,407. Telephone Attachment. Joseph Silverman, San Francisco, Cal. Application filed March 5, 1906.

A spring is connected with a pivoted finger and exerts a tension on the finger on one side of the pivot when the finger is turned in one direction and is adapted to exert a tension on the other side of the pivot when the finger is turned in the opposite direction.

836,427. Motor-starting Switch. Thorsten von Zweigbergk, Preston, England. Application filed May 21, 1906.

A spring tends to separate the terminals of the switch. A magnet is adapted to hold the terminals together. A crank and mechanism are provided. The movement of the crank in one direction cuts out resistance, and movement in the opposite direction closes the terminals without displacing the resistance-governing mechanism.

836,454. Telegraph Key. Edward M. McConihay, Lewiston, W. Va. Application filed December 29, 1905.

Automatic means are placed adjacent to the button of the key lever for preserving normally unbroken circuit through the key and occupy a plane below the top of the button. The means are operative to break circuit only by an uplifting force considered with reference to the base.

836,468. Cap for Electrical Attachment Plugs and the Like. Frank E. Seeley, Bridgeport, Conn., assignor to the Bryant Electric Company, Bridgeport, Conn. Application filed April 23, 1906.

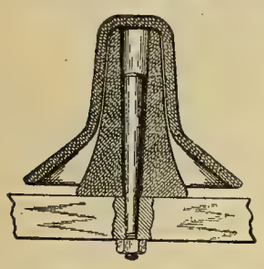
The body part has headed screws with a metallic cap having notches to pass over the stems of the screws and adjacent projections to engage the head of the screw.

836,480. Dry-battery Cell. John W. Brown, Cleveland, Ohio, assignor to the National Carbon Company, Cleveland, Ohio. Application filed September 14, 1906.

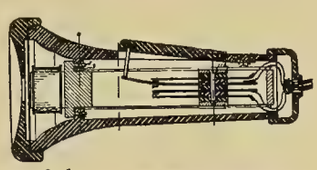
The parts are so disposed that the total internal resistance between the two binding posts through the electrodes and electrolyte will be substantially the same along all paths of the current. (See cut.)

836,482. Cut-out. Clifton L. Bundy and Albert H. Manwaring, Philadelphia, Pa., assignors to the Philadelphia Electrical and Manufacturing Company, Philadelphia, Pa. Application filed June 21, 1904.

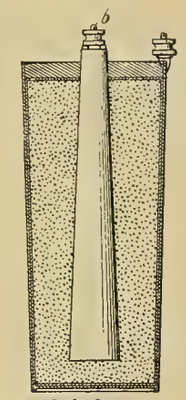
A pair of pivotally-mounted switch members have supply wires connected to them, with a removable plug carrying terminals connected to an electroreceptive device. The plug is arranged to engage one end of each of the switch members to move their opposite ends respectively into engagement with the terminals. (See cut.)



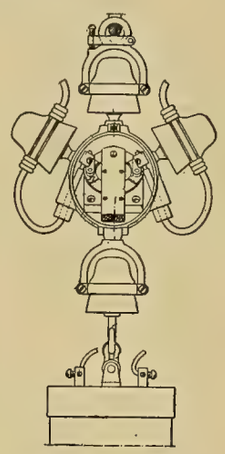
NO. 836,122.—HIGH POTENTIAL INSULATOR.



NO. 836,202.—TELEPHONE-RECEIVER SWITCH.



NO. 836,481.—DRY-BATTERY CELL.



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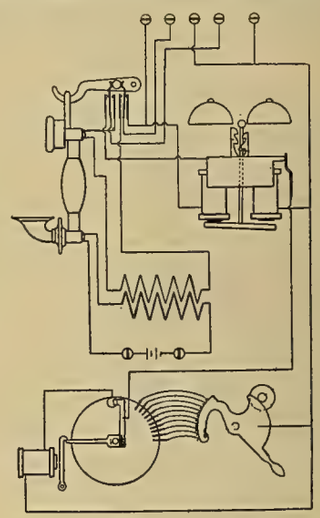


NO. 12,565—SEMI-AUTOMATIC TELEPHONE SYSTEM.

836,489. Testing System for Telephone Lines. William W. Dean, Chicago, Ill., assignor to the Kellogg Switchboard and Supply Company, Chicago, Ill. Application filed June 29, 1903.

A testing device is normally connected with the tip strand of the switchboard cord, and a switch is operated during testing to open the strand in the rear of the connection of the device and to place the operator's telephone set in condition to receive impulses from the device.

836,490. Detachable Incandescent Lamp Shade. Henry D'Olier, Jr., Philadelphia, Pa. Application filed September 21, 1905.

An aperture in the shade or reflector member is adapted to embrace the lamp socket, the axis of the lamp socket being at an angle with the axis of the shade or reflector member. A single independent resilient ring member is adapted to confine the shade or reflector member upon the socket and to permit its rotation.

836,497. Process of Improving the Magnetic Qualities of Iron-silicon-aluminum Alloys. Robert A. Hadfield, Sheffield, England. Application filed August 21, 1906.

The process of increasing the magnetic permeability and electric resistance and reducing the hysteresis action of an iron-silicon-aluminium alloy, low in carbon and manganese, consists in heating the alloy to a temperature above its critical point and then cooling.

836,503. Sparking Igniter for Gas Engines. Harry A. Johnston, San Francisco, Cal., assignor to the Hercules Gas Engine Works. Application filed March 8, 1905.

There is a stationary electrode and a movable electrode. A rocking arm is connected with the movable electrode, an oscillating pin journaled in proximity to the rocking arm. An arm is rigidly carried by the pin, a helical spring encircling the pin and having one end connected to the arm. Means adjustably connecting the other end to the pin are provided, the spring exerting tension on both the arm and the pin. A disk rotates with its face in contact with a projection on the arm to limit the movement of it and has a cam projection for rocking the arm.

836,514. Telephone Cord Circuit. Albion D. T. Libby, Chicago, Ill., assignor to the Kellogg Switchboard and Supply Company, Chicago, Ill. Application filed September 3, 1904.

A relay bridged across the cord circuit controls a signal in a common battery cord circuit. A locking circuit for the relay is closed by itself when energized by current from a sub-station. Means are provided for diverting the generator current from the relay when once energized.

836,521. Igniter. Albert C. Menges, Grand Rapids, Mich., assignor to William Harrison, Grand Rapids, Mich. Application filed January 9, 1906.

The principal parts are an igniter bar, an insulating sleeve and a jarring member. Means are provided for loosely retaining the jarring member in continual proximity to the adjacent parts.

836,531. Means for Receiving Intelligence Communicated by Electric Waves. Greenleaf W. Pickard, Amesbury, Mass. Application filed August 30, 1906.

Silicon is used as an element of means for receiving intelligence communicated by electric waves.

836,558. Apparatus for Working Fused Silica or the Like. James F. Bottomley, Wallsend, and Arthur Paget, North Cray, England. Application filed February 28, 1906.

An electric furnace is so designed that the fused material may be easily removed.

836,576. Static Discharger. William L. Hardwicke, Richmond, Va., assignor of one-half to George W. Wynant, Richmond, Va. Application filed April 3, 1905.

A static discharger is connected with the mechanism of a printing press to relieve the sheets of paper carried by the mechanism of the static charge of electricity.

836,581. Means for Eliminating or Reducing the Influence of Disturbing Currents on Telephone Circuits. Charles M. Jacobs, Reading, England. Application filed January 27, 1906.

A phonophore winding is placed on a receiver, the phonophore winding and receiver winding being one winding.

836,607. Door Opener. Jacob Reinert and Louis Reinert, Allegheny, Pa. Application filed June 16, 1906.

Electromagnetic means are provided for initially opening the door to a predetermined extent, and means are provided automatically operated in the manual opening of the door beyond the predetermined extent to reset the initial opening means.

836,611. Regulating Device for Telephone Relays and Transmitters. Herbert E. Shreeve, Newton, Mass., assignor to the American Telephone and Telegraph Company. Application filed October 26, 1905.

A thermal resistance and current regulator is provided in circuit with the transmitting means.

836,612. Regulating Device for Telephone Relays and Transmitters. Herbert E. Shreeve, Newton, Mass., assignor to the American Telephone and Telegraph Company. Application filed October 26, 1905.

A source of electromotive force is in circuit with finely divided variable resistance material, and a movable electrode in the chamber contains the resistance material. An electromagnet is adapted to control the movable electrode. There is an impedance coil and a condenser. The electromagnet and impedance coil and the condenser shunt one another, or are respectively in parallel branches of the circuit of the source of electromotive force and variable-resistance material.

836,639. Contact Wheel. Edward L. Dunn, Washington, D. C., assignor of one-third to Jacob Gerke, Ballston, Va. Application filed February 21, 1906.

An outer flange incloses each of two central bearings and forms a part of them. An outer ring has external ribs engaging recesses in the wheel, the bearings being located within the bore at the opposite end of it.

836,649. Electric Switch-throwing Device. James A. Posey, Midlothian, Texas, assignor of one-third to H. H. Posey, one-third to W. E. Sewil, and one-third to Annie Posey, Midlothian, Texas. Application filed August 2, 1906.

A circuit-changing device is provided with contacts whereby a current may be directed to either pole of a switch-throwing motor. A circuit-distributing mechanism is operatively connected to the circuit-changing device and to the contacts. A mechanical device is provided for preventing the breaking of the circuit through the circuit-changing device and through the circuit-distributing mechanism during a switching operation. Means are provided for actuating the mechanical device.

836,659. Induction-coil Apparatus. Ernest C. Wilcox, Meriden, Conn. Original application filed June 2, 1905. Divided and this application filed April 14, 1906.

Connecting terminals are located beneath the bottom of a casing adapted to receive the primary and secondary windings, and a depending protecting skirt or flange is carried by the casing and laterally surrounding a part of the terminals.

REISSUES.

12,560. Telephone-exchange System. William M. Davis, Seattle, Wash., assignor to the Stromberg-Carlson Telephone Manufacturing Company, Rochester, N. Y. Application filed October 30, 1903. Original No. 679,731, dated August 6, 1901.

A common-battery telephone system in which the insertion of the plug in the line jack establishes the circuit through a cut-off relay which operates to render the line-indicating signal inert.

12,561. Electric Tube Lighting. Daniel M. Moore, Newark, N. J., assignor to the Moore Electrical Company, New York, N. Y. Application filed November 19, 1903. Original No. 702,315, dated June 10, 1902.

In a high-potential system of electric lighting, an electric lamp consisting of lengths of glass tubing is joined together in situ and forms substantially all of the high-potential circuit. The lamp has terminal sections provided with suitable conducting electrodes connected with a source of energy proper for rendering the gaseous contents of the tube luminous.

12,565. Semi-automatic Telephone-exchange System. Arthur T. M. Thomson, London, England. Application filed May 2, 1906. Original No. 809,232, dated January 2, 1906.

A supervisory lamp for the called plug is in circuit with the calling-plug switch, and a numerical indicator is in the plug circuit. The removal of the calling plug from its plug switch and the plugging of the calling plug into the calling subscriber's jack lights the supervisory lamp at the called plug and actuates the numerical indicators to register the latent signal. (See cut.)

PATENTS THAT HAVE EXPIRED.

Following is a list of electrical patents (issued by the United States Patent Office) that expired November 26, 1906:

415,695. Armature Plate. W. S. Belding, Englewood, Ill.
415,696. Coil Guard for Armatures. W. S. Belding, Englewood, Ill.
415,697. Armature. W. S. Belding, Englewood, Ill.
415,700. Telephone Receiver. J. W. Bonta, Philadelphia, Pa.
415,710. Separable Electric Conductor for Railway Gates. F. E. Fowler, Lynn, Mass.
415,738. Process of Electrically Obtaining Copper. H. A. Seegall, Berlin, Germany.
415,747 and 415,748. Electric Meter. E. Thomson, Lynn, Mass.
415,749. Electric Transformer. E. Thomson, Lynn, Mass.
415,752. Joint for Coupling Underground Cables. B. H. Wesslau, Charlottenburg, Prussia, Germany.
415,758. Thermo-electric Indicator. F. W. Wiesebrock and E. Huber, New York, N. Y.
415,769. Circuit for Multiple Switchboards. J. J. Carty, Cambridge, Mass.
415,806. Armature for Electric Machines. W. S. Belding, Englewood, Ill.
415,817. Electrical Appliance for Winding Clocks. F. A. Lane, New Haven, Conn.
415,856. Electric Heating Apparatus. C. E. Carpenter, Minneapolis, Minn.
415,864. Composition for Overhead Insulators. S. H. Gilson, Salt Lake City, Utah.
415,871. Electro-automatic Valve. M. A. Kissell, Chicago, Ill.
415,877. Automatic Regulator for Paper-feeding Mechanisms (Electric). J. A. M. Ross, Castleton, N. Y.
415,915. Electrical Annunciator. C. E. Lee, Rochester, N. Y.
415,936. Electrode for Secondary Batteries. J. Y. Bradbury and F. J. Stone, Lowell, Mass.
415,962. Composition for Lining Electric Battery Jars. O. A. Enholm, New York, N. Y.
415,963. Galvanic Battery. O. A. Enholm, New York, N. Y.
415,975. Galvanic Battery. G. Otto, Jersey City, N. J.
415,981. Secondary Battery. W. P. Smith, Philadelphia, Pa.
415,990. Electric Trumpet. J. P. Zigang, Domfront, France.
416,006. Induction Telemeter. P. Moennich, Gehlsdorf, near Rostock, Mecklenburg Schwerin, Germany.
416,013. Dynamo-electric Machine or Motor. A. L. Riker, New York, N. Y.
416,103. Electric Lock. G. A. Harter, Chicago, Ill.
416,148. Secondary Electric Clock. E. L. Slocum, Pawtucket, R. I.

WESTERN ELECTRICIAN

EVERY SATURDAY

Vol. XXXIX. CHICAGO, DECEMBER 8, 1906 No. 23

The Rhine River Electric Railway.

By Dr. Alfred Gradenwitz.

An interesting electric-railway system connecting the cities of Cologne and Bonn on the Rhine, in Germany, has been recently put into service and is especially noteworthy on account of the rather high speeds (up to 80 kilometers, or 50 miles, an hour) there utilized. Within the boundary of the city of Cologne the municipal tramway track is used. From this ancient city the railway has its own right-of-way to Eller Street in Bonn, whence it proceeds to run on the streets of the city. The total length of line is 28.3 kilometers. Apart from the general passenger traffic, the railway is to serve as a means of conveyance for the brown coal and briquettes that are transported from the mountains to the Rhine River. Each of the stations has been accordingly equipped with a loading platform for the freight traffic, while a special freight house has been built at Bonn.

The permanent way has been designed for a wheel pressure of 7,000 kilograms. A strictly maintained block-signal system is in use to prevent any risk of collision.

In the electrical equipment of the railway, owing to the local requirements to be met, there are some novel features. According to the original scheme, two trains had to be run each hour in each direction at a speed of up to 80 kilometers, comprising a maximum capacity of four cars and 250 seats. A special difficulty was that the direct current at 550 volts tension derived from the municipal mains had to be used inside both the cities of Cologne and Bonn.

To meet the situation the scheme suggested by the Siemens-Schuckert Works provided a direct-current supply at 990 volts from a power station to be erected at Wesseling (midway between the two termini). This plan was eventually accepted.

The main track was divided into three feeding sections, as follows:

Section 1. Marienburg-Suerth.—Current to be supplied at Suerth by a feeder from the power station and a storage battery of 330 ampere-hours to be installed at Suerth. In order to make up for the drop in potential in the feeders, a motor-generator yielding an additional voltage up to 150 volts was connected with the feeder at the power station.

Section 2. Suerth-Hersel.—To be fed immediately from the Wesseling power house, also supplied with storage battery.

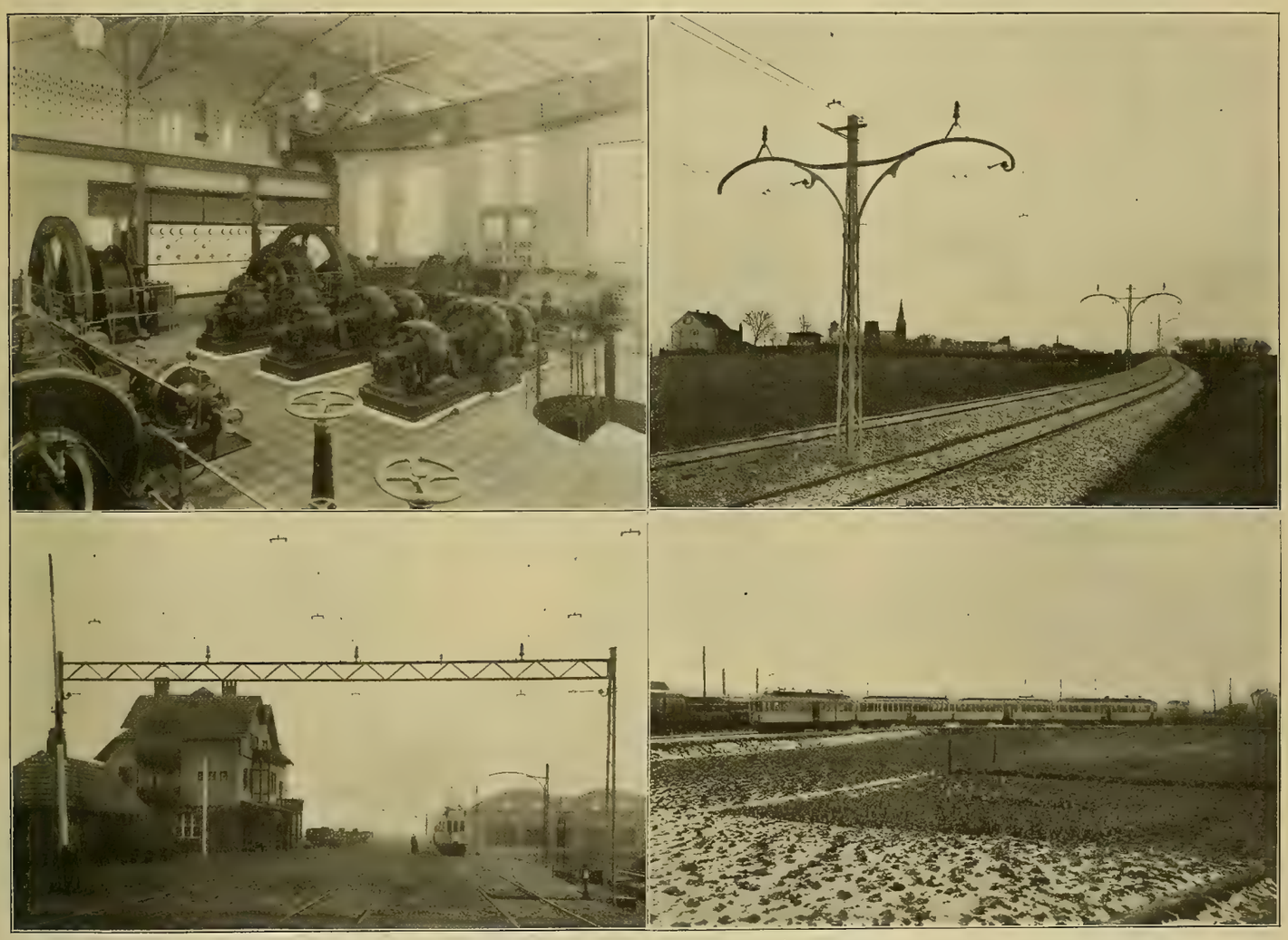
Section 3. Hersel-Bonn.—To be supplied at Hersel in the same way as Section 1, with feeder and motor-generator.

The power station was given sufficient dimensions to enable either of the two engine-generators of 330 kilowatts normal output simultaneously to supply four trains of four cars each, or else provide for any other equivalent load on the track outside of the two cities with an average train speed of 60 to 70 kilometers per hour. Two sets of motor-generators (one to serve as a reserve) have also been installed for the feeders, in addition to a Pirani set intended to insure a more satisfactory co-operation of the storage batteries inserted in parallel with the generators. The dynamo of this set further serves to charge the storage battery. A small battery charged by one of the motor-generators serves for lighting purposes.

Steam is generated by three horizontal Cornwall boilers (with corrugated heating tubes), each of which has a heating surface of 85 square meters, and 35 square meters superheating surface (300° C.), raw brown coal serving as fuel. The track for transporting the latter is placed at a considerable height. The brown coal, arriving in self-discharging trucks, falls immediately in front of the boilers for the most part, while the remainder drops into a bunker, whence it is conveyed to the furnaces by an elevator and conveying belt. The elevator at the same time serves to lift and to load the ashes. The remainder of the power station has been equipped according to the most recent practice.

The sub-station batteries located in special buildings both at Suerth and Hersel, have an output of 330 amperes each in the case of a one-hour discharge. They are connected in parallel to the line and are automatically recharged by the motor-generator in the intervals between the passage of the trains. The switchboards are located at the station and are operated by the station officials. After the conclusion of operation the batteries are every evening fully charged from the feeder by inserting the two machines of a motor-generator set in series, while conveniently reducing the current intensity.

On the overhead-trolley line two wires of 80 square millimeters section are provided for each track. With a view to the high speeds, an adjustable suspension was adopted for the trolley



Interior of Power Plant at Wesseling.
Overhead Construction at a Station.

View Showing Overhead and Track Construction.
A Train of Four Cars.

THE RHINE RIVER ELECTRIC RAILWAY.

line, the two wires of the same track (one above the other) being connected together by rigid pieces, and both upheld by a supporting wire. This supporting wire or cable is insulated at distances of 50 meters and supported by box girder posts with brackets. This construction practically avoids the risks of a breakage of the overhead wires.

At the junctures of the main line with the city tracks insulators have been fitted into the overhead wire to avoid the passage of the 990-volt current into the city systems. The rails are bonded at each joint by two copper strips, each 75 square millimeters in cross-section, and are used as a return. They are, moreover, cross-bonded at distances of 100 meters. The rails are laid on wooden ties in a gravel roadbed.

The stations are lighted from the overhead wires. The electrical equipment of each motor car comprises two motors of a normal output each of 130 horsepower, at 990 volts, corresponding to an aggregate effective output of 260 horsepower per car, which may, however, be increased considerably both in starting and on grades. Each motor car is able to haul a trailer at a speed of about 70 kilometers, while any larger train units may be formed by using a greater number of motor cars, one trailer being allowed for each of them.

All the motor cars belonging to the same train are operated from the front driver's stand by means of multiple-unit control, the two motors of each car being arranged on the well-known series-parallel system.

A special low-tension battery has been provided to operate the motor-driven tram-line switches, this battery, like all the main apparatus, being situated below the car. A main air tank, fed by means of an electrically operated pump motor, is arranged below the motor car to operate the Westinghouse brake and compressed-air whistle.

The current is collected by means of two bows in each motor car. The cars are lighted and heated by electricity.

It may be said that all low-tension conductors serving for the telephones, block apparatus, alarms, etc., are laid in cables, in order to avoid any disturbance of the railway current and any difficulty in superintendence.

The freight traffic is, in the beginning, to be carried on by means of steam locomotives.

A Method of Preventing Sparking in Repulsion Motors.

Alternating-current commutator motors have not come into as general use as the other types of motors with which alternating current is used, because of several difficulties which render the type less adaptable to working conditions. One of the most important faults has been the sparking, which occurs to such a degree as to be destructive to the commutator.

An invention which has for its aim the reduction of this trouble has been patented recently by

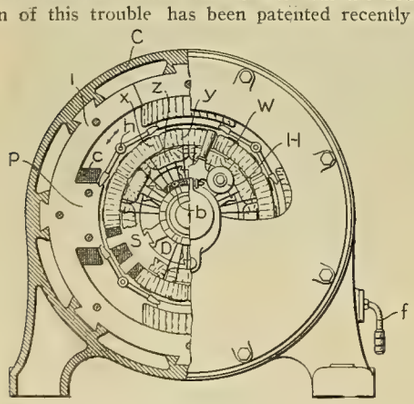


FIG. 1. SIDE ELEVATION OF REPULSION MOTOR DESIGNED TO PREVENT SPARKING.

Charles A. Ablett of Schenectady, and assigned to the General Electric Company.

The result desired is accomplished, it is claimed, by the reduction of the self-induction of each coil of the secondary winding, accompanied by a reduction of the magnetic flux to a minimum through the coil at the time at which the circuit of the coil is broken at the commutator.

To accomplish this result the core of the primary circuit is constructed with its polar projections of such width and pitch that by proportioning the width of the secondary coils a position is found in which the self-induction of the coil and the magnetic flux through it are so small that the circuit may be broken without any serious sparking at the break.

In the case of the repulsion motor the result is accomplished by making the coils of the secondary of a width not greater than the distance between the polar projections of the primary. The circuit of each secondary coil is then broken at the commutator, when the secondary coil is in the position in which it incloses the fewest magnetic lines.

It was found by the inventor also that it would be of advantage to alter the self-induction of the secondary when it is in a certain position after the motor has started.

Therefore the motor is so constructed that the self-induction of the secondary circuits can be changed as conditions require. This change is accomplished by changing the reluctance of the magnetic circuit of the secondary winding.

The methods used by the inventor in procuring the results claimed can be better understood by referring to the accompanying drawings: Fig. 1 is a side elevation, partly in section, of a repulsion motor embodying the invention. Fig. 2 is an end elevation of the motor with parts broken away, and shown partly in section. Fig. 3 is an end view, partly in section, showing the means of changing the self-induction of the secondary circuits, and Fig. 4 is a development of the secondary member of the motor, the location of the polar projections of the primary being indicated by dotted lines and the position of certain portions of the induction-changing device in relation to the primary polar projections also being shown.

The frame of the machine, usually of cast iron, has dovetailed slots for receiving appropriate projections from the laminations (l), which constitute the primary core. The primary coils (c) are slid into the projections and held in position by the flux screens (h), which are of a construction similar to the ordinary anti-hunting devices. These screens extend between the polar projections and

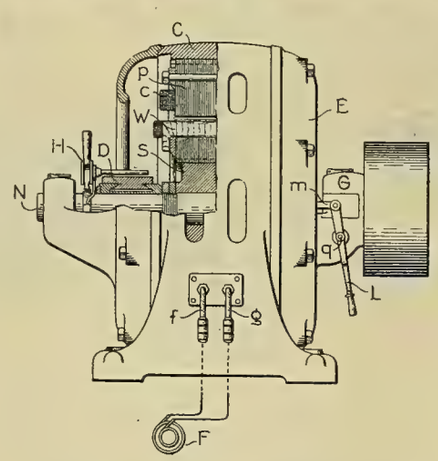


FIG. 2. END VIEW OF REPULSION MOTOR.

are secured in place by engagement with the notches in the projections, as shown in Fig. 1.

This construction of the primary is not new and may be varied. The coils (c) are connected in any suitable way to produce north and south poles alternately about the frame. Upon the secondary (S), which is made in any known and suitable manner, is placed the secondary winding (W), which comprises individual coils, as (x), (y) and (z)—that is, each coil is adapted to be short-circuited upon itself without other coils in series with it. Each of the coils is of approximately the same width as a polar projection (p), and it will be noted that the width of the polar projection is less than one-half of the polar pitch. At certain times, therefore, the coils will lie between the polar projections and will be entirely removed from beneath them. In this position these coils are removed from inductive relation to the primary, and their magnetic circuits are practically broken, thereby reducing the magnetic flux through them and also their self-induction to a minimum. The flux screens (h) assist the action by choking back any leakage flux which might tend to flow between the poles.

The width of each secondary coil is not greater than the distance between the polar projections, and if its width is somewhat less than that distance the action will be improved, because the current in the secondary coil will have an opportunity to die down after the coil has passed out of inductive relation to the primary circuit. The coils are wound in two-phase relation—that is to say, in two sets—one of which is displaced 90 degrees from the other, the sides of adjacent coils of one set being placed in the same slot. Any other suitable arrangement of coils might be used, however. From the terminals of each of the secondary coils leads are brought out and connected to segments of the commutator (D). Bearing upon the commutator (D) are brushes (b), which are so proportioned and placed as to short-circuit each of the secondary coils when it is in operative relation to the primary and to open the circuit of the coil when it lies between the polar projections. In this case the brushes are of sufficient width to cover two commutator segments. When the width of each coil is less than the distance between projections, the operation is improved if the brushes are so set that the circuits of the coils will be broken after the coils have remained between the projections for a short interval, thus giving the current a chance to die down before the circuit is broken, and they are so shown in the drawings. Although not shown in the drawings, there should be a brush for each polar projection. (H) is a rocker-arm of any suitable type, the supporting means for the brush shown being omitted.

The relative positions of the parts as the various

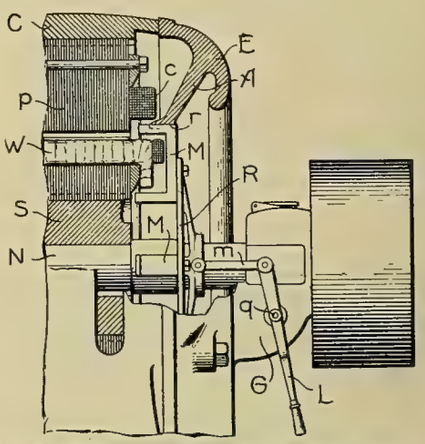


FIG. 3. END VIEW OF REPULSION MOTOR, PARTLY IN SECTION.

secondary coils move into and out of action and their circuits are made and broken may be understood by reference to the coils (x), (y) and (z) in Figs. 1 and 4, the direction of rotation being as indicated by the arrows. The coil (y) lies directly under a polar projection and has not yet been short-circuited, for, as is well known, the axis of the coil should be at an angle to the polar line when its circuit is completed. The axis of the coil (z) lies at an angle with the polar line. The coil is short-circuited and is in inductive relation to the primary, being still under the polar projection. It is, therefore, in operative condition. The coil (x) has just passed out of inductive relation to the primary, but its circuit is still closed and remains so for a short interval after the coil has come between the projections in order to allow the current to die down before the circuit is broken. A small further movement of the secondary member (S) opens the circuit of coil (x) and closes the circuit of coil (y), the axis of the latter then being at an angle to the polar line, and the circuit of the coil (z) remains closed. Continued movement of the secondary member causes succeeding secondary coils to be brought into and out of action in a similar manner. Similar operations take place at each of the polar projections.

The device for varying the self-induction of the secondary circuits is best shown in Fig. 3. The secondary coils are wound so as to extend beyond the primary, as shown. The end plate (E) of the machine frame has at each polar projection an arm (A), having a slot (r), in which is adapted to slide a guide piece secured to the U-shaped mass (M) of magnetic material, the masses (M) being adapted to embrace the extended portions of the secondary coils. Sleeved upon the shaft (N) is a ring (R), (which for best results should be of non-magnetic material), to which are rigidly secured the various masses (M). Ring (R) is slidable upon shaft (N) through such distance as is necessary to cause the masses (M) to approach and recede from the secondary coils sufficiently to produce the desired change in self-induction of the coils, such movement of the ring being brought about by means of links, as (m), located on each side of the shaft (N), the links being pivoted to ring (R) and also to the arms of an actuating lever (L), which is pivoted at (q) in the pulley bearing (G). Movement of the handle of the lever (L) toward and away from the frame of the machine will cause the movements of the masses (M), as described. Care is taken to so mount the masses (M) that no considerable amount of the primary flux will pass through them. This is done by making the air gaps between the masses and the primary and secondary cores considerably greater at all times than the air gap between the primary and secondary members. The proportions of the masses (M) are such as to produce the desired induction.

By referring to Fig. 4 the winding of the secondary member will be more plainly seen and also the relative positions of the brushes and the polar projections. The relative location of the masses (M) is also shown in this figure. It will be noted that these masses are located in line with the polar projections, for while it is desired that the coils of the secondary winding shall be under the influence of these masses when the motor is running, yet this is only true when the coils lie under the polar projections—that is, when they are in inductive relation to the primary. It is not desirable at any time that coils lying between the poles should have self-induction, and in the construction

shown, coils in this position are not affected. The direction of rotation of the secondary member is indicated in this figure by the arrow.

The motor shown may be considered as constructed to give the appropriate conditions for either the starting or running operation, since it

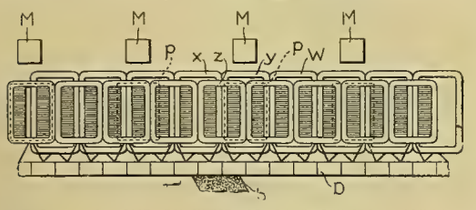


FIG. 4. SECONDARY WINDING OF REPULSION MOTOR DESIGNED TO PREVENT SPARKING.

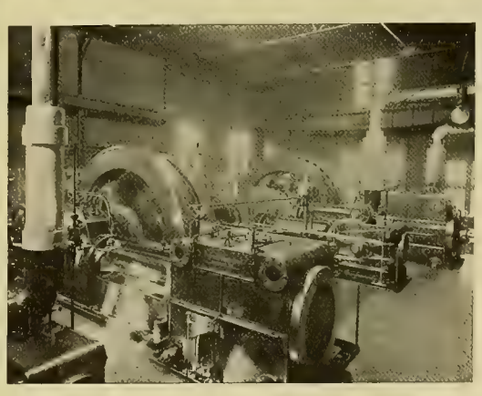
is a matter of proportioning the parts to produce the proper self-induction in the secondary coils for the given case, as will be readily done by one skilled in the art. In the preceding description the motor was assumed to be constructed to meet starting conditions and a device was described for increasing the self-induction of the secondary coils to that value required to meet the running condition. The motor might, however, have been considered as constructed to meet the requirements of running, in which case a device would be employed to decrease the self-induction of the secondary coils to that value required to meet the starting condition. The device as already illustrated and described is suitable for the latter purpose without any structural change other than forming the masses (M) of solid conducting material instead of laminated magnetic material.

Electric Drive in a Chicago Packing House.

There is no better example of the versatility of electric drive for industrial purposes than that afforded in the modern packing house. The comprehensiveness of this industry, including, as it does, a series of establishments for the manufacture of a wide variety of products, makes the application of electric drive very apt. Probably there is no industry in which there is less actual waste or more diversity of products. The Texan steer and his companions, the hog and sheep, hold about the same relation to life in the temperate zone as does the reindeer in the North. The Laplander obtains food, drink, shelter, clothing and transportation from the reindeer, while a glance at a list of the products manufactured from beeves, hogs and sheep shows that the inhabitants of the warmer climates are similarly indebted. Aside from food, clothing, leather goods, soaps and lubricants, this list includes all sorts of products, ranging from billiard balls to fertilizers. Of course, not all these products are made within the confines of a single establishment, but there is such a diversity, and the buildings are so widely separated, that the flexible electric system is particularly applicable.

This more or less isolated arrangement of different classes of machinery, from hog-skinning to box-making tools, emphasizes the inherent flexibility, cleanliness and economy of the electric drive.

Coal Conveyor.



Engine Room of Power House.

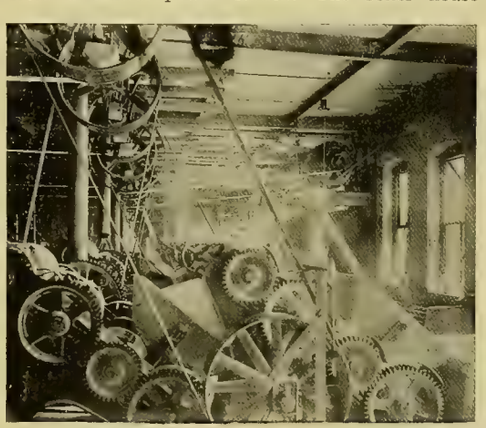
ELECTRIC DRIVE IN A CHICAGO PACKING HOUSE.

The power house is placed in the most economical location and the power generated is transmitted to the various shops and machines without the use of long lines of wasteful shafting. The transmission lines running from the central-station switchboard may be so arranged that not only the exact amount of power used in each department may be measured, but the various shops may be run independently. In this way a certain department may work overtime without necessitating the generation of considerable power, usually wasted in running idle shafting at such times.

At the receiving end of the transmission line the advantages of an alternating-current induction-motor drive are very marked. Ease of control, safety and reduced maintenance charges are the most apparent gains. Machines are of various sizes, and each has peculiar needs for power. Many products of the packing house are highly inflammable, and the detached power house, as well as the use of a sparkless induction motor, materially reduce the fire hazard. In some portions of the establishment particularly hard operating conditions are encountered. Take, for example, the hog-killing room. Here the steam-saturated air is a particularly severe test for machinery, and the induction motor is the only type capable of handling this class of work continuously.

The plant of Swift & Co. in Chicago affords an excellent example of the application of the motor drive. This plant covers a floor space of 87¾ acres. The different branches of the industry are conducted on the most approved modern lines for the quickest and best conversion of live animals to finished food products, as well as the various by-products, of which mention has been made. Every hour of the working day 250 head of cattle, 700 hogs and 625 sheep are slaughtered. The refrigerating plant has a daily capacity equivalent to 2,500 tons of ice.

The packing establishment is operated electrically from a central power station. The boiler house



INDUCTION MOTORS DRIVING SOAP MACHINES.

contains 6,400 horsepower in Babcock & Wilcox boilers, delivering steam at 150 pounds pressure to the engines, and equipped with Murphy stokers and the necessary coal and ash-handling machinery. Draft for the boilers is obtained by a 265-foot stack.

In the engine room there are installed three General Electric three-phase revolving-field 240-volt 60-cycle generators, direct connected to Filer & Stowell cross-compound Corliss engines, all operating at 120 revolutions per minute. The generators comprise one 300-kilowatt, one 600-kilowatt and one 1,200-kilowatt machine, respectively.

From this central generating station the power is led to the various departments, both for motor application and lighting. In all about 3,600 horsepower in induction motors of the General Electric squirrel-cage armature type are installed. The motors range in size from one to 140 horsepower, the average horsepower per motor being 14.37. Many of the motors are in odd and unusual places, some in coolers at zero temperature, others in dry, dusty rooms at a temperature of over 125 degrees; and many novel and special constructions have necessarily been developed in connection with the motor installation and wiring system. A few synchronous motors are used, which tend to help the power factor. One of these is a 100-kilowatt General Electric machine driving pumps.

HOUSE PUMP DRIVEN BY INDUCTION MOTOR

The lighting system is made up of both arc and incandescent lamps; about 12,000 230-volt incandescent lamps and a large number of series alternating-current arc lamps are employed for illumination.

It is interesting to note that the packing establishment was originally operated by several separate plants, with direct-current generators for furnishing light and power. After careful investigation, the alternating-current system with a central power house was installed and the direct-current system abandoned. Actual experience with both systems was afforded by a previous installation of a smaller multiphase plant in one of Swift & Co.'s other packing houses. The installation as a whole brings out forcibly the peculiar advantages of the alternating-current motor to this class of service.

Dynamo Driving by Windmills.

Writing to the London Times Engineering Supplement in relation to the generation of electricity by windmill power, Mr. W. O. Horsnaill of Ipswich, England, says: "It may interest your readers to know that at least one successful installation of this nature has been running in Yorkshire for the last seven years. An earlier plant was put down some 11 years ago, but was not altogether successful, owing to defective design. The following rules give an approximate idea of how such a plant should be laid out to give good results in a fairly exposed position: (1) Ascertain the mean daily load in ampere-hours in December when the evenings are longest. (2) Provide a battery of at least double this output. (3) Install a dynamo which will charge the above battery in 12 hours. (4) Design the dynamo to give an approximately constant voltage over a considerable range of speed. (5) Erect a windmill of sufficient power to run the dynamo at full load with a 10-mile-an-hour wind. (6) Fit the windmill and gear to the dynamo with ball and roller bearings throughout, so as to eliminate friction as far as possible. If a plant be laid out on these lines the cost of power, including ample allowance for capital charges, depreciation, attendance, repairs, stores, etc., will be less than if it were produced by an oil engine, and the windmill is less liable to breakdowns, as it is a slow-running and robust piece of mechanism. Another point in favor of wind power, although it has not yet been tried, is the possibility of making the plant entirely automatic, as is done for train lighting, in which case it could be locked up for weeks together without risk of injury. There is no doubt that recent improvements in variable-speed dynamos and high-efficiency lamps will give an impetus to the use of wind power for the generation of electric current in districts where no source of public supply is within reach."

National Academy of Sciences.

The National Academy of Sciences held its annual meeting in Boston last week. Among the papers presented was one on the aerodrome, by Prof. Alexander Graham Bell, who is of the opinion that Langley solved the problem of air navigation with his flying machine. The paper was partially historical and there was a description of Professor Bell's own investigations at his Nova Scotia laboratory, where he used a kite built up of units of four-sided pyramids. This tetrahedral unit is light and has great sustaining power. While Professor Bell has not made it fly, he has demonstrated that such kites have stability in low velocities of wind—velocities which he thinks are not too taxing for the propulsive power of an engine which the kite can lift.

Dr. George W. Pierce of Harvard University demonstrated the measuring of the wave length in radio-telegraphy—measurements of series of wave lengths were made almost instantly with an accuracy of within one per cent.

Vapor-tube Starting Device.

One of the difficulties encountered by the men who are working to perfect mercury-vapor lamps and tubes has been to devise means for starting them, which is somewhat difficult on account of the high negative electrode resistance. Various

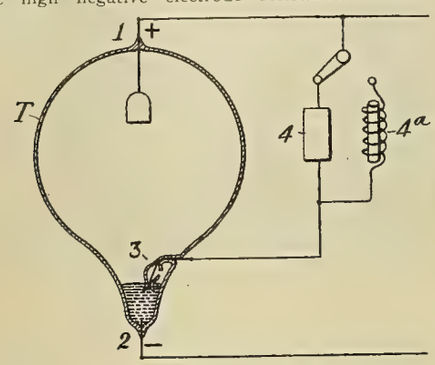


Fig. 1.

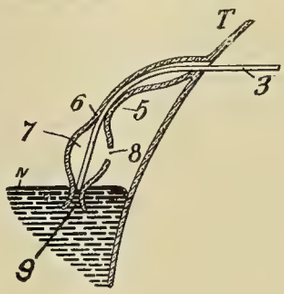


Fig. 2.

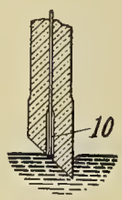


Fig. 3.

VAPOR-TUBE STARTING DEVICE.

means have been used to accomplish the breaking down of this resistance, such as the utilization of a high-potential discharge from an induction coil or other suitable source or by arranging the terminals of the circuit so that they are directly connected together through the mercury in the tube and causing this connection to be interrupted by moving the tube or one of the terminals.

A patent has been recently issued to Theodore Bodde of New York city and assigned to Louis B. Marks, in which the inventor asserts that he accomplishes the starting of vapor tubes with the normal potential used in running them and without resort to moving parts.

Mr. Bodde describes a device in which the positive and negative terminals are primarily in electrical contact so that the current flows through the lamp by conduction, the automatic effect of this current being to render the contact between the electrodes defective and to break down the negative electrode resistance by reason of the vaporization of the mercury electrode.

In Fig. 1 (T) is a vapor tube of any suitable construction; (1) and (2) are the positive and negative terminals, respectively; (3) is an auxiliary positive terminal normally in contact with the negative terminal, and (4) is a suitable device such as a resistance or reactance for controlling the flow of current through the circuit of the auxiliary terminal (3).

In Fig. 2, (6) is the wall of the tube, into which is sealed a platinum wire enclosed in glass, as indicated at (5). The wire is sealed into the glass for a sufficient length to insure the preservation of the high vacuum of the tube. Below the seal the tube is enlarged, as at (7), forming a chamber surrounding the wire and opening by a passage (8) into the space above the negative mercury terminal, indicated at (N). The lower portion of the tube (5) is contracted to form a passage of such cross-section as will give a low current-carrying capacity as compared to that of the platinum wire. The platinum wire (3) extends down to and is just in contact with the surface of the mercury, as indicated. A flow of current of suitable volume through the wire (3) will start at the point of contact with the mercury terminal a center of ebullition, from which mercury vapor will be given off and the requisite separation of the terminals necessary for starting effected, the vaporized mercury passing out into the main receptacle through the opening (8) and being replaced by the flow of mercury through the contracted passage (9). There is thus established a suitable condition of mercury vapor within the tube, and the center of ebullition constitutes a break in the electrode resistance, so that the application of the normal potential to the main terminals (1) and (2) is sufficient to start the tube in operation.

Fig. 3 shows a different construction in that the auxiliary terminal is sealed into the inclosure throughout nearly its entire length, having a capillary space (10), near the end, in which a vapor tension may exist but in which the electrode material will not rise. The end is ground away flush with the end of the auxiliary terminal so that contact is established with the extreme end of the terminal only, and owing to the shape of the inclosure the vapor escapes freely.

Oscillating-current Lamp.

A rather interesting invention is covered by a patent recently granted to James E. Seeley of Los Angeles for what he styles an oscillating-current lamp, designed to provide means for producing violet light, evidently intended for medical or surgical use. The construction of the lamp is unusual, as will be seen by the following description and drawings.

Fig. 1 is a vertical longitudinal section of the lamp. Fig. 2 is a transverse section on line x^2 x^2 in Fig. 1. Fig. 3 is a transverse section on line x^3 x^3, Fig. 1. Fig. 4 is a diagram of the circuit connections.

The lamp comprises a primary or exciting coil (1), a secondary coil (2), and electrodes (3), connected to the coils. The coils are arranged in concentric relation, the primary coil being preferably on the outside and forming the side wall or peripheral casing of the lamp. A back member

Fig. 1.

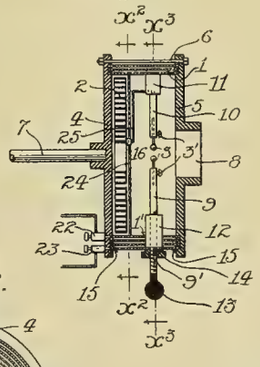


Fig. 2.

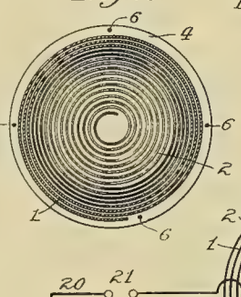


Fig. 3.

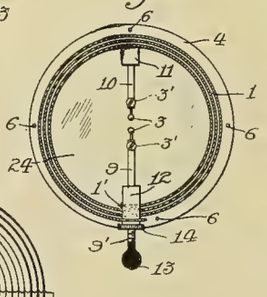
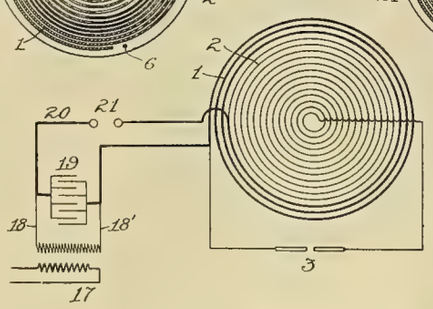


Fig. 4.



OSCILLATING-CURRENT LAMP.

or disk and a front member or disk are arranged at back and front of the lamp and engage the primary coil, which is held in engagement therewith by any suitable means. The back member may be provided with any suitable supporting means, here indicated as a rod (7), and the front member may have a central opening (8) for insertion or attachment of any suitable applicator used in surgical operations or generally for the passage of the rays from the electrodes. The electrodes may be removably supported in their supporting-standards, these standards extending inwardly from the peripheral wall of the lamp—that is to say, from the primary coil—the upper standard being insulated from the wall by an insulating block (11) and the lower standard, connected to the outer portion of the primary coil, being provided with a screw-threaded arrangement, secured to the outer turn of the primary coil. The standard (9') has an insulating knob (13), by which the space between the electrodes may be manipulated.

The primary coil consists of a few turns of comparatively heavy ribbon or strip metal wound in spiral form and engaging in grooves in the front and back plates.

Secondary coil (2) consists of a much larger number of turns of smaller ribbon, also wound in spiral form to form a flat or disk coil, which fits within the coil (1) and rests against or close to the back member (4), this ribbon being narrower than that of the primary coil, so as to leave a space or chamber (16) within the primary coil and in front of the secondary coil. This secondary winding is insulated between the turns on both front and back faces by suitable insulation, such as built-up mica. The electrodes are located adjacent to one another directly in the rear of the opening of the front plate of the lamp, so that the rays issuing from the discharge between the electrodes will pass directly through the opening. The lower electrode (3) is connected directly to outer end of coil (1). The upper electrode (3) is connected by wire (25) to the inner end of coil (2).

The lamp is particularly intended for use with circuits giving a condenser-discharge—that is to say, a discharge of moderately high potential and extremely high frequency. Such a circuit is shown in Fig. 4, where (17) indicates an alternating-current-supply circuit, including the primary of a step-up transformer, whose secondary is connected by circuit-wires (18 18') to a condenser (19), to which is also connected a discharge circuit (20), including a spark-gap means (21) and the primary coil (1) of the lamp. The alternations in the supply circuit operate through the transformer periodically to charge the condenser, which discharges through the circuit including the spark-gap and primary coil (1), this circuit being of low impedance, so that the oscillations developed therein will be of high frequency and of large quantity.

Mr. Seeley has found that with such high-frequency oscillations the violet rays are developed in large amount without the use of extremely high potential of oscillating current, and the lamp is thereby rendered comparatively economical and safe in operation. The location of the primary coil on the outside and the connection of the outer end of the secondary to the inner end of the primary also conduce to the safety of the lamp, the exposed parts not presenting potentials that would be dangerous to the operator.

The electrodes are of iron in case violet rays are to be produced; but the material of the electrodes may be varied according to the character of the discharge or light desired.

A New Lightning Arrester.

A lightning arrester which seems to show some novelty has been patented in France by the Société des Applications Industrielles. The new principle which is embodied in the patent lies in the use of a combination of two different varieties of lightning arrester in the same apparatus, these being the non-arcing metal cylinder arrester and the upward-blowing arrester with curved or slanting electrodes, which lengthen out the arc. At present the company devises two different forms of the combination arrester, both being a modification of the same principle, however.

Fig. 1 shows the larger type of apparatus, which is intended to be used for pole-line work, with especial reference to mounting on transformer posts or in main station buildings. It is simple and

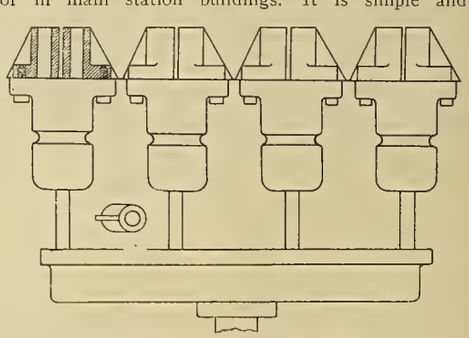


FIG. 1. NEW LIGHTNING ARRESTER.—LARGE-SIZE TYPE.

strong and is not likely to get out of order. Mounted upon a porcelain insulator, which serves as a base, are two castings of non-arcing metal having a cylindrical portion forming the main body. Two identical pieces of this kind are set up, so

that the two cylinders lie facing each other and have a well-adjusted air space between them. The sets of cylinders thus act to suppress the arc due to a lightning discharge in the usual way by the non-arcing principle, combined with the cooling effect of the metal. The cylindrical part is made hollow to save metal and to increase the cooling surface.

Each cylinder carries likewise a web-shaped projection which runs from the base to the top. Two such webs are set opposite each other, so as to form a lightning arrester of the well-known V-form, in which the arc is forced toward the top and blown out. In the diagram are seen four such elements, each mounted on a porcelain insulator, and the whole thus forms a combination arrester, utilizing both of the above-mentioned principles. A rod goes from each insulator to a common base plate of cast-iron, and the latter is supported in the middle upon a single large insulator. Fig. 2 shows the smaller form, which is designed to be mounted on a switchboard panel or other flat surface. For greater convenience in mounting, the design is somewhat changed from the above, and in this case the non-arcing cylinder is made in a separate piece, having fixed to it a projection made of a stout wire, so as to act on the blow-out principle. A base plate, preferably of porcelain, has a set of projections which take the cylinders, these being bolted down, and at the same time holding the wire projections in place. However, the cylinders in the small arrester are not placed in a continuous line, but are grouped together in pairs with the proper space between each, as the plan view shows, and the V-shaped

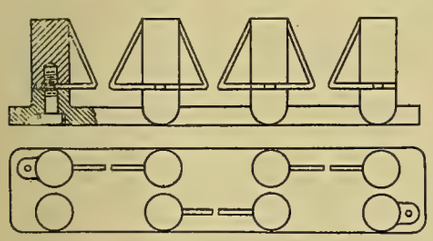


FIG. 2. NEW LIGHTING ARRESTER.—SMALL-SIZE TYPE.

portion is placed at the side. In both forms of arrester, the spaces between the two cylinders and the two webs of a single element are established once for all, and are constant at all voltages; but the number of elements is increased according to the voltage of the line.

Insurance Requirements for Motors on Trolley Circuit.

Electricians will be interested in knowing what fire underwriters look upon as a standard installation for introducing power into a building from trolley wire, and the same is given herewith:

The entire installation, including motor, resistance box, switch cut-outs, wire and electrical arrangements of all kinds, to be outside of the building, and installed in a separate fireproof structure, entirely cut off from the main building. Power can be communicated from the separate structure to the main building by means of a shaft enclosed in an iron pipe, sealed at the ends. The motor can be started, stopped or regulated from inside the main building by any convenient mechanical means which does not bring about a possibility of communicating fire from one structure to the other. The separate structure should be built of brick, tile, cement or sheet metal, and with a non-combustible roof.

The following defects are charged for according to their hazardous bearing upon the risk:

If installation is inside the building, but in a separate fireproof room or vault equipped with standard fire doors.

If inside the building, and not in fireproof room, according to location and occupancy.

For no approved knife switch at a point where wires enter building.

For no approved circuit-breaker or approved fusible cut-out.

For no approved lightning arrester attached to line outside of building.

For wires other than approved rubber covered.

For wires run on other than porcelain or glass insulators, or in contact with pipes, woodwork or other substances than their designed insulating supports.

For wires concealed, except where required for mechanical protection.

For return wire grounded in the building.

New Devices for the Electrical Production of Nitrogen.

By A. De Courcy.

The production of nitrogen or nitrous compounds by the action of the electric discharge upon the air is one which is occupying the attention of several inventors at present. What is desired is to find

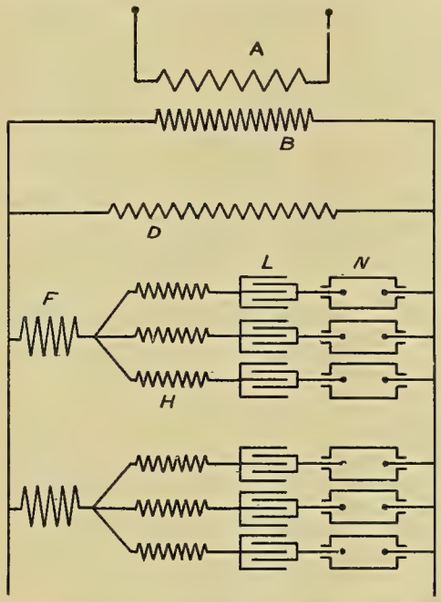


FIG. 1. APPARATUS FOR PRODUCING NITROGEN FROM THE ATMOSPHERE.

the best method of bringing the air into good contact with the discharge so that the best effect will be produced, and the apparatus will give a maximum output. This is necessary to use the electric process on a commercial scale, as is now beginning to be done in different places on the Continent. For this purpose a number of patents for improved apparatus have been taken out within a recent period. As an example of these, I may mention two different processes, which are illustrated in the diagrams.

One of the latest patents comes from a French company known as the Compagnie D'Initiative, for nitrous products. In this apparatus the gaseous mixture which is to be nitrified is brought under the influence of a high-frequency electric discharge. At (A), Fig. 1, is the primary of the main transformer, with the secondary at (B). The latter is used to supply all the different sections of nitrifying apparatus (1) (2), etc., which are connected in parallel on this circuit. Across the secondary is con-

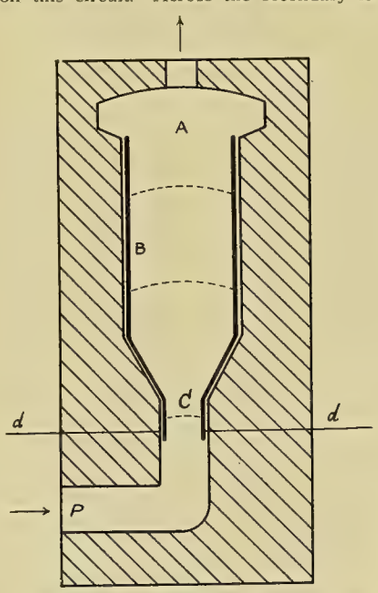


FIG. 2. APPARATUS FOR PRODUCING NITROGEN FROM THE ATMOSPHERE.

nected a choke-coil (D). Each of the sections (1) (2) has a nitrifying chamber (N), in which are placed two electrodes of suitable form to give the discharge and bring it in good contact with the gases of the chamber. One electrode is connected to the secondary wire directly, while the second is joined to the condenser (L) and a choke-coil (H). By properly regulating the choke-coil and condenser high-frequency oscillations in the circuit are obtained. But the value of the frequency should not exceed the point which is found to give the best yield in the nitrification process. The choke-coil (D) is regulated so as to make the wattless current in the machine circuit to be practically negligible, and thus give the best effect. The circuits of the nitrifying chambers (N N) are connected in groups of three or more and are joined to the other wire of the secondary through the choke-coil (F), which is more powerful than the coils (H). By its inductive resistance it prevents the oscillations of one group from interfering with those of another.

A nitrifying process which has been patented lately by A. J. Petersson is shown in Figs. 2 and 3. Here the idea is to increase the action of arcs upon a gas as much as possible by causing the arcs to move within the gas. In Fig. 2 is seen the simplest form of the apparatus. A chamber (A) of suitable kind has a lower opening (P) for the inlet of the gas and an opening in the top for the discharge. On the sides of the chamber are a set of electrodes (B) which are connected by the wires (d d) with the source of current. The electrodes (B) extend from the bottom to near the top of the chamber, and are brought near together in the narrow part of the chamber (C). When an arc occurs at (C) the expansion of the air, on the blow-out principle, will force it upward, and it is drawn out to a series of long arcs between the electrodes (B), passing up through the gas from the bottom to the top of the chamber, and thus coming well in contact with it. The arcs are blown out at (A) and new ones are formed below at (C), thus repeating the action.

In the second form of the Petersson device,

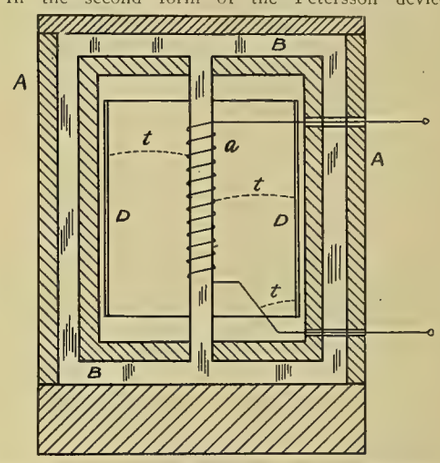


FIG. 3. APPARATUS FOR PRODUCING NITROGEN FROM THE ATMOSPHERE.

shown in Fig. 3, the same effect is given in another way. One electrode consists of a metal cylinder (D), which is contained in a closed chamber. The apparatus contains also a closed iron circuit (B B), whose central core lies within the gas chamber. Surrounding this core is the winding (A), formed of a certain number of turns of heavy bare wire. It acts as the primary of the transformer, while the cylinder (D D) serves as the secondary. When current is sent into the primary from the outside terminals, a series of arcs is formed between (A) and (D). The arcs commence in the lower part, where the primary and secondary are brought near together. Then, as before, they mount to the upper part at (t) (t) (t) until they reach the top, thus traversing all the gas contained in the chamber.

Wiring Conditions in Pueblo.

At Pueblo, Colo., an ordinance providing for the appointment of an electrical inspector has been recently adopted and is being rigidly enforced. The present standard for wiring is very good, and the few suggestions for improvements made by the Underwriters' Electrical Bureau inspector were well received. Some of the old wiring has come in for attention, and the overhauling of other equipments is under consideration. Considerable underground work is being installed, and when completed the pole lines will be removed from the more prominent business streets. The remodeling of the fire-alarm system has been stopped in the midst of the work, leaving the wires resting on the cross-arms instead of being fastened to the insulators. A heavy fall of moisture might interfere with the sending of signals from the more distant boxes. Stationary motors for elevators are being operated from the grounded trolley system.

At Ashland, Wis., the ordinance providing for municipal supervision of electric wiring is being rigidly enforced, and the standard for wiring has been greatly improved.

WESTERN ELECTRICIAN

EVERY SATURDAY.

PUBLICATION OFFICES:

507 Marquette Building, - CHICAGO.

TELEPHONE, MAIN 1746.

Eastern Office, 150 Nassau Street, New York.

Telephone, 5220 Beekman.

Trade Supplied by Western News Co.

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DATES AHEAD.

Northwestern Electrical Association (annual meeting), Coliseum, Chicago, January 16th, 17th and 18th.

Chicago Electrical Show (second annual exhibition), Coliseum, Chicago, January 14 to 26, 1907.

Central Electric Railway Association (annual meeting), Indianapolis, January 17th.

MR. HARAHAN, the new president of the Illinois Central Railroad, is reported to have said that electricity will be substituted for steam locomotives for the suburban service of his company "just as soon as the experimental stage has been passed." It may be remarked that such important railroad systems as the New York Central, Erie and Pennsylvania in the East are apparently well satisfied, if one may judge by their acts, that the experimental stage of electric railroading has been passed for suburban service and the operation of terminals in large cities. Chicago and the Illinois Central cannot afford to lag behind these examples, and we hope that Mr. Fish's successor will be far-seeing enough to realize the fact and act accordingly.

THE CO-OPERATIVE ELECTRICAL DEVELOPMENT ASSOCIATION was so successful in its prize competition, with the co-operation of the National Electric Light Association, for papers on the subject of the new-business department for the central station in cities of moderate size that it may well be supposed that its more ambitious offer in the same direction, now announced, will lead to even more useful results. In brief, the Co-operative association has decided to offer $2,600 in prizes for a handbook to be used by electrical solicitors. The details of the plan are given on another page and will, we are sure, attract wide attention. Apparently there is no restriction as to who may engage in the competition, as was the case in the first offer. The association is entitled to much credit for its enterprise and liberality, which should prove a benefit to all engaged in central-station work. We hope, and do not doubt, that there will be a widespread effort to secure these prizes, or one of them, for they are well worth winning.

WASHINGTON is not to have the immediate benefit of the electrification of all the railroads entering the new union station in that city, after all, it seems. A correspondent in the capital, noting a recent statement to that effect in the Western Electrician, writes to say that a short time ago the commissioners of the District of Columbia sent a request to the railroads entering the city, asking if they would take this step in the near future, but this has met with a flat denial on the part of all the roads, as the claim is made by the railroads that the use of such motors is at present in an experimental stage only, and, further, that it would defeat the object so much in view at the present time, that of rapid transit between Washington and the outside world. They claim there would be much waste of time consequent on such change of motive force. This being the case, it is the intention of the commissioners, especially Commissioner MacFarland, who has the matter very much at heart, to try and bring the matter up before the present session of Congress, and see if by some means the railroads entering the city can be compelled by law to do what they have already refused to do voluntarily. It is to be hoped that Congress will meet the appeal of the commissioners in a sympathetic spirit.

AS THE HOLIDAY SEASON approaches, retail merchants, window dressers and others having to do with show-window displays in which artificial illumination forms a feature should exercise particular vigilance to prevent the danger of fire. Often cotton or other highly inflammable material is used to represent winter scenes or other decorations of like character, and particular pains should be taken to forestall the danger of a fire starting in this flimsy material. It is well to remember that considerable heat is radiated by an ordinary incandescent lamp, and in time it is possible that combustion may be caused from this source if the lamp and the cotton or other light materiai are in close proximity. A case is reported of a recent fire in Savannah, Ga., where a window dresser left a 32-candlepower lamp with no lamp guard in contact with a wax figure covered with light drapery. While fires of this character are usually extinguished with no great loss, yet they may be the cause of a serious conflagration. The requirements of the National Electrical Code are strict in this particular, and it is said that insurance companies are considering the advisability of denying liability on claims where the insured has not observed the conditions of his permit allowing the use of electricity. Therefore, it is wise to be particularly careful in arranging window displays at this season of the year.

ELECTRIC TRACTION as a substitute for steam locomotives on railroads presents an important problem in Switzerland, where waterpower is available. The Federal Council of that country appointed a special commission made up of railroad and electrical engineers, which was called upon to examine the subject from all points of view and to present a report. This report has an especial value, because it is the economic question which is to decide the matter in Switzerland. In the case of many railroad lines which have been "electrified" up to the present time, the adoption of electricity was indicated by some particular technical, hygienic or esthetic requirement, such as the need of greater acceleration in starting the trains, obtaining higher speeds, mounting heavy grades, the prevention of smoke and cinders, or the like. But in the case of Switzerland, on the contrary, it was simply a question whether electric power would prove more economical.

Professor Wyssling, who was the secretary of the commission, reported that the main point to be considered was the amount of power which could be obtained for the purpose in Switzerland. He estimated that the total amount of electrical energy needed by the Swiss railroads would be 1,200,000 horsepower-hours. Calculating an efficiency of 40 per cent. from the wattrwheels to the electric locomotives, he estimated that about 3,000,000 horsepower-hours must be provided in the hydraulic plants. This is 125,000 horsepower during a day of 24 hours. No doubt this amount of power can be secured, but it may be necessary to transmit it for some distance, and it is advisable to determine if a smaller amount will not suffice. One way to do this is to devise a method of utilizing the power lost on down grades, which are numerous in a mountainous country like Switzerland. Professor Wyssling recommends further study of this question.

AT NOT INFREQUENT intervals the daily papers print a story of a marvelous invention by which some gifted inventor has devised a scheme for gathering electricity from the atmosphere or from the earth at practically no cost. But unfortunately these schemes never work out in practice, and after the first flourish of trumpets nothing more is heard of them. This will probably prove to be the case with the alleged invention of one Leclerc, an uneducated French-Canadian, 22 years of age and a plumber by trade. He is reported to have made a unique discovery in the generation of electricity which will reduce the cost of house lighting and heating to a mere trifle.

Mr. Leclerc, it seems, became convinced that electric current can be produced directly from the earth, by which simple process the costly steam or hydraulic plants now installed for the purpose of power generation might be entirely dispensed with. As might be expected, the available account is rather vague in explaining how the inventor worked out the details of his theory so that he could transmute his dreams into a reality, but nevertheless it is declared that he has been fully successful and that "With the aid of a machine of his invention which may be placed in an ornamental box or case, taking up very little space, sufficient electric current can be generated to light and heat any building from the ground directly underneath and at an annual cost so small as to seem almost absurd."

Not only is the cost absurd, but we greatly fear that the same adjective may be applied to the whole story. Electricity is used in the service of man merely as an agent to transmit power, and there is always some loss, perhaps slight, in that transmission. Artificially produced, it requires more power to make it than can be obtained in its utilization, and those who overlook this fact are foolishly following the example of the historic individual who tried to lift himself by his bootstraps.

Electrical and Other Manufactures in the United States in 1905.

Washington, D. C., December 1.—The results of the last census of manufacture for the entire United States shows that there has been an increase in establishments from 207,562 in 1900 to 216,262 in 1905, in each of which the value of production was in excess of $500. The total invested capital has increased from $8,978,825,200 to $12,686,265,673. The number of salaried employes has increased from 364,202, receiving $380,829,091, in 1900 to 519,751, receiving $574,761,231, in 1905. The total average number of wage-earners reported in the census of 1900 was 4,715,023, and in that of 1905 5,470,321, while their wages increased from $2,009,735,799 to $2,611,540,532, an increase of 16 and 29.9 per cent., respectively. The cost of materials used showed an increase from $6,577,614,074 to $8,503,949,476, or 29.3 per cent. The total value of the products reported in 1900 was $11,411,121,122; in 1905 it was $14,802,147,087, an increase of 29.7 per cent. Of all these establishments there are 24,180 for which the value of products is $100,000 or over, only 11.2 per cent. of the total, yet they control 81.5 per cent. of the total capital invested, give employment to 71.6 per cent. of the total number of wage-earners, and manufacture 79.3 per cent. of the total value of the products.

New York, Pennsylvania, Illinois and Massachusetts are, in the order named, the four leading manufacturing states. They contain 86,333, or 39.9 per cent. of the establishments of the entire country, give employment to 2,488,064, or 45.5 per cent. of the average number of wage-earners, and reported $6,978,331,091, or 47.1 per cent. of the value of the products.

The states east of the Mississippi River and north of the Mason and Dixon line and the Ohio River contained 65.5 per cent. of the establishments in the United States, gave employment to 71.1 per cent. of the number of the wage-earners, and reported 73 per cent. of the total value of the products.

During the year 1905 a total of 21,692 automobiles were manufactured at a total value of $26,645,064. Of these 455 were electric runabouts, 39 electric touring cars, 45 electric surreys, one electric phaeton, 209 electric stanhopes and 66 electric victorias; in fact, all the victoria automobiles manufactured during that year were of the electric type. Fifty-three doctors' wagons or cars were electric, all the station wagons or cars, 13 in number, were electric, 109 electric delivery wagons (light), 105 electric delivery wagons (heavy), and 330 of the other varieties comprised the portion of the total number that were operated by electric power.

The returns for 1900 did not show any itemized returns for the output of concerns manufacturing street-railway cars, whereas these returns are given in full in the returns for 1905, and include 2,621 electric cars, closed, at a total value of $5,777,257, 502 combination cars at $1,240,864, 554 open cars at $860,349, and 211 other kinds of electric cars, at a total value of $394,860.

The number of street-railway cars manufactured in 1905, not only in establishments devoted wholly to such work, but also in establishments making steam-railroad cars, and in street-railway repair shops, amounted to 4,654 at a total value of $9,902,310, and of the total there were 3,217 closed electric, at $7,233,534; 517 combination, at $1,289,028; 562 open, at $867,368, and 316 other, at $479,093.

Considering now more particularly the manufactures of electrical machinery, apparatus and supplies, it is seen that, according to the census returns, there has been an increase in the total value from $105,831,865 in 1900, of which $1,397,430 was made in establishments primarily engaged in other industries, to a total of $159,551,402 in 1905, of which $18,742,033 was made in establishments doing other business. These figures, of course, refer entirely to the "electrical" classification as adopted by the Bureau of the Census.

The number of dynamos manufactured during the year 1905 was 15,080 at $11,084,234, as against only 10,527 at $10,472,576 in 1900. The total horsepower increased from 870,832 to 1,328,243. The value of the dynamotors turned out in 1900 was $379,747; by 1905 it had increased to $1,740,534; the value of transformers increased from $2,962,871 to $4,468,567, and of switchboards from $1,846,624 to $3,766,044, while of motors of all kinds there was an increase in value from $19,505,504 to $22,370,626.

The various kinds of motors comprised in these total values are: In 1900 the output of direct and alternating-current motors was 35,604 at a total value of $7,551,480, and having 515,705 horsepower; in 1905 the total number was 79,877 at $13,120,948 and a total capacity of 678,910 horsepower.

The total number of motors turned out for railways in 1900 was 15,284 at $7,568,841 and a total of 666,669 horsepower. In 1905, while the total number was reduced to 12,298 at $4,949,795, yet the capacity was 713,181 horsepower. This was also the case in the motors turned out for automobiles, the number being reduced from 3,017 at $192,030 to 1,899 at $152,685, while the capacity increased from 8,220 to 19,907 horsepower.

The number of motors for fans turned out in 1900 was 97,577 at a total value of $1,055,369 and a total capacity of 12,766 horsepower; by 1905 the number had been increased to 102,535 at $1,168,254, and a total capacity of 30,796 horsepower.

The number of motors turned out for electric elevators was not reported separately in 1900, but the total value for same was reported at $2,523,901, whereas in 1905 there were only 1,333 at a total combined value of $638,473 and a capacity of 13,398 horsepower. In addition to all these there were, in 1900, a total of other motors amounting to 7,913, valued at $613,883 and having a capacity of 11,392 horsepower, and by 1905 this had been increased to a total of 8,481, at $2,340,471 and a total capacity of 36,820 horsepower.

The value of batteries manufactured during 1900 was $3,679,045, of which $2,559,601 was for storage and $1,119,444 for primary batteries. In 1905 the total value was $4,243,893, $2,645,749 being for storage and $1,598,144 for primary batteries.

Another important item of manufacture is carbons, of which the total value reported in 1900 was $1,731,248, of which $1,263,732 was for lighting, $10,974 for furnace and $456,542 for miscellaneous purposes. By 1905 the total value had increased somewhat, being reported at $2,710,935—lighting, $1,050,971; furnace, $172,454; miscellaneous, $1,487,510.

The total number of open arc lamps manufactured in 1900 was 23,656, valued at $276,481. In 1905 the number was only 1,748, valued at $29,989. The number of closed lamps, however, showed an increase from 134,531 in 1900, at $1,551,290, to 193,409 at $1,544,433 in 1905, thus showing a reduction in the total value of arc lamps of both kinds from $1,827,771 in 1900 to $1,574,422 in 1905.

There was also a reduction in the number of searchlights reported, the returns for 1900 showing 8,283 at a value of $225,635, and for 1905 only 1,924 at $114,794.

In the manufacture of incandescent lamps the increase has been large. The returns for 1900 showed that the total value for all kinds of incandescent lamps was $3,515,118, while in 1905 it was $6,953,205. The number of 16-candlepower lamps had been increased from 21,191,131 in 1900, at a total value of $2,910,023, to 83,333,285 in 1905, at $4,608,084; those below 16 candlepower showed an increase from 2,906,817, at $308,626, to 19,779,834, at $1,132,011, while of those above 16 candlepower there was an increase from 1,222,250, at $223,534, to 9,598,439, at $568,204.

There was also a very large increase in the manufacturing of decorative and miniature lamps, which are becoming more and more general in use for decorative purposes, the returns for 1900 only showing 397,432 such lamps turned out, at a total value of $72,935. In 1905 the number was 1,584,495, at a value of $644,906.

A further proof of the favor of electricity for lighting purposes is indicated by the fact that there was an increase in the value of electric-light fixtures from $4,344,599 in 1900 to $5,305,466 in 1905.

Telephone apparatus shows an increase from $10,512,412 to $15,863,698; insulated wires and cables, from $21,292,001 to $34,519,699; electric conduits, from $1,066,163 to $2,416,245; electric clocks, from $132,149 to $373,926; fuses and lightning arresters, from $595,497 to $1,455,203; rheostats and resistances, from $1,186,878 to $1,328,752; electric measuring instruments, from $860,265 to $5,004,763, and all other products, from $15,764,875 to $26,634,963. Of this latter amount, $1,451,337 was for electric switches, signals and attachments, $678,077 for magneto ignition apparatus, and $1,036,962 for electrical therapeutic apparatus, including spark coils.

The only items in the list showing decreased values were annunciators, from $224,885 to $185,870.

A. F. T.

High-voltage Tests at Milan.

Messrs. Pirelli & Co. of Milan forward details to the Engineering Supplement of the London Times of some experiments with electrical high pressures conducted on cables made by them at the Milan Exhibition. In the garden near the pavilion had been erected an aerial two-wire line, carried by big porcelain insulators made by Messrs. Richard Ginori. These insulators are the largest actually made to supply lines of 60,000 volts, and tested up to 160,000 volts. They have four petticoats 40 centimeters high and 32 centimeters diameter. The line wires were hung 1.60 meters apart, and were constituted of copper strands of various diameters—20, 40, 80 and 100 square millimeters—in order to show the difference of the brush discharge according to the diameters of the strand. The experiment was made at night. When 50,000 volts were reached, the smallest strand of 20 square millimeters began to show brush discharges, while with the biggest, of 100 square millimeters, the brush discharge only began at 100,000 volts. The potential was then raised successively to 150,000, 200,000, 250,000 and 280,000 volts. At this potential the hiss of the line was very considerable; from the insulators, line, etc., there was a bright brush discharge. The electrostatic fields were so intense in all the neighborhood that sparks could be obtained from any insulated metallic mass, and any vacuum glass tube lit up spontaneously. At 290,000 volts an arc sprang from one of the insulators and set fire to one of the wooden supports, thus closing the experiment.

Indiana Academy of Science.

The twenty-second annual convention of the Indiana Academy of Science was held in Indianapolis on November 30th, the attendance being larger and the interest greater than that of any previous meeting. The convention was divided into sections, where technical papers were read and discussed. The principal paper presented was on the subject, "Steps in the Development of a Smokeless City," by Professor W. F. M. Goss, dean of the Engineering School of Purdue University. Professor Goss made a strong plea and pointed out methods which could be adopted without any very great engineering feats, that would in time produce a smokeless city.

Legislation, said Mr. Goss, will not abate the nuisance; its suppression must be accomplished through a full understanding of the difficulties encountered. For proper treatment, the subject should be separated into five groups: (1) Large furnace fires, such as are employed in metallurgical processes; (2) large boiler plants, by which is meant all plants in excess of 500 horsepower; (3) small boiler plants and small industrial fires; (4) domestic fires; (5) locomotive fires.

In the first group, gas producers should be used, which receive the coal and deliver highly heated gas to the furnaces. The gas producer makes smokeless the process of converting coal into heat. Automatic stokers in connection with the ordinary good practice of boiler operation will be found efficient in the second instance.

The third classification presents the most prolific smoke producers, and this class is the most difficult to deal with. The only solution is the ultimate installation of electric power. To properly supplant the fires of numerous small boilers now in service it will be required, therefore, that stations be established throughout the business portion of the city, capable of delivering electric current for power and lights, steam or hot water for heating, and a limited amount of high-pressure steam for industrial uses; these central plants to be of sufficient size to justify the use of stokers which will make them smokeless.

Domestic fires should be fed by hard coal only, or, better still, a low-price gas. A central plant should supply steam and hot water for domestic uses and heating.

The suppression of locomotive smoke can be accomplished in two ways, according to Mr. Goss' plan, both of which are expensive. Either compel locomotives operating in the smoke limits to use smokeless fuel or abolish the steam locomotive entirely and substitute electric locomotives in the smoke limits. Mr. Goss told of cities where the latter plan is in successful operation.

New officers for the Indiana Academy of Science are: President, D. M. Mottier of Bloomington; vice-president, Professor Glen Culbertson of Hanover; secretary, Lynn B. McMullen of Indianapolis; treasurer, W. A. McBeth. The academy will hold a spring meeting at some point in the state to be decided upon.

Oskaloosa and Buxton Interurban Railway Opened to the Public.

The first section of the Oskaloosa and Buxton electric railway of Oskaloosa, Iowa, has been completed and cars are running regularly between Oskaloosa and Beacon. In connection with the building of the Oskaloosa Interurban, the local street-railway system, the municipal lighting, the commercial lighting and power plant and the district heating plant have been consolidated and are held by W. H. Kalbach as trustee for the stockholders of the Oskaloosa-Buxton Interurban Electric Railway Company, the officers of which are: President, W. H. Kalbach; vice-president, W. R. Lacey; secretary and treasurer, Wesley Garner. The construction of the Interurban was done by the Engineering, Construction and Securities Company of Chicago, of which A. S. Kimberly is president, C. A. Ross vice-president and C. B. Judd engineer. The work in all departments has been under the personal supervision of Mr. Judd and C. A. Ross. This is the first alternating-current single-phase railway constructed in the state of Iowa or west of the Mississippi River. This company is the recipient of many compliments on account of the excellence of its part of the work.

The Niagara Power Question.

The hearings upon applications to the secretary of war for permission to transmit to the United States electric power developed on the Canadian side of Niagara River have been closed. Additional data will be filed and Secretary Taft has announced that he will not be able to reach a decision in regard to the applications until he can confer with Secretary Root.

The Tonopah Exploration Company has among its projects a hydro-electric power plant and a custom mill for Manhattan, Nev.

WIRELESS OR RADIO-TELEGRAPHY.

By D. McNicol, A. M., A. I. E. E.

CHAPTER II. (*Concluded.*)

Ether.

In the discussion of wave propagation, certain terminology is used, which, unless explained, is apt to impress the student with the idea that a knowledge of the theory involved is difficult to gain.

When we refer to an undulation, we refer to the result of a continuous transmission of wave motion in any given direction of a relative state of the molecules in a stated medium; that is, when the motion of each molecule is orbital. The term "phase" is used to express the condition of a molecule with respect to its displacement and the direction of its motion. Molecules are said to be in "similar phases" when moving in parallel orbital elements and in the same direction, and in "opposite phases" when moving in parallel orbital elements and in opposite direction. More generally, similar phases are those in which the anomalies of the molecules are the same, and opposite phases those in which the anomalies differ by 180 degrees. (By anomaly is meant the angular distance from an assumed right line.)

A "wave" is the particular form of aggregation assumed by the molecules between the nearest two consecutive surfaces in which similar phases simultaneously exist throughout. A "wave front" is that surface which contains molecules only in the same phase; it is generally understood to refer to the surface upon which the molecules are just beginning to move, and it is evident that the velocity of a wave front will always be that of the disturbance propagation.

A "wave length" is the interval, measured in the direction of wave propagation, between the nearest two consecutive surfaces upon which the molecules have similar phases. The "amplitude" of the undulation is the maximum displacement of the molecule from its place of rest.

Sound waves cannot travel through space which does not contain matter of very sensible density, such as air. For example, suppose we set an alarm clock to ring at a certain hour, and then suspend the clock in a glass globe from which the air has been exhausted; we would see the hands on the face of the clock approach the hour when the alarm should sound, and would see the hammer pounding away at the gong, but we would hear no sound, because of the absence of the medium through which waves of sound are propagated. The fact that we can observe the hands of the clock in motion, and behold the agitation of the hammer tapping the bell, indicates that light rays do not require the presence of air in order that they may continue their course.

The following scale shows the rate of vibration producing different phenomena:

Vibrations per second in air.	
16	Lowest audible sound.
32	Lowest musical note.
128	Man's voice (conversational).
256 to 512	Woman's voice (conversational).
2,000	Highest soprano note.
4,000	Highest musical note used.
30,000	Shrill cry of a bat.
40,000	Highest audible sound.
Vibrations per second in ether.	
100 million	Heat rays
230 million	Hertz rays
100 billion	Infra red rays
400 billion	Red, Orange, Yellow, Green, Blue, Indigo, Violet — Range of human sight.
750 billion	
2,000 billion	Actinic rays
Trillions (probably)	Roentgen's X-rays

It will be noted that Hertz waves at 230,000,000 vibrations per second are too rapid to produce heat and too slow to produce ordinary light, so we are insensible of their existence. It has been established that sound waves will travel:

1,286 meters per second in hydrogen,
317 meters per second in oxygen,
262 meters per second in carbon dioxide,
490 meters per second in coal gas,
330.6 meters per second in ordinary air.

or 1,125 feet per second in air at 62° F., and we may, in the following manner, determine the wave length and vibration rate of sound waves:

Rig up two wheels, as shown in Fig. 3, where (A) is a driving wheel bolted to a pulley on (B), which latter wheel is toothed and its axle equipped with a small speed indicator.

If these wheels are properly mounted on a frame and the larger wheel equipped with a handle, a high rate of rotation may be imparted to the smaller wheel. Then, if we fasten a small piece of tin, or stiff oil board (C), where the teeth of the small wheel can strike it, we can in a

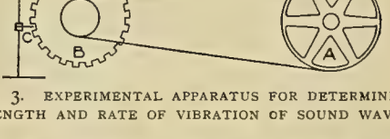

FIG. 3. EXPERIMENTAL APPARATUS FOR DETERMINING LENGTH AND RATE OF VIBRATION OF SOUND WAVE.

given time administer a known number of shocks to the card. Suppose, for instance, that there are 100 teeth in the wheel (B) and that in 10 seconds time the speed counter indicates 50 revolutions, we shall have 5,000 shocks or vibrations given to the card in that time; therefore, 5,000 divided by 10 gives us 500, which is the number of vibrations made by the card in one second, and if sound travels in air at the rate of 1,125 feet per second, we can figure that 1,125 divided by 500 equals 2¼ feet, which is, in this instance, the length of the wave produced.

In the study of ether waves it is important that the student recognize the difference between electrical or ether waves and sound or air waves. Electrical vibrations number from 50 per second, with a wave length of 6,000 kilometers, to 50,000,000 per second, and a wave length of 0.6 centimeter. The longest known heat rays show 12,000,000 vibrations per second, with a wave length of 0.024 millimeter.

As shown in the preceding scale, red light results from 400,000,000,000 vibrations per second. The chemically active ultra-violet rays and the Roentgen rays have shorter wave lengths still, and higher vibration rate. The gap which exists between the electric and heat vibrations probably includes Blondlot's recently discovered N-rays, with a wave length of about 0.2 millimeter.

CHAPTER III.

Waves and Wave Motion.—Hertz Waves.

A wave is a disturbance periodic in time and in space, and anything thus doubly periodic is a wave, whether it be a water wave on the surface of a body of water, a sound wave in air, or a light wave in the ether.

If we drop a pebble in a lake, we see tiny waves spread out in all directions away from the point where the pebble entered the water; the circle gradually increases in diameter as the waves travel farther away from the center.

Should these waves during their progress encounter chips of wood or free floating particles of any substance on the surface of the water, there would be no forward movement imparted to the floating particles by the action of the waves, which goes to show that the water itself is not traveling, but simply that the oscillatory motion imparted to the water at the place of disturbance is taken up successively by adjacent portions of the fluid. The result is that the waves continue onward until the shore is reached.

Should we interpose in the path of these water waves a barrier in the form of a coarse wire netting, the waves would not be interrupted, but would continue on their way unmolested by the transparent obstacle.

Again, should the waves in their journey encounter a post which had been firmly driven into the bottom of the lake, with its top protruding above the water, that part of the periphery of each circle of waves colliding with the post would be broken, but the broken ends would pass around the obstruction and become joined again at a point beyond.

Inasmuch as waves of all kinds have common characteristics, careful observation of the action of water waves clears the way in our minds for the intelligent consideration of wave propagation in other media, where we are unable to observe direct action, but must deal with abstruse phenomena and laboriously trace back to find the hidden cause of the observed effect.

We have seen that water waves continue to travel away from their source long after the wave-creating disturbance has come to rest, and we naturally ask, What took place at the point where the pebble entered the water to cause such persistent motion to be imparted to the surrounding fluid? In seeking an answer we shall find that the inherent elasticity of the water was called into play. The surface, being depressed at a certain point, will, as a consequence of this elasticity, call forth a rebounding action which will cause the water to rise beyond its level and against the force of gravity, which latter force will, however, soon regain the mastery and pull the crest back again; but on account of the inertia-like qualities of the fluid, it overshoots the mark and creates a second depression in the surface of the water.

This persistent rise and fall of the surface is communicated to the surrounding medium, always in a direction away from the point of disturbance. Thus we have created gravitational waves in an otherwise stationary medium. Again, we can show that compression of the mass of a fluid (the same holds true with regard to gases and solids) is capable of producing waves which in their behavior are identical with gravitational waves.

Suppose, for example, that a submarine mine placed 40 feet below the level of the ocean be exploded. We have here an instance where the disturbance is created, not on the surface of the fluid, but at a point within its mass. The explosion of the mine having caused compression of the adjacent fluid, compressional waves are formed which travel out in all directions.

In every case, however, the velocity of propagation of the wave is measured by the square root of the ratio of two quantities, one of which is elasticity of the medium, and the other density or mass per unit of volume. Or the velocity of the wave may be shown to be the product of the wave length and the number of complete oscillations per second executed by any part of the medium through which the wave motion may be traveling.

Now that we have gathered a fair idea of waves, wave motion, and of the media through which waves may be propagated, we shall turn our attention to the consideration of electric waves, otherwise known as Hertz waves, by means of which wireless telegraphy is possible.

Hertz performed the famous experiments which verified the classic theory of Clerk Maxwell, and demonstrated the propagation of electromagnetic waves. He equipped the secondary terminals of an induction coil with a species of Leyden-jar condenser, which is now known as the Hertz radiator (Fig. 4). This apparatus was made up of a pair of metallic plates, attached to which were short metal rods, tipped with knobs, which latter were placed so that they were held a fraction of an inch apart. These knobs were connected to the secondary terminals of the induction

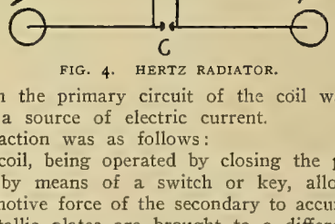

FIG. 4. HERTZ RADIATOR.

coil. In the primary circuit of the coil was connected a source of electric current.

The action was as follows:

The coil, being operated by closing the primary circuit by means of a switch or key, allows the electromotive force of the secondary to accumulate; the metallic plates are brought to a difference of potential, and consequent lines of electrostatic displacement are created, which have the effect of breaking down the air insulation between the metal-knob terminals. When the dielectric gives way under the strain exerted by the high-tension discharge of the powerful secondary current, the entire radiator becomes a conductor for the time being, and the difference of potential previously manifested at the knobs begins to equalize. The current now flows through a complete circuit, part of which is a dielectric.

The magnetic flux created around the conductor has a direction normal to the direction of the electrostatic displacement, and the flux, persisting, re-creates electric displacement in an opposite direction. Therefore, while the coil is kept going, trains of electric waves having an oscillation frequency of 230,000,000 vibrations per second and

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Note.—This series of articles was begun in the issue of December 1, 1906. It will be complete in ten chapters. In reference to the repetition in the title it may be explained that wireless telegraphy is the popular name for the transmission of intelligible signal through space by Hertzian waves, while the term radio-telegraphy was officially adopted by the Berlin International Wireless Conference and promulgated November 3, 1906.

wave lengths depending upon the electrostatic capacity of the secondary circuit and its attachments travel off into space at the rate of 186,000 miles per second.

Hertz's wonderful achievements were obtained with quite simple apparatus. Referring to Fig. 4, which illustrates it, (A) is the induction coil, (B) and (B') the metallic plates or spheres, and (C) the air gap between the knobs of the secondary circuit.

[*To be continued.*]

Transformation of Electric Power into Light.[1]

By Charles Proteus Steinmetz.

VI. The Arc.

In the Geissler tube the current is carried by the gas or vapor which fills the space between the electrodes. The conduction is disruptive in character, or a spark discharge; that is, a minimum voltage is required. Below this voltage no conduction takes place; above it the current passes,

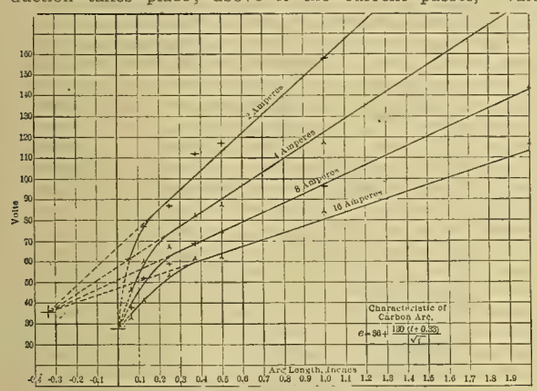


Fig. 2. Characteristic of Carbon Arc.

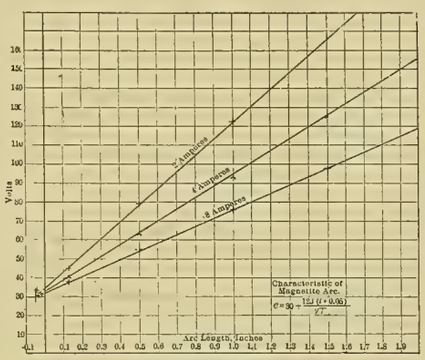


Fig. 3. Characteristic of Magnetite Arc.

TRANSFORMATION OF ELECTRIC POWER INTO LIGHT.

with the appearance of luminescence; and if the voltage falls below the minimum value required to start conduction, the current again ceases. The material of the electrodes has no direct effect, but the spectrum is that of the gas between the electrodes. The character of the current also seems to have no direct effect; alternating current passes at about the same voltage as direct current.

An entirely different set of phenomena is met in arc conduction. The electric arc makes its own conductor. That is, the current is carried across the gap between the electrodes by a vapor bridge, produced by the current from the material of the negative electrode, and maintained by the current as a high-velocity vapor stream issuing from the negative toward the positive, and more or less surrounding the positive terminal. The spectrum of the arc, therefore, is that of the negative terminal, but independent of the gas or vapor filling the space around it, or of the material of the positive terminal, except indirectly by the effect of heat, etc.

The continuous production of the vapor stream requires power in raising the negative material to the boiling point, evaporating it, and producing its rectilinear velocity. This power must be supplied by the electric circuit, as a potential drop at the arc terminals, independent of the length of the arc and of the current—if the volume of the vapor stream is assumed as proportional to the current, which seems to be the case. This potential drop (e_0) may be called the counter-electromotive force of the arc.

The temperature of the arc stream at constant pressure in the surrounding space must be constant, that of the boiling point of the material of the negative terminal. The power radiated per unit surface may therefore be also assumed as constant, and the total power radiated, and therefore the power consumed in the arc stream, as proportional to its surface; that is, to the product of length by diameter. Since the section of the arc stream can be assumed as proportional to the current, it follows that the voltage consumed by the arc stream is inversely proportional to the square root of the current, and approximately proportional to the arc length, or, when allowing for the abstraction of energy from the arc stream by the terminals, proportional to the arc length plus a small constant quantity.

This gives the theoretical volt-ampere equation of the arc:

$$e = e_0 + \frac{a\,(1+c)}{\sqrt{i}}$$

Giving the arc length l in inches, numerical values of this equation are:

Carbon Arc:

$$e_0 = 36 + \frac{130\,(l+0.33)}{\sqrt{i}}$$

Magnetite Arc:

$$e_0 = 30 + \frac{123\,(l+0.05)}{\sqrt{i}}$$

With zinc or cadmium the counter-electromotive force of the arc is:

$e_0 = 16$ volts; with mercury, $e_0 = 13$ volts.

In Figs. 2 and 3 are given characteristic curves for these arcs, for two, four, eight, 16 amperes, drawn from above equations with the values observed by test marked by crosses. As seen, the agreement of the calculated curves with test is as close as can be expected from an approximate formula, with the exception of the carbon arc, in which the agreement is least close. In the carbon arc, for short arc lengths the curves leave the straight lines and slope down toward a value of about 28 volts at zero arc length. Separating two carbon electrodes from each other and observing the voltage at the moment when the carbons leave immediate contact with each other and the voltage suddenly rises, or observing the voltage immediately before the carbons, when shortening the arc, come in contact and the voltage suddenly drops, also gives values around 28 volts. This, in connection with the high value of the constant $c = 0.33''$, looks as if in the carbon arc the seat of the counter-electromotive force e_0 is not the immediate surface of the terminals, but a part of e_0, about eight volts, residing in the space surrounding the electrodes. This phenomena may, however, be explained also by energy transfer from the hot crater of the positive terminal to the negative terminal at a short arc length.

For very low currents, where the arc stream gets very thin and unsteady, and abnormally high energy losses may be expected, the above equations give small values; that is, the observed arc voltage is higher than the calculated, especially with long arcs. So for the magnetite arc of one ampere, we find:

At arc length.....	⅛ inch	½ inch	1 inch
Observed voltage	58	108	184
Calculated voltage	51.5	97.5	159

These equations obviously apply to the arc at constant pressure, as an arc in air, in which the arc section varies with the current. For an arc of constant section, in which, therefore, the pressure and the temperature varies with the current, as the mercury arc in a vacuum, by similar considerations an approximate volt-ampere characteristic is found. This is for the mercury arc:

$$e = 13 + \frac{1}{1.68\,d - 0.066\,i - \frac{1.3\,d^2}{1}}$$

with non-volatile positive terminal, and:

$$e = 13 + \frac{1}{1.68\,d - 0.114\,i - \frac{1.3\,d^2}{i}}$$

with mercury anode,[1] where

l = arc length,

d = arc diameter, in inches.

From the character of arc conduction—that the current makes its own conductor—it follows that the arc must be started; that is, the vapor bridge which carries the current must first be produced by the expenditure of energy before the current can flow. This can be done in many ways: By bringing the terminals in contact with each other and so starting the current, and then by withdrawing the terminals from each other to form the arc stream by the current; or by jumping an electrostatic spark across the gap, and so starting conduction.

It also follows that the arc is a direct-current phenomenon, and in general cannot exist with an alternating current. With an alternating electromotive force at the end of the half-wave, the current dies out, and therefore also the vapor stream; and the next half-wave, to pass in opposite direction, requires a vapor stream moving in the opposite direction. This does not exist, and the current does not pass: but the arc dies out at the end of the half-wave, except if the supply voltage is sufficiently high to jump a spark across the terminals at every half-wave, through the residual vapor left by the preceding half-wave. An alternating arc, therefore, must be at every half-wave in the condition for starting by a spark. Stroboscopic photographs with metal arcs show this phenomenon—a sharply defined static spark at every half-wave, gradually spreading out to the more diffuse arc flame, and then dying out at the end of the half-wave, to start again by a spark at the next half-wave.

The voltage required to maintain the vapor stream, that is, the voltage consumed by a direct-current arc, as discussed above, increases with increase of the arc temperature; that is, increase of the boiling point of the terminal material. It is lowest for the mercury arc, highest for the carbon arc. For a one-half-inch arc it is shown approximately by Curve I. in Fig. 4, with the temperature as abscissas. The voltage required to jump a spark across the gap between terminals, shown roughly by Curve II. in Fig. 4,[1] decreases with increasing temperature, as is well known, and intersects Curve I. at some temperature (A), probably somewhere between 2,500° and 3,000° C. Above this temperature, the spark voltage is below the arc voltage, and a voltage sufficiently high to maintain an arc is therefore sufficiently high to start it again at each half-wave of alternating electromotive force. That is, materials as arc terminals, which have a boiling point above the temperature of intersection (A) of Fig. 4, maintain a steady alternating-current arc at about the same voltage as a direct-current arc, while materials with a lower boiling point than (A) require a higher voltage, usually very many times higher, to maintain an alternating than a direct-current arc. It must be considered, however, that the temperature of the boiling point, while being the foremost factor, is not the only factor in determining the position of a material on Curves I. and II., Fig 4. Individual characteristics somewhat modify the position.

Where, therefore, spark-gap terminals are desired not to maintain an alternating arc, as for lightning-arrester cylinders, they are found on the lower range of the curve—mercury, cadmium, zinc, antimony, bismuth—the so-called "non-arcing metals." Where electrodes for alternating-current arc lighting are required, they are found at the upper end, above (A). In this range belong carbon and most carbides, as those of calcium and titanium. Even carbon shows the phenomenon of restarting at every half-wave, by a high peak at the beginning of the electromotive-force wave, as shown first by Tobey and Walbridge, in a paper on alternating-current arc waves.[2] With increasing approach to (A), this peak at the beginnnig of the electromotive force increases in height, and the power factor of the circuit tends to decrease, by wave-shape distortion.

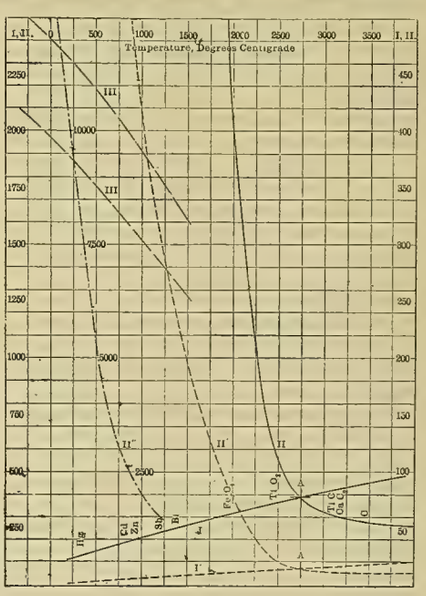


FIG. 4. CURVES OF ARC VOLTAGE AND SPARK VOLTAGE.

Immediately below the intersection point (A) are found very refractory metals, as tungsten and metaloxides, as those of titanium, etc.

The range of voltage between Curves I. and II. in Fig. 4 is the range in which rectification takes place. That is, by maintaining the vapor stream issuing continuously from one terminal, by an outside source, or by the overlap of several arcs, the alternating electromotive force can pass a current in one direction only, and so is rectified. In this range, the arc stream is a unidirectional conductor, of very low resistance in one direction, of practically infinite resistance in the opposite direction.

The voltage range of rectification, then, is high-

1. This is the concluding portion of a paper (begun in the Western Electrician last week) presented at the meeting of the American Institute of Electrical Engineers in New York, November 23, 1906. An abstract of the discussion will be given later.

1. The effect of the anode material on the arc characteristic is indirect. In the case of the mercury anode the heat produced at the anode causes evaporation, and increases the vapor pressure above that existing with a graphite or iron anode.

1. This curve is only estimated and so can make no claim to numerical accuracy. Curves I. and II., the arc and the spark curves, are shown once more in ⅛ scale (left-side ordinates) in dotted lines and the lower part of II., once more, in 2/5 scale, as II.'' in Fig. 4.

2. Transactions A. I. E. E., 1890, Vol. 7, p. 367.

est at the lower end of the curve, and decreases gradually to zero at the point (A). With the first members of the group, the upper limit of the rectification range is somewhat cut down by the disruptive strength of the air surrounding the arc stream, being lower than that of the arc stream, and so passing a static spark outside of the arc stream, or, with a vacuum-tube arc, by a Geissler-tube discharge through the residual gas. In the latter case the maximum voltage which can be rectified depends upon and measures the perfection of evacuation. Such Geissler-tube discharge curves are sketched roughly, in dotted lines, as III., III.[1] in Fig. 4.

While vapors like mercury, zinc, etc., are very good conductors when in motion under the influence of the current of a conductivity comparable with that of electrolytes, when not under the influence of the current they are almost perfect insulators, and so can be distinguished from the so-called "conducting gases," as hydrogen, air, etc., as "non-conducting vapors." Low-temperature-metal vapors thus are non-conductors.

VII. The Arc as an Illuminant.

The spectrum of the arc is that of the negative material; its temperature that of the boiling point of the negative. There are, however, some apparent exceptions. For instance, the arc stream can be superheated by using a high-frequency oscillating current of sufficiently high voltage to maintain an alternating arc, and a frequency so high that a sufficient vapor stream cannot be formed during the half-wave. In this case, groups of spectrum lines frequently become prominent, which are insignificant with saturated vapor; the mercury arc becomes bright red in color; the iron arc loses most of its brilliancy, but gives a great quantity of intense ultraviolet rays, etc. Likewise, the spectrum of the positive, or a constituent of the positive terminal, can be made to appear in the arc.

The tip of the positive is heated to the temperature of the vapor stream, in the carbon arc the temperature of boiling carbon. If the positive terminal consists of or contains some material which boils below the temperature of the vapor stream, then it will evaporate out of the positive, and may thus enter the arc stream. For instance, in a carbon arc, or arc with carbon as negative, if a carbon is used as positive, impregnated with calcium fluoride or borate, which has a relatively low boiling point, then the calcium vapor enters the arc stream and is thereby heated to the temperature of the carbon arc. It becomes luminescent, whether directly by heat, or indirectly by chemical dissociation, or otherwise, need not be considered here. So the efficiency of a carbon arc can be increased by feeding into the arc flame the vapor of some material which gives a brilliant spectrum—as calcium, which gives a yellow light of very great brilliancy. It is fed into the arc by the positive terminal, because this is the hottest, and the efficiency depends entirely on the temperature of the positive. If the positive is very large, so as to keep cool, and consumes slowly, the efficiency decreases, because it is produced only indirectly by material being evaporated from the positive, and then as vapor entering the arc stream. Therefore, a high temperature and rapid consumption of the positive are necessary.

It is entirely different with the true luminous arc, which carries the light-giving material into the arc flame by the electric current, as the vapor blast, which carries the current. The carbon, as negative material, is objectionable, since it gives the non-luminous carbon arc. Iron appears to be a very suitable material, since it gives a spectrum extending over the whole visible range. It produces practically a white light. The positive can then be maintained cold without affecting the brilliancy or efficiency of the arc. The negative can also be cooled without appreciable effect on the efficiency, since the current still produces the vapor blast from it, and so the light. If cooled too much the voltage in the arc may rise a little, because it requires more energy to produce the iron vapor from the cool negative than from the hot negative, but still the efficiency is not much affected.

There are, then, two distinct ways of producing luminescence of the arc; first, directly by using some material as negative which gives a luminous spectrum; that is, a spectrum with many lines in the visible range, preferably covering this whole range, to get white light; second, indirectly, by using some material to carry the current which gives a very high temperature to the arc stream—which means practically carbon—and making the arc stream luminous by feeding some light-giving substance into the arc from the positive terminal. In the former case the arc has the characteristic of the iron arc or titanium arc, whatever material is used; in the latter case, it has the characteristic of the carbon arc.

Since the carbon arc is the steadiest arc, the most work has been done in the latter direction. The former method of feeding the luminescent material by the current from the negative material, has the advantage, however, that the efficiency does not depend on the temperature of the electrodes; the rate of consumption of the negative electrode can thus be greatly decreased by maintaining it at low temperature, while the positive electrode, which takes no part in the arc conduction, can be made entirely non-consuming. This method seems to be a more direct conversion of electric power into light.

These two forms of arc have come into prominence recently—the flame-carbon arc and the metal-compound arc; that is, an arc in which carbon is not used, but some other material which gives a luminous spectrum, as iron or titanium. In the former case the characteristics are those of the carbon arc. All the materials which can be used to increase the efficiency of the carbon arc—calcium compounds are used almost exclusively—deposit as solids after passing through the arc flame, and therefore ventilation must be provided to carry off the smoke; that is, the arc must be a so-called "open" or "burning" arc. The life of the electrodes is about 10 hours. Flame-carbon arcs, therefore, have short-life electrodes, though their efficiency is high. Again, efficiency has to be balanced against life, or decreased cost of power against increased cost of electrodes and attendance. Here in the United States the short-burning arcs for street lighting have practically disappeared. Indoors, the excessive brilliancy and the smoke are objectionable, so that the flame-carbon arc does not offer much prospect for general illumination.

More prospect of success appears to exist in the true luminous arc, an arc using as negative a material giving an efficient and brilliant spectrum. Such material should give lines uniformly distributed, not only in the green or yellow, but over the whole visible range, and the material should not be attacked in air, even at high temperature. The arc must be an open arc, since the material deposits as solid, and to get electrodes with long life, a material is required which is stable at high temperature in the air.

There are very many metals which give luminous spectra, but those which give white are substantially the metals of the iron group only—iron, titanium, wolfram, etc.

Long-burning quality requires a material which is not affected, or only little affected, by the air This, in general, excludes the metals, but requires a stable oxide or other fairly stable compound, as some carbides are. It should also be a conductor, since as arc electrode it has to carry the current. In the intermediate oxide of iron magnetite (Fe_3O_4), a material is found which is a good conductor, is stable at high temperatures as well as at low temperatures, and gives a white spectrum. In such an electro-luminescent arc, any stable material is suitable as a positive terminal. Copper is generally used because it is cheap, is stable at fairly high temperature, is a very good conductor of heat and when heated by the arc carries the heat away with sufficient rapidity not to melt or oxidize appreciably. In all these arcs the vapor stream from the negative is a necessity. In the mercury arc it is easiest of observation, because the arc is enclosed in a glass tube.

The amount of vapor produced by the current from the negative is usually many times greater than necessary to carry the current, and most of it can be condensed without any appreciable change in the arc stream. So also magnetite consumes at a much greater rate than is necessary, of an order of one-fourth gramme per ampere-hour. This rate of evaporation is greatly reduced by the addition of small quantities of a material which is chemically not much different from magnetite, but is much more refractory; so that at the temperature where the magnetite melts this material is still solid and forms a kind of sponge in which the melted magnetite is held and its consumption greatly retarded.

Magnetite, however, while a good conductor of the arc stream, is not very efficient as a producer of light, and added thereto are other materials which give a very high efficiency, as titanium compounds.

In the magnetite arc—as used at present, that is, in which the magnetite electrode contains titanium oxide, etc.—magnetite is essentially the carrier of the arc conduction, just as carbon in the yellow-flame arc; titanium, with its highly efficient white spectrum, takes, in the magnetite arc, the same place as calcium in the flame arc, as light-giving substance, but titanium is carried into the arc stream by the current from the negative, while calcium in the flame arc enters by evaporation from the positive.

The elimination of carbon in the magnetite arc excludes combustion, and this increases the life of electrodes to about 20 times that of carbon electrodes under the same conditions; but, just as with the carbon arc, the efficiency of the magnetite arc can be varied over a wide range, with a corresponding variation of life in opposite direction. That is, by sacrificing some efficiency, the life can be greatly increased, or the efficiency can be increased by somewhat reducing the life by increasing the percentage of light-giving material—usually titanium oxide in the magnetite arc, calcium fluoride or borate in the flame-carbon arc. In either case a very high percentage of the light-giving material tends to the formation of a non-conducting slag at the electrode surface, and if the highest possible efficiencies are desired—one-fourth watt per candlepower, and better—the effect of the non-conducting, or poorly conducting, electrode surface has to be eliminated, by starting the arc from the side of the electrode, or some other method.

Magnetite, titanium oxide, and most metals or their compounds are, on curve, Fig. 4, below the intersection point (A); that is, do not maintain a steady alternating arc. For alternating arcs, therefore, one of the materials is required which is above point (A) in Fig. 4. In this range there are carbon, carbides and similar compounds.

Thus, the titanium arc with alternating current cannot use magnetite as carrier, and titanium oxide as light-giving material; but titanium carbide is used as arc conductor. It obviously is not so incombustible as the oxide, but still so much more stable than carbon as to be well within the range of long-burning arcs.

To conclude, then, in the luminous arc we seem to have the first instance of a commercial application of a direct conversion of electric power into light, without heat as intermediary form of energy. It is not limited to very low values of efficiency. But, so far, it seems that only the green mercury spectrum, the yellow calcium spectrum and the white titanium spectrum offer an efficiency so vastly superior to that of incandescent solids that, as regards the efficiency of light production, no possible improvement in incandescent lighting could hope to approach it. Typical of these three most efficient spectra are the mercury-arc lamp, of practically infinite life and bluish-green color of light; the yellow-flame carbon arc, of the short life of the open arc lamp of old, and the white titanium carbide, or magnetite arc, of a life equal to or greater than that of the enclosed carbon arc.

Prize Competition for the Production of an Electrical Solicitors' Handbook.

It will be remembered that earlier in the year the Co-operative Electrical Development Association offered $1,000 in prizes for papers on the subject of the organization and conduct of new-business departments suitable for central stations in cities of 50,000 population and under. These prizes were awarded by the president of the National Electric Light Association at the Atlantic City meeting on the judgment of a special committee, since which time they have been given wide publicity through the co-operation of the electrical technical press, as well as by the association in pamphlet form. A few weeks since, the subject of offering prizes for an electrical solicitors' handbook was discussed with the co-operating committee of the National Electric Light Association, and it was decided to offer $2,600 in prizes for such a production. The prize money is divided as follows:

One thousand dollars for the Light Section, of which $500 will be awarded as the first prize; $300 as the second, and $200 as the third.

One thousand dollars for the Power Section, of which $500 will be awarded as the first prize; $300 as the second, and $200 as the third.

Six hundred dollars for the Heat Section, of which $300 will be awarded as the first prize; $200 as the second, and $100 as the third.

In general, it is desired to secure a handbook which will be both instructive and stimulating to representatives of central stations, contractors or others who are soliciting the public for the sale of electrical service for light, heat and power.

A little pamphlet is in the course of preparation containing general suggestions for the benefit of those who will compete for the prizes, and this will be very gladly sent upon request.

A committee appointed by the president of the National Electric Light Association will judge the handbooks, or sections of the handbooks, submitted, and its decision, which will be made just before the next meeting of the National Electric Light Association, will be announced at that convention and the nine New York drafts for the several amounts distributed to the winners.

The winning contributions, or combination of winning contributions, will be made of the greatest possible benefit to the electrical business along such lines as may be later determined by the joint committee.

This affords an excellent opportunity to make a valuable contribution to the commercial progress of the art, to achieve a reputation for business progressiveness, and, withal, to be well paid for the time, thought and energy required.

Everett W. Burdett on Public Ownership.

The Boston branch of the American Institute of Electrical Engineers held a meeting on November 21st, at which Everett W. Burdett spoke on "Public or Private Ownership of Public-Service Utilities—Which is Preferable?" He presented data showing that the theory of municipal operation had suffered by the experience of Glasgow and other cities of Great Britain. He concluded: "It appears that when tested by the results obtained in the two great English-speaking countries of the world, the practical application of the paternal or socialistic theory of local government does not justify itself with the results produced with the American theory of as little government as possible. And it is to be remembered that these results in America, marvelous both in kind and extent, are to be attributed not only to individual initiative, but also to the much-reviled corporation."

The Patent Factory.

By George Ethelbert Walsh.

Contrary to a rather widespread impression an invention is generally a growth rather than a sudden inspiration. Moreover, it is often the product of several minds working along parallel lines, each contributing its quota of experimental knowledge. Forecasting an invention is not an impossible feat. The need of some sort of time-saving or labor-saving device is felt in an industry. Experts are called in and the ground thoroughly canvassed, impracticable methods eliminated, and the most feasible systematized and described. Then the work of developing the invention is turned over to experts, or rather to professional inventors, who can roughly forecast what they will do.

The conditions of modern industry demand the elimination of chance and uncertainty so far as possible. Inventions have upset business and manufacturing interests more than any other factor in the last ten years. The installation of expensive machinery is a costly undertaking if some inventor comes along with a patent six months later which practically makes the machinery ancient and obsolete.

"Last year," confessed a leading manufacturer of novelties, "my plant was practically knocked out by the invention of a device which makes it possible for my rivals to save $50,000 a year. I must either go out of business or invest in new machinery and pay big royalties to the inventor. This periodical revolutionizing of conditions by new inventions is one of the disturbing features of manufacturing. Is it any wonder that big concerns keep a sharp lookout for patents and even employ an army of experts to watch the applications for new patents?"

The professional inventor works better in cooperation with others interested in similar subjects, the deficiencies of one thus often being supplied by another. Associations of inventors have therefore become important organizations in this industrial age, and most of our great patents are products of one of these "patent factories" rather than of a single individual.

Edison's patent factory is not an exception to this rule, for while his personality dominates the establishment over which he presides, and credit is given to him for the inventions, he has surrounded himself with experts whose labors contribute to the general cause. Not only is the great "wizard" relieved of a great mass of detail work by his assistants, but suggestions and experiments are constantly coming to him from his associates. In his "patent factory" he employs some of the best chemists and mechanical experts in the country. Work of an experimental nature is intrusted to them which would require years of patient toil from a single inventor without the equipment of the modern plant.

Tesla is another great inventor who conducts his own "patent factory." With one of the best-equipped electrical and experimental laboratories in the world, he has surrounded himself with bright young men who have succeeded in chemistry, electrical sciences, mechanics and physics, and his labors of inventing are systematized to the point of simplicity. Most of Tesla's important discoveries in electrical science were predicted years ahead of their ultimate perfection, and the work of making good his promises has established for this inventor a unique position in the world of electricity.

Another important "patent factory," which differs from these two in some important respects, is the Ampere Electrochemical Company of Niagara Falls. Instead of a single dominating mind heading this plant, half a dozen inventors compose the company and direct its affairs. The company is not an operating concern, but purely an experimental organization or association of inventors. The object of the "patent factory" at Niagara Falls is to delve into the mysteries of electrochemistry for the purpose of discovering new processes for commercial application; but when a new patent is developed it is turned over to an operating company for exploitation. The inventors themselves have no interest in the applications of their patents.

The founders of this strange "patent factory" are men well known in the world of electrochemistry. Professor F. B. Crocker, C. A. Doremus, S. S. Wheeler and C. S. Bradley were the original organizers of the experimental plant, and later they had associated with them A. H. Buch, D. R. Lovejoy, H. E. Knight, N. Thurlow and Charles B. Jacobs. The results of this patent factory are evident in a hasty glance at some of the most important electrochemical industries which have grown up around Niagara, where a vast amount of electric current can be had at small cost.

To this "patent factory" can be traced the discovery of the present method of making artificial corundum by fusing bauxite by a patented process; the work of obtaining nitric acid from nitrogen and oxygen by electrical methods; the different processes of utilizing and producing barium sulphate and barium salts for the purification of our drinking water, and the production of artificial camphor from turpentine at Port Chester, which a few years ago failed after a short experimental test.

The large industrial and manufacturing companies have in recent years established "patent factories" of their own, where experts conduct tests and experiments along certain well-defined lines for mutual interests. These commercial "patent factories" are equipped with the best laboratories in the world, and men of genius and experience preside over them. The association of half a dozen experts in such a plant tends to make the work of discovery and invention simpler and more practical.

The General Electric Company spends tens of thousands of dollars every year in supporting its "patent factory." The presiding genius of this plant is Dr. C. P. Steinmetz, an inventor of world-wide fame. He has to his credit a long list of patents which have helped to bring the generation, transmission and application of electricity up to their present-day efficiency. With him are associated men of almost equal gift for invention and specialists in certain fields. The total output of this factory averages scores of new patents and improvements upon old ones every year. Any employe of the company who has a promising idea is encouraged to present it to the head of the patent factory, and if considered of value it is exhaustively tested and tried by experts. While the company holds all the patents developed by any of its employes, proper remuneration is made to the inventors, so that each one is stimulated to make suggestions and improvements. Frequently the development of a patent is more dependent upon the opportunities of the inventor to make exhaustive experiments with costly machinery and tools than upon the initiative impulse of the individual. Thus many valuable patents of today would never have been perfected had the inventors been forced to rely upon their individual means and work.

The Westinghouse Electric and Manufacturing Company is another representative concern which has a well-equipped "patent factory" in operation in connection with its manufacturing plant. Many valuable patents are taken out by this company, and most of them are traceable to the energy and foresight of the professional inventors employed by the company.

Another important "patent factory" is that of the Western Electric Company, which has to do largely, although not exclusively by any means, with telephone patents.

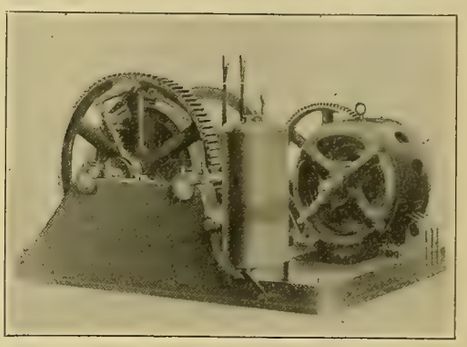
The various large concerns owning their own "patent factories" are rapidly specializing the work of inventing. The electrical manufacturers confine their attention to inventions in their industries, and the makers of special machines limit their tests and experiments to machinery in their particular line. The Ampere Electrochemical Company makes no efforts to invent dynamos and motors and equipents, but studies only the field of electrochemistry. Iron and steel mills find it more convenient and economical to confine their labors to the perfection of details of their plants and rarely branch out into other industries. In this way inventions are becoming specialized, and the professional inventor devotes his time and genius to certain departments of work.

The possibilities of inventions are probably greater in the electrical and electrochemical fields than in any other to-day. The electrochemist, in particular, has many untrodden paths ahead of him. By the aid of the electric current changes have been effected in the sugar and paint trades which make for efficiency. Electrochemists are to-day working with promise of success toward the manufacture of starch from by-products. Artificial rubber of fair value has also been produced, and the cyanides, silicides and ammonia are all promising products for the electrochemist. Synthetic electrochemistry is generally recognized as one of the greatest future businesses of the world; and that the Falls of Niagara were created for this purpose is the opinion of the workers in this field.

While the individual inventor may find his opportunities somewhat circumscribed by these changes, the gain obtained through the organization of professional inventors is great. Greater results flow therefrom, and the young man associated with a modern "patent factory" secures in time a training which makes his inventive gift of far greater value to himself and the world. In the field of discovery and invention of to-day expensive and elaborate tools and laboratory equipment are frequently essential to success, and the modern "patent factory" supplies these requirements.

Allis-Chalmers Electric Hoists.

Electric hoists, in order to give the best service, must be designed and built especially to meet operating conditions. When so constructed and properly installed they are as easily handled and give as good results as steam-driven machines, while they are as readily controlled, are as little liable to get out of order, and require no more skillful operators. They should be heavily and substantially built, conveniently and compactly arranged, and the motor adapted to its work. In many cases the advantages of electric over steam or air-driven



ALLIS-CHALMERS SINGLE-DRUM ELECTRIC HOIST.

hoists are so manifest that argument is unnecessary. For underground locations, or for places at some distance from the necessary location of the power plant, it is much easier and cheaper to run wires than pipes, thus avoiding all loss from condensation or leaks. Either direct or alternating current at any of the standard voltages and frequencies may be used, and the hoists can be built for any desired load and speed of rope.

Allis-Chalmers Company of Milwaukee has recently put upon the market a line of standard machines designed to work under approximately the same conditions as its well-known small steam-driven hoist. The single-drum electric hoists are of 15, 25, 35, 50 and 75-horsepower capacity, and double-drum hoists are made by that company in 30, 50, 75, 100, 125 and 150-horsepower sizes. In this hoist the drum runs loose upon the shaft and is made in one piece, of the best quality of cast iron. The spider hubs are fitted with bronze bushings, which can be readily replaced in case of wear. The drum spiders have strongly ribbed arms, and the drum shell is reinforced by deep circular ribs, so that all twisting and bending strains are fully met.

The brake is of the steel-band type, with wide face, and is provided with suitable turnbuckle adjustment for taking up the wear on the brake blocks. One end of the brake band is securely anchored by eyebars around the operating shaft, and the other end has a turnbuckle attachment to the lever on the operating shaft controlled by the operator's hand lever.

The main gear, keyed on the drum shaft, forms the driving member of the clutch, which is of the band-friction type. The fixed end of the band is securely anchored to the driving gear and has suitable adjustment for shortening the band to compensate for wear. The movable end of the band is actuated by a simple and strong arrangement of toggle lever, motion to which is imparted by a collar sliding on the drum shaft and controlled by the operator's hand lever through suitable connections. When the clutch is thrown in, the band is tightened around the drum shell by the powerful toggle motion, and the pull of the rope on the drum tends to still further tighten the grip of the band on the shell, thus securely holding and lifting the load. Both band-friction clutch and band brake are hand operated, the operating levers being conveniently arranged and provided with quadrants and locking pawls.

For driving these hoists Allis-Chalmers Company furnishes either direct or alternating-current motors, wound for the usual voltages, and if alternating current, either 25-cycle or 60-cycle machines. The controllers used with these hoists are of the drum type, similar to those in common use in street-car service. On all single-drum hoists the motor is not reversed, but on double-drum hoists the handle or lever of the controller not only controls the speed, but also reverses the motor, and is locked in the off position. The controller is securely attached to the frame of the hoists, and the lever is so located as to be conveniently reached and easily handled by the operator.

More detailed information in relation to these sets may be obtained from a pamphlet, "Electric Hoists" (Bulletin 1506), recently issued by the Allis-Chalmers Company.

Probable Merger of Indiana Interurban Roads.

It was rumored in Indianapolis during the last week that plans for the organization of a holding company, to include all the Indiana traction lines owned by the syndicate represented in Indiana by Hugh J. McGowan are gradually being developed, and it is thought that incorporation papers will be ready for filing by the first of the year. No official announcement of the merger has been made, but enough is known, it is said, to indicate that the new holding company will include eight or nine interurban main lines and half as many branch lines. The main lines to be merged are those of the Indiana Union Traction, the Indianapolis and Eastern, the Indianapolis and Northwestern, the Indianapolis and Western, the Indianapolis and Martinsville, the Indianapolis Coal Traction, the Richmond Street and Interurban and the Fort Wayne and Wabash Valley traction companies. These roads, with the numerous branch lines controlled by them, will make the largest traction system in the world.

It is said that the Indiana lines will be leased to the Indiana, Columbus and Eastern Railway Company, recently organized and incorporated in Ohio, to operate all the lines of that state owned by the same syndicate which owns the Indiana merger lines. The Ohio company is capitalized at $13,000,000. W. Kelsey Schoepf of Cincinnati is president. Hugh J. McGowan represents the syndicate in Indiana, and will doubtless be made president of the Indiana holding company. When this merger is ready to launch into business it will own and operate 682 miles of interurban railway in Indiana. In addition to this, the street-car systems of several cities will be included under its control. The Indiana holding company will have under its control some 200 more miles of interurban railway than has the Ohio company, known as the Indiana, Columbus and Eastern, which will likely become the leasing company.

A New Primary Battery Reported from Fond du Lac.

The Fond du Lac Daily Commonwealth of November 26th describes in general terms a new primary battery which it says will produce "electric current at much less cost than by and other means." The positive element is described as a "carbonated element" prepared by an electrolytic process, while "the negative is an alloy of metals that furnishes the highest possible potential." Considerable mystery is shown in the published description, but it is said that the two elements "so act upon the chemicals in solution as to decompose them when the circuit is closed. This is probably one of the first organic batteries—that is, one that makes use of organic chemicals—ever invented." The claim is made that "a standard cell weighing 18 pounds has a capacity of 1,000 ampere-hours without recharging." The cell is six inches square and 10 inches deep, it is said, and it is asserted that it can be put on the market for about $5.

A company has been organized to manufacture the battery. E. J. Huber and C. J. Medberry of Fond du Lac, with many others, are interested in the new company.

Steam Roads to be Electrically Equipped.

The Harriman roads in Wyoming, Idaho, Montana and Nevada are to be electrified, according to the Salt Lake City Tribune. Within six months, it is said, work is to be taken up on the lines from Green River, Wyo., to Sparks, Nev., and from Butte, Mont., to Salt Lake City and the Garfield smelters. It is possible that the system will also include the double-tracking and electrification of the San Pedro from Salt Lake to Provo.

The Harriman system, says the Tribune, can electrify these lines and compete with any interurban system anywhere. Power can be transmitted from the Shoshone Falls plant, which can be greatly amplified, for a net cost of $15 per horsepower per annum, it is said. This gives the railroad an advantage on initial cost of power over the present Utah Light and Railroad system, which is $33 per horsepower annually, and an advantage over steam-generated electricity, which costs $38 per horsepower per year, and over steam-generated power of $51 per horsepower annually.

Chicago Street Railway Situation.

City officials of Chicago say that a plan for the settlement of the street-railway problem will be formulated before the end of the year. The council transportation committee and representatives of the Union Traction Company and the Chicago City Railway Company have been negotiating on the basis of an ordinance which is to contain the terms of a settlement. It is said that an agreement has been reached on most points, the questions of compensation to the city and the valuation to be placed on the properties, should the city decide to buy later, being the principal ones yet to be settled. The latter now only awaits the report of the city's experts who are reviewing the figures presented by the traction companies as the value of their properties. As showing the attitude of the aldermen, at the last council meeting a resolution was passed ordering the transportation committee to arrive at some conclusion as to a settlement and report to the council before the end of the year.

Electrochemical Papers Before the Faraday Society.

The twenty-third ordinary meeting of the Faraday Society was held on November 13th, in London, S. W. Dr. F. Mollwo Perkin, treasurer, was in the chair.

Mr. W. Pollard Digby read a paper entitled "Some Investigations Relative to the Depreciation of Electrolytically Produced Solutions of Sodium Hypochlorite."

This paper deals in the first place with depreciation taking place in bottles of various colors, in which dark amber bottles gave the best results, the loss in 1,817 days being about 40 per cent. for a solution containing 4.216 grammes of available chlorine per liter. The corrosive action of hypochlorite solutions upon various metals is then discussed, and the depreciations due to graphite, copper, zinc, lead and iron plates immersed in such solutions are set forth for a period of 480 hours. A much greater depreciation takes place, due to galvanic action, when two dissimilar metals immersed in the liquid are connected by an insulated wire; the paper gives records in the case of 21 different couples. When iron is present as one metal in such a couple, the depreciations are generally greater than for any two other metals.

As regards the area of the exposed surface in the cases of single metals immersed in hypochlorite solutions, it was found that doubling or trebling the surface doubled or trebled the rate of depreciation.

Brief reference is made to the value of protective coatings as applied to metal couples, but no conclusive results were obtained.

As it is a matter of difficulty to paint evenly the inside of small plates, and, still more, of pipes, the writer deprecates reliance upon insulating materials for the protection of any vessel in which hypochlorite liquids are stored, or of any metallic piping in contact with hypochlorite liquids. When once the paint breaks down, corrosion of the metal will follow at a rapid rate.

Accounts are also given of the value of bitumen as a protective agent for wood exposed to hypochlorite solutions.

In conclusion the author urges that storage, transport, and methods of conveyance from place to place, or even from one part of a factory to another, are details meriting attention. Certain conditions of storage may clearly be regarded as fatal to stability, particularly those in which the galvanic action of dissimilar metals is likely to arise.

Mr. Charles V. Biggs then read his paper describing "The Hermite Electrolytic Process at Poplar."

This paper is a contribution to the data at present available on the subject of the electrolytic productions of hypochlorites. It consists of a description of the plant in use at Poplar for the preparation of a solution containing about 4.5 grammes of available chlorine per liter, for use as a disinfectant in the borough.

The system adopted is to mix a certain quantity of fluid in an elevated tank, and then to allow this fluid to flow through four double troughs or cells, placed one above the other, so that the liquid descends continuously by gravity. Each trough is divided laterally by a partition, and in each of the two divisions five distinct "elements" are suspended. The positive plates are of thin platinum wire wound upon slate slabs and the negative plates are of zinc. there are thus four troughs, each containing 10 "elements," or 40 cells in all. After passing through the successive cells, the liquid discharges into a carboy. Sodium hydroxide is used as a preservative; it flows, drop by drop, into the carboy as it is filling and serves to neutralize free hypochlorous acid. As the liquid passes through the troughs it is subjected to the action of a current of 15 amperes at 230 volts, being 5.6 volts per cell.

The tank is charged by placing in it 100 liters of a saturated solution of sodium chloride and 20 liters of a saturated solution of magnesium chloride. To this is added as much water as will bring the whole up to 840 liters. The rate of flow through the apparatus is 3 1-3 pints per minute.

Curves are appended showing (1) the rise in value of the solution as it passes through the cells, amounting to about one gramme per liter for 10 cells; (2) efficiency in grammes per B. T. U. for this plant, which is highest at a current of 16 amperes. Above this amperage energy is wasted in heat, and below it the flow becomes too high.

A number of tests of samples of the liquid made are given. Liquid made during the warm weather of the exceptional summer of 1906, at a temperature of 104° F., was found to have lost only 0.1 gramme available chlorine per liter in six weeks. Several samples of liquid made before the conditions of the plant (as to mixing, rate of flow, etc.) were very fully determined, showed losses of 0.1 and 0.2 gramme per liter in six months; the higher strengths (4.8 to 5.3 grammes per liter) losing 0.5 gramme in six months.

The author concludes that the magnesium hypochlorite, as made at Poplar, is sufficiently stable for practical purposes, and that it could be made in a warm climate without necessarily rapid deterioration. The warm-weather specimens quoted had been kept in ordinary dark-glass bottles, merely corked.

Mr. J. B. C. Kershaw (communicated) considered that electrolytic hypochlorite was unlikely to replace bleaching powder at present prices. He criticized the efficiency of the Hermite plant at Poplar.

Dr. R. S. Hutton hoped that further information regarding the electrodes and other important details of the Poplar plant, and also further data regarding cost and efficiency, would be forthcoming. He drew attention to the theoretical work that had been done on the Continent. Replying to Mr. Kershaw's strictures, efficiency depended on concentration. At Poplar high concentrations were used, so the efficiency was relatively low.

Dr. F. W. Alexander gave complete details regarding the cost of running the Poplar plant. The plant has been producing an average of 200 gallons a day of 0.4 gramme solution since January last at a total cost for current and material of under £33. Two laborers sufficed to watch the plant and bottle the solution. The defects of the original Hermite process had been successfully overcome. They had no trouble with non-conducting films on the zinc cathodes. Non-stability was caused by the presence of undecomposed salt in solution.

Dr. S. Rideal was of opinion that the convenience of being able to make hypochlorite on the spot as required for disinfecting purposes rendered it far more suitable than bleaching powder. The dust nuisance caused by motors rendered the use of a sterilizing fluid for street watering a necessity.

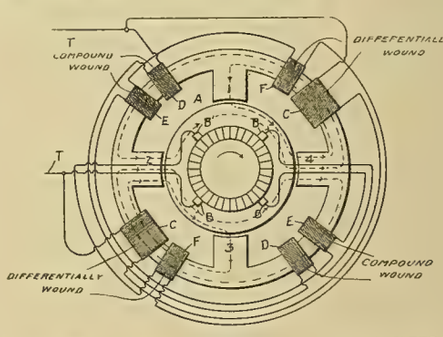
Mr. L. A. Smart remarked on the value of such electrochemical processes to borough engineers if they could be arranged to run so as to increase the load factor of the power station.

Mr. W. Defries pointed out that although the price of raw materials would probably not decrease, that of power tended to diminish, so electrolytic hypochlorite would in time compete favorably, even as regards price, with chloride of lime.

The paper by Dr. Alex. C. C. Cumming "On the Electrochemistry of Lead," was taken as read, and the discussion postponed until the December meeting.

Constant Current at Varying Speeds.

A new method of procuring a practically constant-current output from a generator operating under various conditions is the object of a recent invention. In a patent granted to Maurice Milch, Schenectady, N. Y., and assigned to the General Electric Company it is declared that by the method



CONSTANT-CURRENT GENERATOR FOR VARYING SPEEDS.

described the current output of a generator can be made practically constant, although the machine is operated at varying speeds or with varying resistance connected across its terminals.

The method consists in so arranging the machine that the current delivered by it produces a strong cross-field, leading off the current induced in the armature by the cross-field by means of a set of auxiliary brushes and utilizing this current for demagnetizing the main field.

The accompanying drawing shows, somewhat diagrammatically, a constant-current generator arranged in accordance with the invention.

In the drawing (A) represents the armature, provided with a set of brushes (B) (B), from which the current for the external circuit is taken. (C) (C) represent the main field coils, which are mounted in a field magnet arranged with four poles. Only two main field coils are employed, however, and these are connected so as to make the poles (1) and (2) of one polarity and the poles (3) and (4) of the other polarity. As regards the coils (C) (C), the field magnet is consequently bipolar, each pole being divided in two parts, the poles (1) and (2) being magnetically equivalent to a single pole, and the poles (3) and (4) to a single pole of the opposite polarity.

The brushes (B) (B), which supply the external

circuit, are placed in the usual manner at or near the neutral points with respect to the poles produced by the coils (C) (C). The coils (C) (C) are shown connected in shunt to the machine terminals (T) (T). The current flowing through the brushes (B) (B) tends to produce a magnetization of the machine at right angles to the magnetization produced by the shunt coils (C) (C) —that is, it tends to make the poles (1) and (4) of one polarity and (2) and (3) of the other polarity. This tendency is opposed and overwhelmed by a set of coils (D) (D), which are connected in series with the brushes (B) (B) and with the external circuit. These coils, overpowering the magnetizing action of the armature current between brushes (B) (B), produce a magnetization proportional to the current in the external circuit at right angles to that produced by the shunt coils (C) (C). This cross-magnetization induces an electromotive force in the armature which is a maximum at the points displaced 90 degrees from the brushes (B) (B). At these points a second set of brushes (B′) (B′) is placed, and in series with these brushes are connected two sets of coils (E) (E) and (F) (F). The coils (E) (E) assist the coils (D) (D) in producing the cross-magnetization of the machine, while the coils (F) (F) oppose the magnetizing effect of the main coils (C) (C).

The operation is then as follows: A slight increase in the current in the external circuit, due either to an increase of speed of the machine or a decrease of resistance in the external circuit, increases the cross-magnetizing effect of the coils (D) (D), and consequently increases the potential between the brushes (B′) (B′). This increased potential increases the current in the coils (E) (E), which further increases the potential across the brushes (B′) (B′), and the increase of current in the coils (F) (F) reduces the main-field magnetization of the machine. The current output of the machine is thus kept substantially constant over a wide variation of speed or with wide variations of resistance in the external circuit.

Telephone News from the Northwest.

The Northwestern Telephone Exchange Company will make extensions and improvements to its system in the Twin Cities. There will be installed in the addition to the Minneapolis Main exchange a switchboard with 9,000 connections. Through the country there will be a number of exchange buildings erected, as well as extensions and improvements to the system constructed.

The Northwestern Telephone Exchange Company had a meeting of its managers from different cities and towns of the Northwest in Minneapolis last week to consider the various phases of their work. A smoker and social gathering was held in the general offices. A theater party was also given the visitors by the company, and a banquet concluded the meeting.

H. H. Herrick has been appointed local manager of the Northwestern Telephone Exchange Company at Owatonna, Minn., succeeding Mr. Jensen, who is transferred to a position with the company in Minneapolis.

The Homestake Mining Company of Lead, S. D., will install a complete telephone exchange for its plant. The switchboard will be for 100 connections.

The Northfield Telephone Company of Northfield, Minn., has been incorporated with $25,000 capital stock by William Ebel, D. D. Turner and A. L. Dixson.

C. L. Wilcox has sold the Interurban Telephone system, with exchanges at Orange City and Alton, Iowa, to Y. Dykstra, the consideration being about $10,000.

The Western Electric Telephone Company has decided to put in a new central-energy switchboard at Mason City, Iowa, and make other improvements, the total cost being about $60,000.

The Eden (Iowa) Mutual Telephone Company has filed articles of incorporation with a capital stock of $5,000. C. L. Giggins is president and George S. Angier secretary and treasurer. R.

Indiana Telephone Items.

The Central Union Telephone Company at Shelbyville, which recently took over the Mutual Telephone Company, has transferred all the lines connecting this company and the country exchanges in Shelby County to the new switchboard, which has just been installed at the Main exchange. In a few days the subscribers of these several systems will all be connected up for service over the Central Union line.

The advantage of maintaining a school to train substitutes for telephone service was demonstrated at Logansport a few days ago, when the girls employed in the exchange of the Home Telephone Company walked out because they were not granted a half-holiday. Their places were readily filled by trained substitutes from the school, and the force of 40 operators was completed within an hour.

Rumors to the effect that the Central Union Telephone Company is about to absorb the Indianapolis Telephone Company and the New Long-distance Telephone Company, both owned and controlled by the same interests, are vigorously denied by Horace F. Hill, vice-president and general manager of the Central Union Telephone Company, and by George C. Hitt, secretary of the Indianapolis company. Both companies are constructing large and commodious central-exchange buildings which will be installed with the latest equipment. The relations between the two companies are sufficiently harmonious to give the city and the state as good telephone service as exists anywhere.

The financial report of the Delaware and Madison Counties Telephone Company for 10 months of this year totals in gross income $80,329.36; operating expenses, taxes and insurance, $45,645.51, leaving a net income of $34,683.85.

When the City Council of Lebanon, Ind., gave the Central Union Telephone Company an exchange franchise it neglected to limit the rates that might be charged for service. The company announced that the service would be free until 300 subscribers were secured. When the 300 were secured it continued the free service until 400 subscribers were secured, which was announced on November 1st. After having had free service for a year the patrons are objecting to the payment of charges of 25 per cent. in advance of the rate charged by the Independent company in the city, and in consequence thereof some are refusing to pay the excess. S.

Pacific Slope Telephone News.

The Pacific States Telephone and Telegraph Company, which became an Oregon corporation a few years ago and made its head office nominally at Portland, Ore., although the heavy office work has always been carried on in San Francisco, has announced its intention of reincorporating under the laws of California. An officer says that the company's capital stock is to be increased to $50,000,000. It is proposed to authorize bond issues of $10,000,000, $15,000,000 and $20,000,000 five per cent. bonds to be issued when required for betterments and extensions. Plans are being considered for a reorganization, including, it is said, the issuance of six per cent. preferred stock and common stock to shareholders, in lieu of the present stock. The present capitalization of the company is $17,000,000, of which 85,172 shares or 50.10 per cent. of the total is owned by the American Telephone and Telegraph Company of New York. The service covers practically all of California, Oregon, Washington, Nevada and parts of Idaho and Arizona.

This company has bought a Market Street lot opposite the Palace Hotel and west of the Crocker Building, paying the highest price for realty in San Francisco since the fire. The company will erect a building on the new site for use as a pay station. A new exchange building is being erected by this company on the Piedmont hills in Oakland at a cost of $40,000. The Piedmont office will in the future handle the entire service for that district.

A direct telephone line between Sacramento, Cal., and San Francisco is projected by the Pacific States Telephone Company. Oroville and Oakland are to be the only intermediate offices.

The farmers of Clear Creek, Nevada County, Cal., who have organized a telephone company with E. B. Odell as president, have commenced the construction of a pole line to connect their district with Grass Valley.

The Siskiyou Telephone Company, which has purchased 10 miles of wire, will at once extend its line from Sawyer's Bar, Cal., to the Gold Ball mine, Lucky Bob mine and the Holman Fosket mine.

Albert Held, architect, announces that contracts for the Home Telephone Company's building in Spokane will be awarded in December. The building will cost between $60,000 and $70,000. Work is now progressing on the excavating, and the company is actively at work setting poles and otherwise preparing for the establishment of the automatic service. President Tucker says the new exchange will be in operation in eight months.

The Pacific States Telephone and Telegraph Company has made arrangements with the owners of the rural telephone lines at Athena, Ore., to use them in conjunction with its line. In a few days a new switchboard will be installed and both lines connected at one office. A.

Concrete Telephone Poles Attract Attention.

The Richmond (Ind.) Home Telephone Company's reinforced-concrete telephone pole, described in the Western Electrician, is attracting attention of telephone and telegraph companies in many parts of the country. The first pole constructed was set in position on Thanksgiving Day, and the company is preparing to set a mile of the posts in a few days. The pole was designed by Superintendent Bailey, and he is receiving many letters from the heads of big telephone and telegraph companies asking for information. As no patent on the pole is possible, he is giving the information freely. He says that the concrete poles can be manufactured for $6 apiece. Four twisted steel rods are used to form the skeleton work, and the concrete is "poured" about these in the mold.

Telephone Negotiations in Chicago.

It is reported that an agreement has been reached between a group of Independent telephone men interested in the large Independent telephone systems throughout the country and the Illinois Tunnel Company of Chicago, whereby the former will operate the automatic telephone system of the tunnel company in Chicago under lease. The Chicago automatic system is to be developed and extended into a first-class local system, giving long-distance connection with the outside lines of the Independents or any other lines. Those interested in the new venture have appeared before a council committee and laid before it some of their plans.

In the meantime the council committee is still hearing the claims of the Chicago Telephone Company and the Manufacturers' Telephone Company, the former seeking a renewal of its franchise and the latter asking for a franchise, with the view to succeed the Chicago company.

GENERAL TELEPHONE NEWS.

The Mount Zion Rural Telephone Company of Cashion, Okla., has been incorporated with a capital stock of $20,000.

A. D. Jones, a physician of Louisville, Ky., who has perfected a telephone that can be used from a moving train, has, according to a Louisville dispatch, received an offer of $100,000 from Chicago promoters for his rights to the invention. But Dr. Jones has declined the offer.

The latest edition of the Chicago Telephone Company's directory required 300 tons of paper in its making, besides furnishing employment for a small army of compilers, proofreaders, printers and pressmen. The volume contains over 160,000 names, and approximately 168,000 copies were issued.

Among the recently incorporated telephone companies are the following-named: Sullivan Telephone Company, Sullivan, Wis.; Canton Telehone Company, Canton, Kan.; Spring Ranch Telephone Company, Spring Ranch, Neb.; Deep Fork Telephone Company, Oklahoma City, Okla.; Hickory Hill Telephone Company, Rich Hill, Mo.

The monthly instrument statement of the Chicago Telephone Company shows that the net gain in the number of telephones installed in the city during November was 1,671, and in the country 750, a total increase of 2,421. On November 30th the company had in service in the city 121,734 telephones and in the country 46,797, a total of 168,531.

The Roberts Telephone and Electric Company of Abilene, Texas, has in transit the material for the erection of a 40-mile toll line, 1½ circuits No. 12 iron, between Abilene and Stanford, along the right-of-way of the Abilene and Northern Railroad, and will add other circuits when necessary. The company hopes by the first of the year to have this line completed and ready for business.

The Rocky Mountain Bell Telephone Company is extending its lines. Besides completing the line to Spokane, by which two circuits do the work of three, and almost completing the Bonners Ferry composite line, which may be used for telegraph and telephone purposes, connecting Cœur d'Alene with Iola, Elmira, McArthur, Naples, Moravia and Bonners Ferry, it has begun another line to Harrison by way of Fourth of July Canyon. These improvements are expected to greatly facilitate business between these points.

The official report of the Chicago convention of the National-Interstate Telephone Association, held in June, has been published in a book of 248 pages. It is a complete record of the proceedings—papers, reports, addresses and discussions—and gives names of officers and committees and all those attending the convention. The constitution of the new association formed at the convention is given, the whole forming an authentic history. Sample copies may be had at a nominal figure by addressing the International Independent Telephone Association, Electric Building, Cleveland, Ohio.

An application for an Independent telephone franchise has been refused by the council of the village of Norwood. It was strenuously opposed by Philip Fitzsimmons of Cincinnati, who has an Independent franchise for that city, with trunk lines built throughout Norwood, and who expects shortly to bring the Independents into Cincinnati through the Fitzsimmons Independent Telephone Company. This company will then be able to serve the entire Millcreek Valley with Cincinnati service as well as with connection with the Independent long-distance lines. The Queen City Telephone Company has an application pending before the Probate Court having been refused by the City Council last July.

The telautograph is said to have been installed in a Cincinnati hotel for the use of guests in ordering their meals. The guest writes his order and it is immediately transmitted from the dining room to the kitchen. Each order has a duplicate, and aside from the time and labor saved, all dispute as to mistaken orders is avoided.

CORRESPONDENCE.

Continental Europe.

Paris, November 21.—Under the title of Sociedad de Aparatos Industriales y Domesticos, a stock company has been formed in Madrid whose main object is to handle all kinds of apparatus relating to electricity, water and gas. This company is agent in Spain for the important French houses Maurice Eyquen and the Société Lyonnaise de Mecanique et Electricité, and from now on it will take a leading position in the trade, carrying a large stock, in which special attention will be given to current meters. Another new company, lately formed at Barcelona under the name Electra del Segre, will carry on operations relating to hydraulic plants, and especially intends to operate a series of falls in the Segre River and the Urgel Canal, transmitting power to Artesa and elsewhere upon an overhead line at high voltage, covering a large district in the province of Lerida.

Tempering of steel can be well carried out by the new Koerting furnace, which is brought out at Berlin. Great accuracy is obtained by the use of a magnetic indicator which allows of determining the heat of the tempering very closely, by estimating the magnetic field in the steel specimen and thence deducing the temperature, owing to the relation between the critical heat and the loss of magnetism in the steel. As to the furnace itself, it is formed of a refractory box containing metallic salts. Into each end passes a carbon electrode. According to the current, the melted bath can be brought between 750 and 1,325 degrees centigrade; the current varies between five and 50 volts. By means of an electric pyrometer based on the thermo-electric principle, the temperature of the bath is obtained. For steels which are to be worked in the lathe at a high speed, the tempering heat lies about 1,100 or 1,300 degrees. An ammeter, however, will give an approximate idea of the heat, after some practice. This form of furnace has the advantage of giving a uniform heat to the pieces, while with gas and coal there is some risk of overheating certain parts of the pieces. No oxidation is found in this case. Only one-fifth of the time is needed to bring the steel to the temper, compared with other methods, while the furnace can be brought from cold up to the working heat in half an hour. Besides, it is quite portable and easily handled. On the tests, it was found that the energy required per square centimeter of electrode was 1.4 watts for a heat of 1,000 degrees, 2.2 for 1,150, and three watts for 1,300 degrees.

In the new tungsten-filament lamp, brought out by Just and Hanaman of Germany the construction of the filament includes three phases, first, covering a carbon filament with a layer of tungsten; second, combining the carbon and metal so as to give a carbide of tungsten; third, to drive off the carbon by heat or oxidation, leaving the tungsten. A very fine carbon filament is flashed in a gas containing tungsten in order to take on a coat of the latter. Then to combine the two elements, the current is raised so as to give a higher heat. This is done in an inert gas, such as hydrogen. Lastly, the carbon is volatilized off at a very high temperature lasting for 24 hours, in vacuo. This lamp is said to have been tested at 1.05 watts per candle, for a 12-candlepower lamp, and lasted for over 3,100 hours.

A project of some importance has been organized in the mining region in the north of France by the Société Industrielle du Nord upon the designs of Engineer Lebon. The company proposes to erect a central generating station of considerable size which will produce 15,000 horsepower. The greater part of the current will be supplied by 2,000-horsepower engine and alternator units on the three-phase system at 5,000 volts, for distributing upon an overhead network within a radius of 30 miles. For the outlying districts the voltage will be raised to 30,000 volts by step-up transformers. It is stated that the cost of installing the plant will be somewhere near $1,000,000 As to the overhead lines, they will be of 100-square-millimeter copper wire and mounted on heavy poles of armed beton, spaced about 100 feet apart. The cost of a pole will be $50, and the cost of running such a line is estimated at $300,000, which, with $200,000 for the transformers in the sub-stations, gives a total cost of $1,500,000. Counting a total efficiency of 70 per cent. for the plant and an average yearly load factor of 35 per cent., it is estimated that about 30,000,000 kilowatt hours will be the output of the plant.

Great Britain.

London, November 21.—One of the London financial daily papers has announced the probability of considerable modification of the London County Council power bill. It is suggested that instead of the council working the undertaking, it should build the generating station and lease the undertaking to a private body, on conditions, leaving it to the latter to lay the mains and develop the business on ordinary lines. Such a compromise, there is reason to believe, would meet with the approbation of the president of the Board of Trade and a number of the progressives on the Council, and, on the other hand, if the County Council persist in carrying on the undertaking, there is every prospect of considerable opposition from its own party. As a matter of fact, there is nothing whatever new in this suggestion, for the promoters of the Administrative County of London and District Electric Power Company made an identical offer to the County Council last year, but the idea was scouted as preposterous.

In the midst of all the undignified squabble between private enterprise and municipal ownership, it has for long been a matter of surprise to me that the members of the County Council, in connection with this question of compromise, should have so persistently—either wilfully or negligently—overlooked a striking object lesson which is before them every day. The whole of the electric-tramway systems of Middlesex and Hertfordshire are operated upon such a scheme, with notoriously beneficial results all round. The County Council of Middlesex, for instance, provided the capital for, and laid, the permanent way, while the tramway company erected the overhead equipment and provided the rolling stock and energy. All losses are naturally borne by the company, while profits are shared in the order of about 60 per cent. to the company and 40 per cent. to the municipal authority, or something in this proportion.

The industrial condition of the electrical industry, brought about obviously through the supply being greater than the demand, is giving rise to considerable thought upon the part of the larger electrical manufacturing companies. The Times, in its engineering supplement, takes the matter up now and points out that unquestionably the depression is responsible for many dynamos and motors being sold which are falsely rated, and suggests that a system equivalent to the practice in regard to weights and measures would be a boon, there being penalties for shortage in horsepower, for instance. The following sentence has been since quoted as not being altogether uninspired and with a pretty good hint from which quarter. It runs thus: "For the commercial depression in this branch of manufacture (the electrical industry) there are only two possible remedies. Either we must witness the complete or partial closing of some of the larger works, or there must be formed an association for the avoidance of desperate competition." As a matter of fact, meetings of electrical-manufacturing firms have been held, but little publicity, naturally, has been given to them. There is no doubt that something approaching a desperate condition of affairs is coming upon the industry, and immediate measures must be taken if a repetition of the German troubles a few years ago is to be avoided. The following significant remark may be noted from an electrical financial journal: "It is clear that the company which has been the main cause of the present depressed situation must not look to its rivals to assist it out of the pit it digged for others."

There is no doubt that the comparative failure of the London electrified steam railways is acting as a strong deterrent to those suburban-railway companies which are to be looked to by the electrical industry as providing plentiful work in the near future. Every one of the London companies has a suburban zone distinct from its main-line traffic, and the conversion of these lines to electric traction may be regarded as lawful business by the electrical firms. The London and North Western Railway Company contemplates the building of a special electric line on one of its branches, but it is merely on paper yet, while the Great Northern Railway Company is now reported to be dissatisfied with any of the proposals put before it.

The Mersey Docks and Harbour Board (Liverpool) is ordering some electrical sound-transmitting apparatus from the Submarine Signal Company of Boston. The apparatus in question has been experimentally used for three months, and it is stated that the sound can be heard three times the distance traveled by the sound of a foghorn. Even on vessels not fitted with the picking-up apparatus, it is possible to receive the sounds by placing an ear against the vessel below the water line.

In the electric-lighting order granted to the Bermondsey Corporation in 1902 was inserted the original of the now famous Bermondsey clause which provides that the prices to be charged during any year shall be so adjusted as to preclude any call upon the rates. The gas companies were the framers of this clause, their object being, primarily, to protect themselves against unfair competition. The Bermondsey Borough Council, however, has also competition from electric-supply companies in respect of its electrical undertaking, and one of the latter quite recently offered a supply for public lighting at a lower price than the council charged itself. Of course, the offer was rejected and the managing director of the company has now petitioned the local government board on the methods which characterize the bookkeeping on the part of the Bermondsey council As ratepayers, of course, the company is affected considerably in this matter, for the difference between three cents per unit (the company's price) and five cents per unit, at which public lighting stands in the council's books, would mean a saving of $5,500 annually to the ratepayers. G.

Dominion of Canada.

Ottawa, December 1.—The special committee of the City Council of Galt, Ont., has recommended that an agreement be entered into with the electric-light company of the city, to extend over five years, giving the city power of nullification at the end of three years, on six months' notice. The cost is to be 25 cents per lamp per night, on moonlight schedule.

Tests in telephoning over telegraph wires have been conducted by the Canadian Pacific Railway between North Bay, Ont., and Montreal, Que., a distance of 600 miles. The experiment proved successful, and it may result that the railway will employ its wires for a public telephone business.

The city of Ottawa will enter into an agreement with the Ottawa and Hull Power Company for leasing some 3,000 horsepower of electrical energy for the next 10 years at a rental of $15 per horsepower, the supply to be given at the discretion of the city, and paid for in lots of 100 horsepower. The Ontario Legislature will be asked to empower the city to borrow, on a vote of the property owners, $500,000 for the purchase and development of a civic power plant, or, in the alternative, for power to lease or purchase electric power for the purposes of the municipal electric plant. This indicates that the policy of the city is to secure a supply of power for 10 years and then to have a power plant belonging to the corporation.

A company is being formed for the purpose of developing 40,000 horsepower on the Quinze River at the head of Lake Temiskaming. The power will be used for mining purposes in the Cobalt silver-mining region, which is only 18 miles distant, and also for lighting purposes, as well as for an electric railway to run from New Liskeard to the source of the power. There will also be ample power to operate a large pulp and sawmill industry, to be established on the Quinze River. A number of prominent Canadian financial and business men are interested in the project, P. J. Loughrin of Toronto for the present acting as secretary for the proposed company.

Cecil B. Smith, engineer in charge of the hydro-electric works at Winnipeg, Man., has returned from that point, where he has been organizing a staff and superintending the work of drafting and planning of the work. Winnipeg is much in earnest about the development, as it forms part of the means which contribute to the city's rapid growth. The power to be developed at Point du Bois, although designed for an ultimate 60,000 horsepower, will for the present be restricted to 25,000 horsepower. However, it is clear that the full developmentt will be needed soon. When it is required, there is, at many other falls on the river, half a million horsepower available. The Point du Bois power is 77 miles distant. There are no engineering difficulties in the way of the work, which is a straightaway task, and simply has to be executed. With the large pondage behind the falls, the installation, when complete, with 60,000 horsepower available, will be capable of carrying a high-peak load of 100,000 horsepower. It is said that the city will undertake a campaign for mills and factories as soon as power is available. W.

Winnipeg, Man., December 1.—Francis Dagger, Manitoba government telephone expert, is now touring the country and holding two meetings each day for the purpose of explaining to the electors the government's plan for the government and municipal ownership of telephones. At the next election, which will be held early next year, the government will promise to pass a bill, if returned to power, to authorize the municipal ownership of all telephones in the province and the building of a long-distance line by an Independent company under the control of the government. Mr. Dagger states that if the government is returned on this policy the price of telephones will be reduced by fully 50 per cent. Both parties are indorsing the proposition, and it appears as though the days of the Bell company in Manitoba are numbered.

The Nepigon Pulp and Paper Company, whose waterpower concessions on the Nepigon River, Port Arthur, have been cancelled by the government, is contending that it paid its rentals and therefore its lease could not be cancelled. It has also gone so far as to submit the terms of the detailed contract to the council of Port Arthur for the furnishing of power from the Nepigon River. The council is considering the offer and is awaiting estimates from the hydro-electric power commission. The Hon. Mr. Beck, chairman of the commission, says the offer of the company is to furnish high-tension power at $15 per horsepower a year up to 3,000 horsepower. Above that the company wants $20 per horsepower. The town would also have to build a transforming station costing $50,000 and guarantee the company's bonds for $100,000. Considering the very favorable conditions in the district Mr. Beck does not consider the offer a fair one.

Superintendent G. V. Reed of Moosejaw has handed in his resignation to the City Council and

has accepted the position of superintendent of the telephone and electric-light plant at Kenora, Ont.

The council of Glenboro, Man., is considering a proposition to install an electric-light plant to light and supply power for the town.

The Edmonton City Council has rejected the offer of the Canadian White Company, Montreal, to build, equip and operate an electric street railway in that city, and has decided to build the electric railway itself and operate it under municipal ownership. Mayor May can give particulars.

The Edmonton City Council has offered to install an extension of its automatic telephone system into Strathcona, the town across the river, if the latter will grant a 20-year franchise. At the present time Strathcona is without telephones, and it is very probable the offer will be accepted.

W. M. Alexander of Brandon, Man., has made an offer to the Calgary City Council to build and equip a street-railway system and an electric-light plant in that city. Mr. Alexander is backed by a syndicate prepared to finance the deal to the extent of $500,000.

Charles H. Mitchell has been engaged by Prince Albert, Sask., to figure on a proposition to develop waterpower for electrical purposes in that city. Robert J. Hartley, Prince Albert, Sask., can give information.

The council of Fort Francis, New Ontario, has rejected all tenders received for the proposed electric-light plant, as the council has decided not to erect the plant.

The Revelstoke, Trout Lake and Big Bend Telephone Company has made connections with Arrowhead, B. C., and the new long-distance system is in operation. A number of other extensions are planned by this company. William Cowan is president of the company. R.

New England.

Boston, December 1.—L. G. Knight & Son will use electric power in their new machinery manufactory at Gardner, Mass.

The Consolidated Railway Company has finally purchased control of the so-called Ray system of electric railways, comprising four roads with a trackage of 71.8 miles and capital aggregating $1,012,000. These companies owned railway lines between Providence, R. I., and Milford, Mass., and between Pascoag, R. I., and Plainville, Mass. The Consolidated company now controls direct electric railways between Worcester, Mass., and Providence, with the exception of eight miles. Last summer, in compliance with the Massachusetts law, as then interpreted, the New York, New Haven and Hartford Railroad Company announced that it had disposed of all its holdings in electric companies in this state. As the Consolidated company is a subsidiary of the railroad company, it is likely that the law has been reinterpreted. The Woonsocket Electric Machine and Power Company has a contract to supply power for the Ray system of roads for 20 years.

The Electrical Securities Corporation reports for the year ended October 31st, as follows, compared with the previous year: Receipts, $542,930, against $326,022; expenses and interest, $233,131, against $237,434; preferred dividend, $50,000, against $50,000; balance, $259,799, against $38,588; surplus, $244,808, against $38,588. The company was formed in 1904 to buy and sell the securities of electric railway, light and power companies. The General Electric Company holds a large amount of its stock.

The Edison Electric Illuminating Company of Boston has voted to petition for authority to increase its capital by the issue of 24,200 shares of new stock, the proceeds to be used for meeting the floating debt incurred by extensions and for additions to its property. During October the company obtained 825 new customers and received orders for 22,868 incandescent lights, 111 arc lights, and electric motors aggregating 737 horsepower, a gain of 35 per cent, compared with October, 1905.

Dr. Reginald A. Fessenden has presented a Fessenden wireless-telegraph receiver to the engineering department of Howard University. The apparatus will be used for experiments and instruction.

Allan W. Paige and associates have bought the franchise and rights-of-way of the Troy, Renssalaer and Pittsfield Electric Railway for $58,000. This road was to be 52 miles long. It is understood that the purchase was made for the Connecticut Railway and Light Company.

The Atlantic Insulated Wire and Cable Company, whose leased quarters were recently burned, has awarded the contract for a concrete building, 84 by 350 feet, in Stamford, Conn. New machinery has been ordered and the contract calls for the completion of the plant within 60 days.

The Pittsfield Electric Company has been authorized to issue bonds amounting to $50,000 and stock amounting to $75,000 by the Massachusetts Gas and Electric Light Commission. The stock is to be sold at 135. The proceeds from these securities are to be applied to the payment of debt incurred for the Silver Lake station and other improvements and additions to the company's plant.

The New England Telephone and Telegraph Company is planning to lay a cable across Lake Champlain to connect Burlington, Vt., and Plattsburg, N. Y. The company is building an exchange in Burlington. B.

New York.

New York, December 1.—The combined elevated and underground system of the Interborough Rapid Transit Company took in 1,486,777 fares on Monday, November 25th, and established a new record for the heaviest day of traffic. More passengers were carried than ever before in the history of the combined or separate companies. The income for the day to the company was more than $74,000. The elevated lines carried 917,143 passengers, an increase of 88,235 over the corresponding day last year, and a gain over the best day in 1904. The Subway carried 569,634 passengers, which is an increase of 83,324 passengers over the corresponding day of last year.

On this business of one day the total revenue of the Manhattan lines and the Subway shows an increase of $8,534.92 over the corresponding day of last year. General Manager Root said that about 50 more cars have been put in operation in Manhattan, making a total of about 1,600 cars in daily operation.

It is probable that the Interstate Commission will recommend two bridges between New York city instead of one as at first contemplated. This commission was appointed by Governor Higgins of New York state and Governor Stokes of New Jersey for the purpose of looking into the plans for connecting the two cities. The committee is ready to begin drafting its report. It is said that a rough estimate of the cost of the spans of the two bridges alone would be from $25,000,000 to $35,000,000 each. This is entirely outside of the cost of approaches and terminals.

The Westchester Lighting Company, serving a large residence and suburban section, extending from Long Island Sound to the Hudson River and from the Borough of the Bronx to Tarrytown, has a modern central-station plant at New Rochelle, the principal feature of which is an Allis-Chalmers 1,500-kilowatt steam-turbine generating unit, now being installed. The electrical power generated here is three phase, 60 cycles, 13,200 volts and is used mainly for lighting purposes. The power house has six water-tube Stirling boilers, 250 horsepower each, and two Babcock & Wilcox boilers of 524 horsepower each. Coal is brought up the channel in barges to the company's docks, where it is hoisted and conveyed by automatic coal-handling devices. The main generating units are operated condensing, the reciprocating engines and the new Allis-Chalmers turbine being equipped with jet condensers. The electrification of the lines of the New York Central and Hudson River Railroad, and of the New York, New Haven and Hartford Railroad, both of which run through the area fed by the Westchester company, have brought with them a new impetus to the growth of the district.

The present subway system in this city, according to figures printed in the Wall Street Journal, is 24.5 miles in length, and cost approximately $50,000,000, or an average of $2,040,816 per mile. This is considerably lower than the estimated cost of the new lines which the Rapid Transit Commission proposes building in the near future. However, in comparing the cost of the present system with the estimated cost of the proposed lines, it must be remembered that portions of the present line are built upon an elevated structure. The greatly reduced cost of building an elevated line would tend to reduce the construction average per mile considerably for the whole system. The cost of the subways, as given below, includes the construction of the tunnel, building of stations and laying of tracks. The installation of power-transmission appliances, building of power houses, and purchase of necessary rolling stock comes under the head of equipment, which can reasonably be figured at $1,000,000 per mile. The following shows the lines which are to be built, the mileage, and the average cost of construction per mile: Eighth Avenue, 10.3, $2,367,475; Jerome Avenue, 5.5, $2,522,181; Lexington Avenue, 13.1, $2,328,244; Third Avenue, 13, $2,020,384; Bronx extensions and additions, 12, $843,750. The Bronx lines will be mostly elevated structures, hence the lower cost of construction.

Assemblyman W. R. Oglesby of Westchester on November 27th called the attention of the Yonkers Common Council to the method employed by the New York Central Railroad Company of carrying its electric power through the cuts below Yonkers. He described the iron pipes which run on the side of the retaining walls. Inside the pipes are insulated cables. Mr. Oglesby is said to have explained that in case of accident or the derailing of a car it was likely that these pipes would be smashed, the insulation torn off, and a fire would result. It appears that the danger exists both on the Harlem and Central divisions. Mr. Oglesby believed that the pipes should be buried. The matter was referred to the railroad committee of the aldermen for consideration. C. I. C.

Southeastern States.

Charlotte, N. C., December 1.—The Radford (Va.) Water Power Company, operating a street-car system and lighting the town of Radford, has been sold to J. L. Vaughan of Shawsville, who is president of the Southwest Virginia Agricultural and Live Stock Association.

The final tests of the plant of the Merchants' Power Company at Memphis, Tenn., have been made, and the big plant appears to be a perfect piece of work. Electric lights will be supplied free to the city on Main Street to the number of 50, while the conduits are in place and the cables are to follow at once, so that the plant can be supplying lights with no delay.

The Macon and Albany (Ga.) Securities Company has organized the Macon, Americus and Albany Electric Company. Nicholas J. Cruger of Albany is president. According to the plans, the long lines are to be complete within 18 months.

The Maryland Trust Company at Baltimore recently delivered $750,000 of the deposited United Railways income bonds, each owner of these $1,000 bonds also receiving $100 in the new funding bonds. The trust company had $2,000,000 ready for delivery, but those notified did not appear on the date named.

March 1st has been set as the date on which electric power from Buckhorn Shoals will be sent into the town of Fayetteville, where many industries are awaiting the coming of the new electric power.

J. M. Hodges proposes to install a lighting plant in the town of La Grange, N. C. L

Ohio.

Cleveland, December 1.—The new car barns and shops of the Lima-Toledo road at Lima have been completed and the machinery and other equipment is now being placed in them. All the repair work for the Northern Ohio lines of the Schoepf syndicate will be done at the shops, it is said. Up to this time, the only road in operation is the Lima-Toledo from Lima to Leipsic. The line from Lima to Defiance will be electrified and a road built from there to Columbus. The connection with the Fort Wayne, Van Wert and Lima is also close, however, and in case a large power house is built here, it may furnish current for all the roads named.

Interurban men will meet with the state railroad commission the coming week to discuss the application of the new laws to their lines. The members of the commission are working toward co-operation with the owners in their supervision of these roads.

The Toledo Railways and Light Company will have a sight-seeing car for use next summer. It is now about completed and will be dedicated by the newspaper men who will make a trip to Ottawa Beach as the guests of the company.

The Toledo and Western will be sold at public sale on December 5th subject to underlying bonds amounting to $1,500,000. The price offered must cover the floating debt of the company.

Work on the Columbus, Marion and Bucyrus between Marion and Bucyrus is being pushed along rapidly, and, if possible, will be continued through the winter. The plan is to have it in operation as early in the summer as possible.

Cleveland traction men are anxiously awaiting the decision of the United States Supreme Court on the injunction case of the Cleveland Electric Railway Company against the city and the Forest City Railway Company. Court convenes Monday, but the decision may not be rendered for some little time.

The refinancing plan of the Cleveland and Southwestern will include the payment of back dividends of 10 per cent. to the holders of preferred stock on March 1st. The committee will probably meet at an early date to report upon other phases of the business. The road is making an excellent showing now.

Plans have been perfected by the Cleveland, Brooklyn and Elyria Railway Company to build its line into the city and across the "flats," where a road has been desired by the business men for some time. Arrangements have been concluded with the Wheeling and Lake Erie, it is said, by which the electric road will parallel it and run to the depot on West Sixth Street, within a short distance of the Public Square. This will give the road an advantageous entrance to the city.

It is said that the traction roads will endeavor to compel interchange of business with the steam roads through placing themselves under the jurisdiction of the Interstate Commerce Commission and operate under the Hepburn law.

As a taxpayer, the Cleveland Electric Railway Company has filed another injunction suit to prevent the Forest City Railway Company from using Quincy and Central avenues. The allegation is again made that the mayor is financially interested in the company.

Bids on a number of the new routes on the East Side at Cleveland will be opened the early part of the week and a fight for consents will probably commence at once.

Waterworks officials at Toledo claim that electrolysis is damaging the water mains. They have been making experiments to ascertain whether much damage has been done.

Bids will be received on December 10th for furnishing current for the state house lighting, but it was left with the committee as to whether it is expedient to establish a plant in the building.

People of Bryan will vote upon the question of issuing $40,000 bonds for the improvement of the municipal light and water plant.

New hard-coal heaters are being installed in

the cars of the Toledo Railways and Light Company.

The Cuyahoga County Building Commission has instructed the county commissioners to purchase or lease ground on which to build a light, heat and power plant for the buildings to be included in the group plan at Cleveland.

The City Council has passed an ordinance authorizing the Board of Public Service at Cleveland to advertise for bids for the electric street lighting for next year.

At a meeting of the stockholders of the Union Gas and Electric Company of Cincinnati a few days ago, the directorate was enlarged by the addition of four new members. Norman Plant and Henry L. Doherty of New York and Theodore Clauss and Harry Nordicka of Cincinnati are the new members.

The Millcreek Valley Electric Company of Elmwood Place has been incorporated with a capital stock of $10,000 by George R. Feltes and others. An electric plant to supply heat, light and power will be erected.

The electrical workers gave their twelfth annual ball at the Grays' Armory in Cleveland on the evening of November 28th. About 800 people attended the ball, which was considered a success in every way. O. M. C.

Michigan.

Grand Rapids, December 1.—Announcement is made by E. M. Hopkins of Detroit that funds have been secured and contracts let for four interurban roads which will form a trans-Michigan system connecting Detroit and Grand Rapids. The line was proposed some time ago and the grading begun about a year ago at various points, but the required backing could not be found. The W. A. Cullen Construction Company of New York has the contract for construction of the lines under a surety bond of $100,000. They are to be completed 18 months from March 1, 1907.

The four roads will be known as the Grand Rapids and Ionia, the Grand Rapids, Belding and Greenville, the Ionia and Owosso, and the Owosso and Pontiac, touching each of the towns named. The four companies have a bond issue of $4,250,000. The entire capital stock is $4,900,000. The officers and directors are: President, E. M. Hopkins, Detroit; vice-president, J. L. Hudson, Detroit; treasurer, John T. Rich, Detroit; secretary, Frank Wescott, Owosso; members of the board of directors, J. Boyd Pantlind, Grand Rapids; Robert D. Graham, Grand Rapids; Charles H. Pomeroy, Saginaw; John P. Hopkins and Edward Holmes, Detroit.

The city of Marshall is considering enlarging its municipal lighting plant to be able to furnish power to all the factories that desire it. Some of the aldermen want to take up the business which is now going to the Commonwealth Power Company when its franchise expires in five years.

The Northwestern Michigan Light and Power Company will issue bonds to the extent of a half million dollars for extensions and improvements. The bonds are protected by a trust mortgage and run for 20 years. Edward M. Deane of Grand Rapids is president of the company, Frank G. Deane, secretary. R. S. Kimball of Boston is the heaviest stockholder.

The right-of-way of the old Bay City-Saginaw Rapid Transit Company has been sold at a mortgage sale to Lee E. Joslyn and R. A. McKay, as trustees, in Bay City. It is not announced who they bought it for, but it is reported that it is for John H. Blomshield and D. J. Kennedy of Detroit, who hold a mortgage on the property. The right-of-way of the company is graded part of the way between Saginaw and Bay City.

The Michigan United Railways is considering the installation of a private telephone-exchange system for its employes in Lansing. The company is using the telephone for dispatching its cars.

The Michigan State Telephone Company has expended $10,000 in Bay City this season in conduit work. It will now begin the improvement of its overhead system. L. W. B.

Indiana.

Indianapolis, December 1.—T. A. Bell of St. Louis has been elected president of the Indianapolis, Huntington, Columbia City, Northwestern Railway Company, which is projecting a line between Indianapolis and Goshen, with chief offices in Indianapolis. Mr. Bell succeeds C. E. Merrifield. This line when constructed will be 156 miles in length. A portion of the road between Syracuse and Vawter Park is now under construction. The remaining divisions may be completed during the coming year.

The Columbus, Greensburg and Richmond Traction Company has effected a reorganization and elected officers, with A. M. Kuhn as president. The officials are now negotiating with Chicago capitalists for the financing of the road.

The officials of Indiana Union Traction Company are asking for bids for the construction of large electric-railway shops to be erected in North Anderson. The large building will be of stone, brick, steel and concrete, and will be fireproof throughout. Every piece of machinery will be operated by electric power.

Henry Watson Cornell of Chicago is in Indiana speaking to commercial bodies with a view of encouraging investments and investigations into the method and the work of the proposed Chicago-New York Electric Railroad Company, which proposes to build an electric road to transport passengers from Chicago to New York in 10 hours. The stock will be issued in comparatively small lumps, the company building a part of the road each time before issuing the next lump of stock.

The Winona Traction Company has completed and put in operation nine miles of road between Peru and Oakdale.

C. D. Emmons, general manager of the Ft. Wayne and Wabash Valley traction lines, denies that there is any truth in the recent press announcement that the Indiana Union Traction Company has purchased and would take over and operate the Wabash Valley line on January 1st.

Suit has been brought at Rushville against the receiver of the Indiana and Cincinnati Traction Company to recover $5,000 damages for the death of each man killed by coming in contact with a barbed-wire fence heavily charged with electricity in the vicinity of the company's power house.

Considerable interest is being manifested in the proposed electrification of the Louisville, New Albany and Corydon Railway Company's line in Southern Indiana. Seven miles of new road will be constructed between Corydon and New Albany, to be operated by electricity, after which the road now operated by steam will be changed to an electric road.

The responsibility of the Indianapolis Water Company and the Indianapolis Street Railway Company for damage to water pipes by electrolysis has been brought to the attention of the Board of Public Safety and the Board of Public Works. A large number of water consumers are complaining that electrolysis has destroyed the water pipes leading into their premises and are demanding that the officials locate the liability for such repairs, either upon the water company or the traction company.

The Chicago, Indianapolis and Terre Haute Traction Company has been organized with headquarters in Indianapolis. The company proposes to construct an interurban line from Lafayette to Terre Haute by way of Attica, and a branch line north from Attica to Fowler, Kentland and Kankakee, Ill., and from Attica to Rockville and Danville, Ind. These branch lines will give the road interurban connection at Kankakee into Chicago, and at Danville into Indianapolis. The territory through which it is proposed to build is a rich farming country and a score or more of towns and cities are enterprising and without interurban service. S. S.

Illinois.

Peoria, December 1.—George M. Meyers and Harry B. Field will install a new electric-light plant in Washington, Ill. They have begun a canvass for business and have secured enough to justify them in building the plant.

The Simpson Mutual Telephone Company of Rock Island has been incorporated with a capital of $2,000, to furnish telephone service. John R Harper is one of the incorporators.

The Springfield Belt Railway Company of Champaign has been incorporated with a capital of $5,000 to build a belt line around Springfield and to Jacksonville and Lincoln, Ill. This is another of the Illinois Traction Company's properties, and will be used to save hauling through traffic through the city of Springfield.

Much trouble was caused by electric wires at a large fire in the downtown district this week and has caused the proposition to place the lighting wires underground to be brought up again. This would require a new franchise for the local company. So far the citizens have not seen fit to recommend the ordinance which the company proposed; neither has the company liked the ordinance proposed by the citizens' committee.

President J. S. Daily of Chillicothe has issued a call for the Fifth District Independent telephone convention to be held in the parlors of the Hotel Tey on December 20th. A number of good speakers are on the programme. Secretary Cheadle is spending the first 10 days of the month on a trip through Canada, and his paper will deal with the telephone development in that country.

The Illinois Traction Company has now an entrance into St. Louis. Although it crosses 33 railroads, it has managed to get the crossings in. All are grade crossings but three, and much trouble was experienced in getting some of them in. The company has received several new cars for use on the south end; 12 are express trailers and will at once be put in service. Six new passenger cars, 55 feet long, with a seating capacity of 65 people, have been delivered and more are expected soon.

The Peoria Terminal Railway Company intends to buy the Peoria and Pekin terminal when it is offered for sale by the receiver, but if not able to purchase the property will build a road between Peoria and Pekin and give local service in Pekin also.

The Commercial Storage Battery Company of Chicago has been incorporated with a capital of $10,000. The incorporators are F. R. Swartout, J. C. Essick and Stephen D. May. V. N.

Mexico.

Mexico City, Mexico, November 25.—A network of long-distance telephone lines and local telephone systems in all of the principal cities and towns is to be constructed in the state of Vera Cruz by a company of Mexican and foreign capitalists, which is being organized for the purpose. Manuel S. de Cobera and J. Sitzenstatter, both of this city, have obtained a concession from the state government of Vera Cruz for the proposed enterprise. Mr. Sitzenstatter is an electrical engineer, who has had much experience in Sweden and Mexico in constructing telephone systems.

It is announced that several hundred thousand dollars will be invested in the enterprise. The terms of the concession provide that the work of constructing the system must begin within 18 months. It is stated by Messrs. Cobera and Sitzenstatter that as soon as the details for the organization of the company are completed the work of installing an underground telephone system in the city of Vera Cruz will be commenced. This will be within the next few weeks. All of the principal streets of Vera Cruz are to be paved with asphalt, and it is desired that the work of laying the underground telephone conduits shall be done before the paving work is begun. It is also planned to install local telephone exchanges in the cities of Cordova, Orizaba, Jalapa and a number of smaller towns. All of these cities will be connected by long-distance lines. The company will erect its own factory for manufacturing conduits.

There are many large sugar and coffee plantations in the state of Vera Cruz, and it is believed by the promoters of this enterprise that many of them will be glad to have telephone connection with the outside world. H.

Northwestern States.

Minneapolis, December 1.—Actual work toward the proposed trolley line from Minneapolis to Anoka, Minn., has been started by the surveyors for the Twin City Rapid Transit Company, which recently bought the line to Robbinsdale, and which will form part of the new road. A new bridge will have to be built across the Mississippi River at Anoka, and possibly one across the Rum River.

The council at Tecumseh, Neb., is considering the advisability of putting in a new electric-light plant.

An electric-lighting system is to be established at Wauneta, Neb.

An electric-light plant is to be built at McCool, Neb.

Plans are being prepared for a new dam for the lighting plant at Fergus Falls, Minn.

The Iowa-Missouri Traction Company has been organized for the purpose of building a trolley line from Fairfield, Iowa, to Memphis, Mo.

The Independent Gas and Electric Light and Power Company will ask for a light and power franchise at Davenport, Iowa.

Surveyors of the Milwaukee Electric Railway and Light Company are laying out the route of an electric line from North Milwaukee to Fox Lake, Wis.

Arrangements have about been completed for establishing a new electric-light plant at Pierre, S. D.

Joslin Brothers of Oshkosh and associates have organized a company for developing the water-power on the Peshtigo River, and transmitting power to Green Bay, Marinette and Oshkosh, Wis., and Menominee, Mich. The company will be capitalized at $600,000.

The Gorman Electric Company's plant at 315 Minnesota Street, St. Paul, was destroyed by fire on November 28th, the loss being about $12,000. R.

Pacific Slope.

San Francisco, November 28.—Regular electric car service has been inaugurated on the Hanchett electric street-railway system at Palo Alto, Cal.

The San Francisco Board of Works has granted the Van Ness Avenue Retailers' Association a temporary permit for the installation of 60 ornamental iron poles, each carrying two arc lights upon four by eight-foot stone safety stations, along the middle of the avenue, extending from Market Street to Pacific Avenue.

The Marin Terminal Railway Company, which has been planning the construction of a 22-mile electric railway southward from Petaluma, Cal., to Point Pedro, is preparing for construction work. The company will soon be in the market for electrical equipment for its proposed power house at Point Pedro, whence a line of fast ferry boats will make connections with San Francisco. The main office of the system is located in San Francisco.

Reports are in circulation that the Bay Counties Electric Railway Company, a rival to the Marin Terminal, will shortly begin work on a parallel line from Richardson's Bay to Santa Rosa and Napa. The name of R. M. Hotaling, former treasurer of the California Gas and Electric Corporation, is mentioned as one of the promoters of the new concern, which is said to have purchased for terminal purposes 1,000 acres of marsh land facing Richardson's Bay, at a cost of $100,000.

The Oakland Traction Consolidated, which controls the electric street-railway systems covering Oakland, Berkeley and Alameda, Cal., will hold a

special meeting of its stockholders on January 15th next, to authorize the creation of a bonded indebtedness of $12,000,000.

The Mendocino Electric Light and Power Company has closed a contract by which it will get its current from the Fort Bragg Electric Light Company. Current will be transmitted down the coast. A part of the existing pole line is being rebuilt.

The early installation of an electric plant at Battle Creek, Cal., is contemplated by the Battle Creek Power Company, which has been assured by engineers that 12,000 horsepower can be developed. J. A. Whitehead has found that there will be a market for the entire output of the proposed installation.

The Board of Trustees of Redlands, Cal., will receive sealed bids up to December 26th for the purchase of a franchise for electric light and power and for gas-lighting systems.

P. C. Carroll of Seattle, Wash., has brought suit against the Postal Telegraph Company for $1,000 damages, alleging that the company did not deliver a telegram which he filed in San Francisco announcing his escape from injury at the time of the earthquake last April. He also claims to have paid a fee of 25 cents for a second dispatch to Seattle, which he filed in Oakland. This, it is alleged, was not delivered.

The formation of a stock company at Fairfield, Wash., for furnishing commercial electric lights is being discussed. L. M. Collins has installed a small generator for lighting his machine shop and an increase of this installation is proposed for general lighting. A.

PERSONAL

The late Charles Merriam of Boston made a bequest of $25,000 to the Massachusetts Institute of Technology.

Thomas F. Delury, who has been connected with the Pacific States Telephone and Telegraph Company for 14 years, has been made local manager at Oakland, Cal., succeeding W. B. Hubbard.

Samuel Cabot of Boston, a member of the Corporation of the Massachusetts Institute of Technology, died at his home on November 27th, of pneumonia. He was 56 years old, and a manufacturing chemist.

Thomas Billingsley, assistant superintendent of the St. Paul (Minn.) City Railway Company, has resigned his position and has left for Spokane, Wash., where he will be general superintendent of the system in that city.

Announcement was made on November 23d by the Utah Light and Railway Company that F. L. Morse of New York will be superintendent of the Salt Lake street-railway lines. For some time Mr. Morse was superintendent of the electric lines of the Brooklyn Rapid Transit Company.

Everett E. Miles, who was formerly in the construction department at the Fort Wayne Electric Works and resigned to go to Panama to take a position in the electrical plant on the canal, has returned to Fort Wayne, Ind., after a sojourn of several months on the Isthmus. He is quoted in the Fort Wayne News as saying that the climatic conditions are not what he thought they would be and he was fast losing not only his health but his ambition. He resigned his position and has now resumed his former work at the electric works.

Mr. William H. Browne has resigned as director, treasurer and general manager of the Stanley Instrument Company of Great Barrington, Mass., with which he was connected for nearly five years. Since 1886 Mr. Browne has been engaged in the electric light, power, traction and manufacturing business. He began with the organization and building of the electric railroad and lighting plants in Richmond, Va., and was afterward general manager of the United Electric Light and Power Company, New York city. From 1895 to 1902 he was general manager of the Royal Electric Company, Montreal, Canada, thereafter going with the Stanley Instrument Company. While Mr. Browne has made no definite arrangements for the future, he anticipates undertaking the supervisory administration and management of several plants.

ELECTRIC LIGHTING.

The Garnett Electric Light Company has sold its plant in Garnett, Kan.

Oscar Nelson has been granted an electric-lighting franchise in Essex, Iowa.

The Columbian Electrical Company of St. Joseph, Mo., has increased its capital stock from $6,000 to $30,000.

The Clarendon (Ark.) Electric Light and Ice Company has sold its plant to the White River Ice and Coal Company.

The electric-light company of Omaha, Neb., will build a new sub-station for use in furnishing light to Benson and Dundee, suburbs of the city.

A modern electric-light plant has been installed in the hustling little city of Algood, Tenn. Although Algood contains less than 1,000 inhabitants, says the Nashville Banner, its stores, factories, mills, hotels and most of its residences are wired and securing the benefit of the electric lights.

The Iowa Electric Power Company of Keosauqua, Iowa, has been incorporated with a capital stock of $150,000 by William Walker and others.

A company to be known as the Battery Light and Power Company of Milwaukee, Wis., has been incorporated with a capital stock of $500,000.

A franchise has been granted to the Utica Gas and Electric Company at Frankfort, N. Y., to transmit power of the plant of the Continental Tool Company.

The City Council of Bisbee, Ariz., has adopted an ordinance granting the International Gaslight Company a franchise to maintain an electric-light and power system, with pole lines and conduits.

The Northwestern and Michigan Light and Power Company of Manistee, Mich., has been incorporated to succeed the Manistee Gas and Electric Company. The company will issue $500,000 in bonds for making extensions and improvements.

The municipal authorities of the city of Santa Anna, Salvador, Central America, have recently contracted with an American firm for the installation of an electric-lighting plant for its streets, stores and private houses. The power will be taken from the Santa Anna River.

The Merchants' Power and Light Company of Elgin, Ill., has accepted the ordinance granting it a franchise. The company will be reorganized and its capital stock increased from $2,500 to $100,000. For the present the company will rent the power plant already constructed. All that will be required to be installed is the generators and improvements in the wiring.

At a recent town meeting in Arlington, Mass., a committee on municipal electric lighting asked for further time for the consideration of the subject and an additional appropriation of $750 for expenses, but there was so much opposition that the matter was dropped for a time. The town has not been able to make a financial success of its waterworks, and this fact was used as an argument against municipal lighting.

Citizens of San Diego, Cal., are planning to extend the artistic street lighting in that city. Fifth Avenue is brilliantly illuminated, largely by arc lights. D Street is to receive attention now. No arc lights are to be used, all the lighting to be done by incandescent clusters. An iron post of graceful design is to be used and on the top of each post will be placed about five clusters of lights, each cluster being composed of three incandescent bulbs, enclosed in a large ground-glass globe.

Among recently incorporated electric-light companies are the following: Lake Arthur (La.) Light and Waterworks Company, capital $15,000; Citizens' Electric Light and Power Company, Wichita Falls, Texas, capital $10,000; Perkins (Okla.) Electric Light and Power Company, capital $5,000; Palestine (Texas) Electric Light Company, capital $40,000; Corpus Christi (Texas) Ice and Electric Company, capital $65,000; Brownsville (Texas) Water, Light and Power Company, capital $100,000.

ELECTRIC RAILWAYS

Hamilton Browne is said to be negotiating for the purchase of the local street-railway line in Marshalltown, Iowa, and he may extend it to Ferguson.

The Cleveland (Ohio) and Cheron Electric Company has been incorporated with a capital of $2,500,000. The company hopes to build and operate an electric railway connecting Cleveland with Cheron.

The traffic report of the Chicago and Oak Park elevated railway for the month of November shows that the company carried an average of 51,382 passengers a day, which is a gain of 1.52 per cent. over October.

The Buffalo and Lake Erie Traction Company and the Dunkirk and Fredonia Railroad have been consolidated at Buffalo. The name of the new consolidated company is the Buffalo and Lake Erie Traction Company. The capital stock is $4,070,000.

The electrification of 30 miles of the Rochester Division of the Erie Railroad will be completed by January 1st and it is expected that cars will be operated on that day according to report. The current will come from Niagara Falls and will be conveyed 225 miles.

The Ozark Traction Company has been incorporated with a capital stock of $80,000, for the purpose of building and operating an interurban railway from Waynesville, Mo., to Mountain Grove. W. G. Gan of Waynesville and J. J. Burns of Webster Grove are incorporators.

The federal court at Lincoln, Neb., overruled the objections of the Lincoln Traction Company to a confirmation of the sale of the franchise of the old Home Street Railway Company to the Citizens' Company and ordering that the deed transferring the property be made to include the franchise on all the streets of the city.

According to the annual report of the railroad commissioners of Connecticut, the electric roads carried nearly 50 per cent. more passengers during the year ending December 31, 1905, than the steam lines. The steam roads carried 64,403,149 passengers and the trolley lines 102,849,160.

The York County (Pa.) Traction Company intends to construct 125 miles of railroad within the county during the next few years, and work upon four or five lines will probably be begun this winter or next spring. Among these are the lines to Spring Grove and Hanover, to Paradise, Loganville and Glen Rock to Wellsville and Dillsburg, to Yorkana, and perhaps East Prospect and Long Level, and from Bittersville to the Susquehanna River. In course of time the 21 existing corporations affiliated with the York Street Railway Company are to be merged into three corporations —one to control all the railroads, one to govern the power, heating and lighting, and a third to be a land company.

POWER TRANSMISSION.

Bids will be received at once for the construction of a power house and dam on the Sioux River, near Washburn, Wis. The estimated cost is $60,000. W. A. Robinson is city clerk of Washburn, Wis.

The owners of the Barnes-King Mining Company of Kendall, Mont., propose to build a power plant on Spring Creek, and to operate an electric railway to Lewiston, Mont. It is proposed to expend $250,000.

C. A. Hartley and J. A. Powers of Oshkosh, Wis., are organizing a company with a capital stock of $600,000 to develop power on the Peshtigo River. Over 6,000 horsepower will be developed, which will be marketed in the nearby cities.

The Ellsworth Heat, Light and Power Company of Ellsworth, Wis., has let a contract for the development of a waterpower plant to replace the present steam plant which it now operates. The waterpower plant will be located about eight miles from Ellsworth, on Rush River, and current delivered to Ellsworth by a 6,600-volt transmission line. The contract for furnishing all of the machinery and supplies and also for installing this plant has ben let to B. S. Potter of Minneapolis, Minn.

Winnipeg River, in Canada, has a series of falls from which it is possible to develop 300,000 or more horsepower. The Winnipeg Electric Railway Company has a power plant at Lac du Bonnet, with facilities for generating about 25,000 horsepower. The city of Winnipeg has authorized the construction of a municipal power plant at Point du Bois on the Winnipeg River, and preliminary surveys for this work have already been made. The distance of this place from Winnipeg is 72 miles. The possible maximum of 100,000 horsepower can be developed. It is estimated that the cost of this power in Winnipeg will be $17 per horsepower. All inquiries regarding bids for the proposed work should be addressed to Cecil B. Smith, engineer of power construction, Winnipeg, Man.

Speaking in the Canadian Parliament on the subject of public ownership of utilities, Sir Wilfrid Laurier said that, so far as the ownership of water and light projects was concerned, he saw no reason why it should not be vested in municipal authority, but he would not care to have the Dominion government given the care of the distribution of electrical energy added to the work it already had. With regard to the prohibition of electrical energy, Sir Wilfrid pointed out that the United States, with cetrain exceptions, covering some 160,000 horsepower, prohibits the importation of electrical energy into that country from Canada. Personally, he was not prepared to say that it was not a good proposition, but these matters were now under the consideration of the International Waterways Commission. Both Canada and the United States, he said, were interested in this question, and there were also three or four companies incorporated by the Dominion Parliament, not only for the development of energy in Canada, but for its exportation to the United States. It was a matter requiring serious consideration, when a great deal of capital had been invested in these enterprises, that they should be prohibited from exporting their product. Such action was altogether premature at the present time, and until the report of the commission was received, he did not think the government was called upon to take action.

PUBLICATIONS.

The D & W Fuse Company, Providence, R. I., has just issued what is probably the most complete catalogue of fuse material that has ever been compiled. This catalogue, No. 12, lists, among other material, link fuses, cartridge fuses, cartridge cut-outs, indicating plug fuses, service switches, railway and subway boxes, etc. It contains many

excellent illustrations showing nearly all of the specialties and devices listed. The description of the various fuses and the very complete set of diagrams giving the dimensions of fuses, etc., make the book a valuable one to anyone having occasion to use this class of protective device.

Pass & Seymour, Solvay, N. Y., ask all and sundry to pin their faith to P & S products. The company furnishes the pin, which is attached to an original card which gives a word about porcelain sockets. Special attention is called to the new porcelain enclosed contact receptacle, trade No. 971, just the thing for damp cellars, breweries, etc.

The Reynolds Electric Flasher Manufacturing Company, 191-193 Fifth Avenue, Chicago, has just issued a booklet entitled "Signs That Attract." The booklet gives descriptions of the Reco and improved Reynolds flashers, Reco whirlers and other specialties manufactured by the company. It is well illustrated and a very complete catalogue of sign flashers, and the company seems justified in enclosing forms containing suggestions for ordering the different specialties. This should be of interest to central-station managers and electrical dealers.

Two recent publications from the advertising department of the Automatic Electric Company, Chicago, are of original design and very attractive. One is on the question of operation and contains, among other things, facsimile reproductions of articles from Milwaukee and Little Rock papers commending the automatic system as compared with manual operation of telephone exchanges. The other bears on the Chicago situation and shows the prospect of the Independent interests getting into Chicago by connecting with the telephone system of the Illinois Tunnel Company, which uses the automatic instruments manufactured by the Automatic Electric Company.

The first number of the Electric Traction Weekly of Cleveland has made its appearance. This paper is published by the Kenfield-Fairchild Publishing Company of which H. J. Kenfield is president, C. B. Fairchild, Jr., vice-president and editor, F. L. Heath, treasurer, and George S. Davis, secretary and associate editor. The Interurban Railway Journal of Indianapolis has been sold to the new journal and is incorporated with it. The first issue consists of 24 pages of reading matter, with no advertisements, but it is announced that advertising pages will appear in later issues. Nearly all the officers of the new company have been connected with the Street Railway Journal or the former Street Railway Review, and the first number of their production has a bright, pleasing appearance.

SOCIETIES AND SCHOOLS.

The monthly meeting of the Illuminating Engineering Society will be held in the Edison Auditorium, 44 West Twenty-seventh Street, New York city, on Friday evening, December 14th. A paper will be presented by Dr. C. P. Steinmetz, Schenectady, N. Y.

The committee of the Massachusetts Institute of Technology corporation has not announced a successor to President Pritchett, and it is said that the latter has been asked to retain the office in connection with the chairmanship of the board of managers of the Carnegie Pension Fund, but President Pritchett says he will not remain at the head of the Institute.

The Worcester (Mass.) Polytechnic Institute has ordered an electric car body from the Cincinnati Car Company. It will be 40 feet long and will contain no seats, leaving room for testing and recording instruments. A portable air-compressor outfit has ben bought for the Institute's new electrical-engineering laboratory. It will be mounted on a small truck so that it can be used in any part of the building where air pressure is desired for cleaning machinery or other purposes.

The land-and-building-fund committee of the American Institute of Electrical Engineers, of which T. C. Martin is chairman and George H. Guy, 114 Liberty Street, New York city, is secretary, has issued an appeal for additional subscriptions to the fund, which is needed to provide for the Institute's share of the necessary real estate and equipment for the Engineering Building given by Mr. Carnegie. This share is $200,000, and $150,000 has been already subscribed.

TELEGRAPH.

Governor Magoon has ordered prepared a decree, which will permit the Commercial Cable Company to enter Havana, Cuba, by way of Vedado from Key West. The International Western Company has held this territory exclusively for 40 years.

The Austrian Minister of Commerce is said to have decided to make a trial of the recording telegraphic apparatus of Donald Murray, on the line between Vienna and Prague, with a view to its ultimate adoption for the whole country if found to work successfully. It is estimated that a saving of re-transferring in the case of 31,000,000 messages annually throughout Austria would result from the use of this apparatus.

SPACE TELEGRAPHY.

According to the New York Times, an announcement has been made from Copenhagen, Denmark, that Lord Armstrong has purchased the patent rights for America of the space-telegraph system invented by Waldemar Poulsen, the Danish engineer.

The Clark Wireless Telegraph Company of Detroit has opened stations at Detroit, Mich., and Cleveland, Ohio, and is erecting a station at Buffalo, N. Y., for commercial business. The company is sending out circulars giving a list of its offices and a description of the work that has been accomplished and that is planned.

MISCELLANEOUS.

The City Council of Rock Island, Ill., has practically decided to adopt an electrical-inspection ordinance drawn by the Underwriters' Electrical Bureau. The mayor and chief of the Fire Department favor it, and there seems to be little doubt of its ultimate passage and approval.

Use of the tunnels of the Illinois Tunnel Company in Chicago for the transfer of mail commenced this week between the postoffice and the Northwestern and Polk Street stations. The system is now complete to all the railway stations. Registered mail will be carried by wagon on the surface, as in the past.

At Colorado Springs, Colo., the ordinance regulating electric wiring is reported as unsatisfactory and a new one will soon be submitted for the consideration of the City Council. The chief of the Fire Department is the inspector and has been the means of raising the standard for wiring to a considerable extent. He is a practical wireman.

The total production of coal in California during 1905 was 77,050 short tons, valued at $382,725. These figures are taken from the report of Mr. E. W. Parker of the United States Geological Survey. The principal feature of interest connected with the production of coal in California has been the apparently successful efforts to utilize the lignite or sub-bituminous coals produced in the state in the manufacture of briquettes.

A Montreal dispatch says that the Canadian Consolidated Rubber Company has resulted from the merger of the Canadian Rubber Company, the Granby Rubber Company and the Maple Leaf Rubber Company of Port Dalhousie, Ont. The capital of the new company is $5,000,000, with $2,600,000 six per cent. 40-year bonds. S. H. C. Miner is president, G. N. Stephens vice-president, and D. Lorne McGibbon, second vice-president and managing director.

The Peerless Woolen Mills of Rossville, Ga., will install an extensive new engine-generator and induction-motor equipment recently purchased from the Allis-Chalmers Company of Milwaukee. The prime mover is a 20 by 36-inch Allis-Chalmers Reliance Corliss engine, belted to a 250-kilowatt Allis-Chalmers alternator. The motor equipment includes two of 75 horsepower, one of 140 horsepower, two 30, one 20 and one 15 horsepower. A three-panel switchboard and an exciter complete the outfit.

The United States Civil Service Commission announces the postponement to January 3-4, 1907, of the examination scheduled for December 5-6, at several cities in each of 18 states mentioned, to secure eligibles from which to make certification to fill at least four existing vacancies and vacancies as they may occur in the position of aid in the Coast and Geodetic Survey, at $720 per annum. A vacancy as computer at $1,400 to $1,800 per annum, according to experience, and one as draftsman, at $1,400 to $1,800, according to experience, both in the service of the Coast and Geodetic Survey at Manila, P. I., may also be filled from the eligibles resulting from this examination, provided suitable eligibles are secured. For these two positions the age limit is 20 years or over.

Comparing the present mining industry in Mexico with that of even two or three years ago, a remarkable change is seen to have taken place, as is apparent to those who are located in the immediate camp or camps using the new electric power. While it is true that the majority of the mines are still using steam or hand power, in some of the well-known camps the excessive cost of power on account of the difficulty of obtaining fuel at a reasonable price has brought the owners to look for a cheap power. This was absolutely necessary where the ore mined was not of extremely high grade. This demand for cheap power has been solved in the adoption of electricity. This is cheapest when a waterpower is owned or can be obtained reasonably near at hand, but there are many other means of generating electricity with great economy. One of these methods is by the gas engine, now rapidly being introduced into the republic. The gas engine of the present day, though not as simple to operate as a simple steam engine, has greatly improved over those of former years. In El Oro and Guanapuato alone the Westinghouse Electric and Manufacturing Company, though its agents, G. & O. Braniff & Co., who are making this a specialty, has installed over 10,000 horsepower of electrical machinery, all of which is driven from a waterpower source. The cost of this power is from two to three times cheaper than the corresponding power by use of wood or coal, without taking into account the greater convenience, saving of time, increase in output, etc. Those who have once used electric motors have only the highest recommendation for them and would by no means consider the thought of returning to steam.

An account is given in the Zeitschrift des Vereines Deutscher Ingenieure of a new substance, "ergin," lately introduced in Germany, for driving internal-combustion engines. While possessing many of the characteristics of alcohol, it is said that it is of more uniform composition, and that it may be compressed to a very high temperature without the liability to preignition. It requires a larger admixture of air than alcohol to form the inflammable charge in an engine cylinder. The consumption is given at about one-half pound, and the cost at 6.85pf. (about 1¾ cents) per horsepower-hour. It yields a heat efficiency of about 30 per cent. Motors driven with "ergin" have already been worked with advantage in Germany, not only for small powers, but as a standby in suction-gas plants, and, when employed to generate electricity, they are said to insure greater stability in running. In an engine cylinder "ergin" or alcohol can be used interchangeably without altering the diameter of the piston or the dimensions of the flywheel.

TRADE NEWS.

The Citizens' Light and Water Company of Garrett, Ind., is preparing to install an engine and boiler and other electrical equipment. G. C. Scott is superintendent.

Bids will be received until December 12th for the electric lighting plant for the ice boats at Annapolis. F. C. Letraub and N. H. Hutton are the harbor engineers.

The Barriett Electric Manufacturing Company of Cincinnati, Ohio, will increase its capital stock from $25,000 to $100,000, for the purpose of building a new factory.

The Standard Electric Storage Company is the name of a Chicago company incorporated to manufacture electric supplies. The incorporators are A. C. Tarbett, Louis E. Otto and A. W. Underwood.

BUSINESS.

With the completion of its factory addition, the Wallace Barnes Company of Bristol, Conn., will be in a position to handle an entirely new line, that of screw machine products up to one inch in diameter. This company manufactures small springs of every description and deals in wire and cold-rolled steel.

The Central Electric Company of Chicago has contracted with the Allis-Chalmers Company for furnishing a 16 by 36-inch Allis-Chalmers Reliance Corliss engine, direct coupled to a 250-kilowatt Allis-Chalmers alternator, with exciter, for the Pullman Company, Pullman, Ill. The alternator is a 2,300-volt, 60-cycle, three-phase machine.

In a little folder, enlivened with Santa Claus pictures and nursery rhymes, the Columbia Incandescent Lamp Company of St. Louis calls attention to its four outfits for decorating Christmas trees with electric candles. Each outfit has an attachment plug, silk-covered cord, connection block, red, green and clear lamps and one, two, three or four, as the case may be, circuits or festoons of eight sockets each.

Sales Manager John W. Brooks of Pass & Seymour, Solvay, N. Y., visited Chicago last week. Mr. Brooks reports the porcelain business as especially active at the present time. It will be remembered that Pass & Seymour have, during the last six months, been strenuously at work extending the factory at Solvay. Mr. Brooks reports that, even with the present increase in manufacturing facilities, it is most difficult to keep up with the demand.

The National Brake and Electric Company, Milwaukee, Wis., reports, among recent orders for generators, the following: Simmons Manufacturing Company, Kenosha, Wis., one 1,000-kilowatt engine-type alternator; Union Electric Light and Power Company, St. Louis, Mo., two 500-kilowatt three-unit synchronous motor-generator sets and one 200-kilowatt induction motor-generator set; Proctor & Gamble (for Staten Island plant), one 400-kilowatt engine-type alternator and one 125-kilowatt engine-type alternator; Hicks Locomotive and Car Works, Chicago Ill., one 500-kilowatt belted alternator; Clymer Power Company, Riegelsville, Pa., one 250-kilowatt waterwheel-type alternator; United States Light and Traction Company, Hobart, Okla., one 250-kilowatt engine-type alternator, and also one 250-kilowatt engine-type alternator for Sheridan, Wyo.

ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued (United States Patent Office) November 27, 1906.

836,666. Electric Controller. Roy W. Brown, Amsterdam, N. Y. Application filed January 23, 1906.

Mechanical means are provided for holding a number of switches closed. The switches are arranged in series. Means are provided for releasing the switches, and the switches are placed in separate compartments containing insulating fluid.

836,668. Operator's Key. Albert Carliss, Chicago, Ill., assignor to the American Electric Telephone Company, Chicago, Ill. Application filed April 1, 1901.

A combined ringing and listening key, in which one or more of the listening contact springs are adapted to hold the hand-operated lever in an operative position when inclined to listening operation, and the ringing contact springs are adapted to prevent the lever from remaining in an inclined operative position when it is inclined to ringing operation. Suitable circuits, excluding lever and rolls, are controlled by the springs.

836,691. Stop Device for Circular Knitting Machines. Ernest H. Ludwig, Manitowoc, Wis. Application filed January 29, 1906.

Contacts are arranged so that they operate a stop device when the tension of the yarn is interrupted.

836,724. Ship's Progress Indicator. Thomas Whittle, Prahran, and William Cumming, Malvern, Victoria, Australia, assignors to Whittle. Application filed July 18, 1905. Renewed September 25, 1906.

Electromagnetic means controlled by the ship's engines operate an indicator along a map slot to indicate position of the ship.

836,754. Process of Improving the Magnetic Qualities of Iron-silicon Alloys. Robert A. Hadfield, Sheffield, England. Application filed February 27, 1906.

The process of increasing the permeability and reducing the hystersis action of an alloy low in carbon and manganese and containing iron with from one to five per cent. of silicon, consists in heating the alloy to a temperature above its critical point and then subjecting it to cooling only.

836,755. Process of Improving Certain Magnetic Qualities of a Magnetic Body. Robert A. Hadfield, Sheffield, England. Application filed July 5, 1906.

The process of reducing the total magnetic and electric loss in a magnetic body consists in first heating the body to a temperature between 700 degrees and 800 degrees centigrade, maintaining the temperature constant for not less than 10 consecutive hours, and then slowly cooling the body.

836,756. Magnetic Alloy. Robert A. Hadfield, Sheffield, England. Application filed July 5, 1906.

An iron-silicon-manganese alloy contains silicon from one to five per cent. and manganese in proportion less than one-half of one per cent.

836,757. Process of Improving the Magnetic Qualities of Iron-silicon-manganese Alloys. Robert A. Hadfield, Sheffield, England. Application filed July 5, 1906.

An admixture of manganese in proportion not sufficient to impair the magnetic qualities is added to an alloy of iron and silicon, then the iron-silicon-manganese alloy is heated to a relatively high temperature below its melting point, and the alloy is allowed to cool. It is then reheated to a temperature below that first employed, and finally cooled.

836,758. Magnetic Alloy. Robert A. Hadfield, Sheffield, England. Application filed July 5, 1906.

The combination in an alloy is made of iron and silicon in proportion of from one to five per cent. and aluminum in proportion less than one per cent.

836,759. Method of Making Magnetic Materials. Robert A. Hadfield, Sheffield, England. Application filed July 5, 1906.

The method consists in alloying a magnetic substance with silicon, heating the mass and working it into a sheet, heating such sheet to a temperature below the melting point of the material, and allowing it to cool, reheating the sheet to a temperature below that first employed again and allowing it to cool.

836,760. Method of Making Magnetic Materials. Robert A. Hadfield, Sheffield, England. Application filed July 5, 1906.

A magnetic substance is alloyed with silicon and the alloy is heated to a temperature below its melting point. The substance is mechanically treated to reduce it to a sheet and the sheets reheated to a temperature below its melting point, and different from the first-named temperature, and is finally cooled.

836,761. Method of Making Magnetic Materials. Robert A. Hadfield, Sheffield, England. Application filed July 5, 1906.

This process consists in alloying a magnetic substance with silicon, heating the substance to a temperature below its melting point, mechanically treating the substance to reduce it to a sheet, reheating the sheet to a temperature below its melting point but above the first-named temperature, and finally cooling.

836,762. Process of Improving the Magnetic Qualities of Iron-silicon-aluminum Alloys. Robert A. Hadfield, Sheffield, England. Application filed August 21, 1906.

The process consists in adding to an alloy of iron and silicon an admixture of aluminum, then heating the iron-silicon-aluminum alloy to a relatively high temperature below its melting point, allowing the alloy to cool, reheating it to a temperature below that first employed, and finally cooling.

836,774. Arc Lamp. Frederick S. Murray, New York, N. Y., assignor to the New York Calcium Light Company, New York, N. Y. Application filed April 13, 1904.

Means for holding and feeding carbons to maintain an arc are inclosed by a wedge-shaped closed case; an operating handle for the means projects through the bottom of the case; a frustum-shaped reflector comprising one wall of the wedge-shaped case is also closed at its rear by another wall of the wedge-shaped case, which wall is provided with a translucent window. The reflector is provided at its rim with supporting guides for screens.

836,789. Portable Electric Hoist. Walter N. Vance, Chicago, Ill., assignor to the Yale & Towne Manufacturing Company, Stamford, Conn. Application filed July 9, 1906.

A load or chain sheave is mounted in a frame. A motor is secured to the frame at one side and an electric controller secured to the frame at the other side, the armature of the motor, the load sheave of the hoist and the controller shaft being in substantially the same horizontal plane. The motor is mechanically connected to the load or chain sheave, and means are provided for actuating the controller.

836,794. Automatic Device for Operating Valves and Other Mechanisms. Oscar Winter and Fred W. Waterman, Elyria, Ohio. Application filed February 17, 1906.

Electromagnetic holding means control the release of a latch to permit a valve-controlling member to operate by gravity.

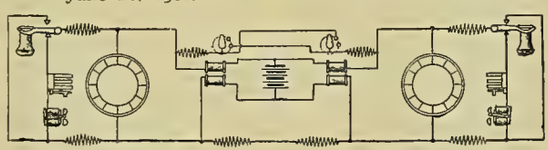
836,805. Telephone or Switchboard Plug. Alva B. Dozier, Taylor, Texas. Application filed May 10, 1904.

Integral resilient jaws are secured to a semi-cylindrical casing and are provided with toothed, inner and screw-threaded outer surfaces. An adjusting nut is removably mounted upon the jaws.

836,808. Electric Time Switch. John Gunning, Bournemouth, England. Application filed December 16, 1905.

A timing dial has adjustable releasing and closing tappets. A pivoted switch arm is adapted to be displaced by the closing tappet. A detent co-operates with he switch arm and is adapted to be displaced by the releasing tappet. There is a second pivoted switch arm and a spring urging the second arm to close on the first switch arm. A stop limits the movement of the second arm, and an insulating piece is moved by the first switch arm to displace the second arm against its spring when the first arm is displaced by the closing tappet.

836,819. Reflector. Wilber A. McCoy and William S. Kutscher, Allegheny, Pa. Application filed June 20, 1906.



NO. 836,904.—AUTOMATIC SYSTEM OF INTERCOMMUNICATION.

Stamped integrally from a sheet of thin metal, the reflector has an inclined reflecting portion stiffened by a rigid integral substantially a vertical ring and a rigid integral substantially horizontal ring formed of the material surrounding the central opening.

836,827. Circuit Controller. James P. Pool, New York, N. Y. Application filed June 13, 1905.

An adjustable circuit-controlling member comprises a number of jointly movable annular sections, each of which is provided with a contact terminal, and a number of separate stationary electrical conductors passing through the annular sections and extending respectively from the contact terminals.

836,836. Transmission Tower. Daniel R. Scholes, Chicago, Ill., assignor to the Aermotor Company, Chicago, Ill. Application filed February 21, 1906.

For high-potential transmission of electrical energy the tower has a cross-arm having a truss formation and formed of a pair of members arranged on opposite sides of the tower. The cross-arm has substantially parallel intermediate portions and converging end portions.

836,848. Telephone Apparatus. David H. Wilson, Chicago, Ill., assignor to George W. Kretzinger, Chicago, Ill. Application filed December 8, 1902.

A main induction coil is mounted upon a suitable base and has its polepieces brought into proximity to each other. A telephone-receiver diaphragm is mounted upon the induction coil opposite the polepieces. The induction coil acts as the basic element, the receiver being carried and actuated by the induction coil.

836,863. Process of Making Electric Condensers. Henry P. Clausen, Chicago, Ill., assignor to the American Electric Telephone Company, Chicago, Ill. Application filed February 2, 1903.

The process consists in bringing together two strips of dielectric having a metal strip therebetween, passing the three-ply strip over a roll, whereby the plies are held securely together, passing the strips through a bath of heated paraffine, rolling two of the three-ply strips into a composite roll, flattening of the roll and subjecting the roll to an immersion in a paraffine bath.

836,895. Electric Block Signal. Walter E. Sands, Brooklyn, N. Y., assignor to the L. A. Thompson Scenic Railway Company, New York, N. Y. Application filed December 29, 1905.

In each block of a railway track there is a setting section, releasing section, safety-set section and main section. An alarm is placed in the main section. Means on the car are adapted to close electric circuits through the several sections. The alarm circuit is controlled by means actuated by the closing of the several section circuits.

836,904. Automatic System of Intercommunication. Anthony Van Wagenen, Sioux City, Iowa. Application filed July 31, 1902. Renewed March 3, 1906.

Means are provided at the central station for operatively connecting lines of different subscribers, comprising automatic switches having each electrically operated contact mechanism, including an operating magnet permanently included in the corresponding subscriber's circuit out of the main path of telephonic fluctuations therethrough, of a common source of electrical energy for the subscribers' circuits, included in circuit with each such magnet, and arranged likewise to supply current for the operation of subscribers' telephone instruments; and telephone instruments and means for operating the central-station switches at the several subscribers' stations. (See cut.)

836,915. Illuminated Sign. William T. Bradshaw, Oakland, and Charles H. Townsend and Oscar F. Erickson, Berkeley, Cal. Application filed August 7, 1906.

The sign body has sides apertured in the form of the letters to be displayed, inner surfaces of the walls of the sign body being suitably faced to reflect the light. Lamps are placed in the sign body, and concave apertured reflectors are secured on the outside of the sign body, each around one of the apertures in the sides thereof. (See cut.)

836,936. Temporary Telegraph Station. Charles S. Maynard, Chardon, Ohio, assignor of one-fourth to John Maynard and one-fourth to W. B. Treat, Cleveland, Ohio. Application filed September 24, 1906.

A cross-connection contains an instrument between two line wires, one line wire being open in one of the established stations, the other line wire being open in the other of the established stations.

836,965. Electric Door Opener. Edwin W. Fyler, Hyde Park, Mass., assignor of one-half to Warren E. Fyler, Hyde Park, Mass. Application filed April 9, 1906.

A movable armature normally engages a movable member and prevents the door from being opened. A stop mechanism normally prevents the armature from releasing the door. An electromagnet when energized releases the stop from the armature and moves the armature to release the door.

NO. 836,915.—ILLUMINATED ELECTRIC SIGN.

836,973. System of Motor Control. George H. Hill, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed May 20, 1905.

A pair of relays control actuating means for controlling a reversing switch. Means are provided so that each relay in its operative position renders the other relay inoperative to control the actuating means.

836,974. Meter. Frank Holden, Rugby, England, assignor to the General Electric Company, Schenectady, N. Y. Application filed April 24, 1905.

In this mercury meter means are provided for establishing a magnetic field and a number of conductors are mounted for rotation in this field. The conductors are immersed in a liquid bath for connecting two or more conductors in series. Means are provided for registering the rotation of the conductors.

836,978. Alternating-current Motor. Marius C. A. Latour, Paris, France, assignor to the General Electric Company, Schenectady, N. Y. Application filed May 16, 1905.

The armature has a number of separate windings which are connected to successive commutator segments. Connections are made between a number of equipotential points on these windings and impedances are inserted in the connections. The commutator brushes have not sufficient width to bridge adjacent segments connected to the same winding.

836,981. Train-control System. Charles E. Lord, Cincinnati, Ohio, assignor to the General Electric Company, Schenectady, N. Y. Application filed October 1, 1904.

Each of a number of cars has a number of pneumatically actuated contacts forming a motor controller. Means are provided for producing an automatic progressive action of the contacts, and a pneumatic train system including a master valve is arranged so that the progressive action of the contacts may be checked from the master valve without affecting the contacts already operated.

836,994. Interlock for Electric Switches. Oran O. Rider, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed September 28, 1905.

Means are provided for compelling a number of electric switches to operate in a definite order and to restore the last switch operated to its former condition before operating the next. (See cut on next page.)

836,998. Alternating - current Motor. Ernest Schweiger, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed May 2, 1904.

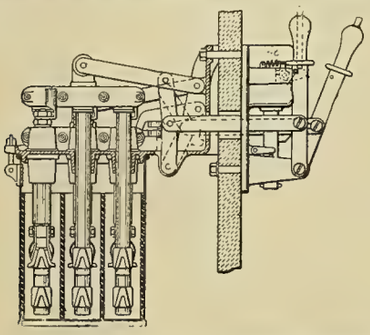
The primary winding is supplied with alternating current and secondary winding has a commutator and short-circuiting brushes. An auxiliary winding revolves with the secondary winding and is electrically connected to it. Means are provided introducing in the auxiliary winding an electromotive force varying inversely with the speed of the motor.

837,022. Safety Apparatus for Railways. Granville T. Woods and Lyates Woods, New York, N. Y., assignors to the General Electric Company, Schenectady, N. Y. Application filed October 5, 1905.

A movement to either extreme position of the controller handle controlling the motor circuit of an electrically propelled car opens the motor circuit. Means controlled by the handle in either extreme position cause the brakes of the car to be applied.

837,023. Circuit-breaker. Gilbert Wright, Pittsfield, Mass., assignor to the Stanley Electric Manufacturing Company, Pittsfield, Mass. Application filed January 11, 1904.

Two magnet windings are in series with the circuit to be protected. One of the windings is of smaller wire than the other. A movable core is controlled by said windings and a member actuated by the core is arranged to short circuit the winding of smaller wire when the core is in its normal position. A circuit-breaker is tripped by the movement of the core to open the circuit.



NO. 836,994.—INTERLOCK FOR ELECTRIC SWITCHES.

837,033. Cooling Dynamo-electric Machines. Paul Bunet, Paris, France, assignor to the General Electric Company, Schenectady, N. Y. Application filed March 23, 1905.

The commutator bars are provided with heat-radiating projections and a fan casing encloses the projections.

837,037. Motor-control Apparatus. Frank D. Case, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed April 17, 1905.

Some of a number of separately actuated contacts are arranged to be actuated in automatic progression. Means are provided operating a reversing switch, which means control a switch in the actuating circuit of the contacts, which are arranged to be actuated in automatic progression.

837,044. Testing Device. Alvarado L. R. Ellis, Lynn, Mass., assignor to the General Electric Company, Schenectady, N. Y. Application filed October 23, 1905.

The device includes means of indicating the effective strength of a magnet by comparing it with a standard magnet.

837,054. Construction of Incandescent Electric-lamp Sockets. Gilbert W. Goodridge, Bridgeport, Conn., assignor to the Bryant Electric Company, Bridgeport, Conn. Application filed April 9, 1906.

The incandescent-lamp socket has a cap and shell to be detachably connected, one of the parts having spring arms with radial pins, each with an external push-button and a stem of two diameters, the other part having notches contracted at the edges.

837,055. Construction of Incandescent Electric-lamp Sockets. Gilbert W. Goodridge, Bridgeport, Conn., assignor to the Bryant Electric Company, Bridgeport, Conn. Application filed April 9, 1906.

The cap has spring arms with radial push pins and the shell has notches to engage the push pins. The spring arms and shell have engaging parts.

837,066. Meter. Frank Holden, Rugby, England, assignor to the General Electric Company, Schenectady, N. Y. Application filed November 17, 1905.

A magnet structure has two gaps therein arranged magnetically in series. An armature has a plurality of conductors mounted for movement in the gaps, and means including a bath of a conducting liquid, in which the armature is immersed, are provided for connecting a number of the conductors in series.

837,073. Incandescent-lamp Socket. William W. Jones, Bridgeport, Conn., assignor to the Bryant Electric Company, Bridgeport, Conn. Application filed May 12, 1906.

The socket has two parts, shell and cap. One of the parts has angled notches or grooves engaging with projections borne by the other part. A spring tongue is cut in the flange of the cap and means are provided to engage the spring tongue with the shell to prevent rotary motion.

837,083. Process for the Manufacture of Glycolic Acid. Otto Liebknecht, Frankfort-on-the-Main, Germany, assignor to the Roessler & Hasslacher Chemical Company, New York, N. Y. Application filed June 14, 1906.

The process consists in the electrolytic reduction of oxalic acid in the cathode-compartment of an electrolytic apparatus in the presence of lead electrodes, the oxalic acid being dissolved in a dilute sulfuric acid kept warm during the reduction and of such a degree of concentration that it excludes the oxalic acid from substantial participation in the conductivity.

837,084. Apparatus for Illuminating Photographic Studios with Electric Incandescent Lamps. Philipp G. von der Lippe, Vienna, Austria-Hungary. Application filed January 9, 1906.

A number of frames carry conducting wires. Means are provided for shifting such frames independently of each other vertically and horizontally and for supporting electric glow lamps on such conducting wires for electrically connecting them with such wires and for shifting them along such wires.

837,092. Circuit-breaker. William Merrill, Wilmington, Del. Application filed October 19, 1905.

A movable liquid-containing device is on a support. A ball within the tube is movable by gravity to hold the tube in two positions. Means are provided so that the position of the tube is changed when the circuit is closed and means are also provided so that the movement of the ball within the tube in its changed position causes the breaking of the circuit.

837,097. Electric Alarm. Ernest S. Moorer, Anderson, S. C. Application filed September 16, 1905.

A heat-controlled circuit is included in a telephone circuit apart from the subscriber's instrument so that alarm is given both at subscriber's position and at central office when heat-controlled device operates.

837,107. Apparatus for the Sterilization of Water by Means of an Electric Current. Marius Otto, Paris, France, assignor to the American Ozone Company, Niagara Falls, N. Y. Application filed July 1, 1904. Renewed March 13, 1906.

The sterilizing device comprises a mixer, an emulsifier discharging the water to be sterilized thereinto, means for supplying water to the emulsifier, an ozone-supplying means, and means whereby the water-supplying means draws in ozone from the ozone-supplying means and carries it to the emulsifier.

837,115. Wood-cleaning and Polishing Device. John W. Plummer and Harry F. Plummer, Altoona, Pa. Application filed April 16, 1906.

A flexible shafting has an operating head attached to one end of it, and has means attached to the other end of said shafting for rotating it and the operating head. There is an operating handle upon said shaft and adjacent the head, and a flexible guard frame surrounding the handle and the operating head. An operating tool is attached to the under surface of the operating head, and means are provided for holding the same in place.

837,154. Railway Signaling System. Louis H. Thullen, Edgewood Park, Pa. Application filed May 22, 1905.

A signal is operated by an alternating curent impressed on a closed track circuit by movement of a car on the track.

837,174. Lifting Magnet. Charles E. F. Ahlm, Cleveland, Ohio, assignor to the Cleveland Armature Works, Cleveland, Ohio. Application filed May 22, 1906.

Two or more polepieces envelop a central polepiece and extend below its polar face. Each of the polepieces has oposite polarity to the central polepiece. (See cut.)

837,178. Automatic Circuit Closer. Tully W. Benson, Wewoka, I. T. Application filed January 4, 1906.

The device is for telegraphy and consists of a key, a step-by-step circuit-closing device arranged to bridge the main line around the key, an electromagnet for actuating the device, a relay, and an energized circuit leading through the electromagnet and having contacts of which one is formed by the back stop of the relay.

837,182. Attachment Plug for Electric Lighting. David E. Bown, Pittsburg, Pa. Application filed August 14, 1905.

The body portion has a shank. A screw cap is connected to the shank and has a cap plate on it. Means are provided engaging with the shank for removably holding the cap in place.

837,183. Fuse Plug for Electric Lighting. David E. Bown, Pittsburg, Pa. Application filed August 14, 1905.

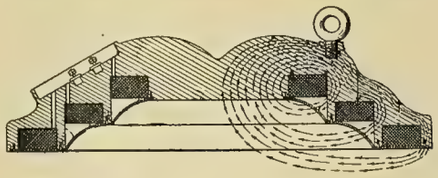
It comprises a body portion, a screw cap fitting on the body portion, and a cap plate removably held within the screw cap.

837,184. Attachment Plug. David E. Bown, Pittsburg, Pa. Application filed November 6, 1905.

This comprises a body portion, a terminal-carrying portion for fitting within the body portion, and means engaging with the terminal-carrying portion for enabling the same to be swiveled upon and detached from the body portion.

837,201. Automatic Circuit-breaker. Albert E. Doman, Elbridge, N. Y., assignor to the Elbridge Electrical Manufacturing Company, Elbridge, N. Y. Application filed May 21, 1902.

An electric circuit has a direct current and includes in the circuit the make-and-break sparking terminals of a gas engine. A spark coil is included in the circuit, an air chamber at one end of the coil having one of its walls movable. An armature is carried by the movable wall and is attracted by the energizing of the coil. Means controlled by the movable wall are provided to break the circuit when the terminals remain in contact. (See cut.)



NO. 837,174.—LIFTING MAGNET.

837,213. Electric Motor. Manes E. Fuld, Baltimore, Md. Application filed February 6, 1906.

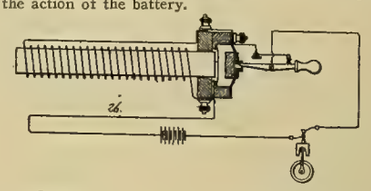
Studs are connected to the arms of the field magnet. Reversely disposed brush holders are mounted on the studs and provided with elongated eyes. The brushes are each composed of a single strip of elastic material notched to fit in one of the eyes and terminating in a resilient loop, the free end of which bears against the corresponding brush holder.

837,227. Railway Signaling System. Joseph G. Horazdovsky, Cleveland, Ohio, assignor of one-sixth to John J. Koller, one-sixth to Ladimir Herold, and one-third to Victor Nusbaum, Cleveland, Ohio. Application filed May 21, 1906.

One or more signaling devices are placed adjacent each end of a block or section of a railway track. An electric circuit includes the signaling devices, and means are provided including an electromagnet and an armature for making and breaking the signal circuit. A track instrument or switch is placed at each end of the block or section, the track instruments or switches being in circuit with the electromagnet. One of the switches is adapted to be closed by the entrance of a train upon the block or section, and the other switch is adapted to be opened by the departure of the train from the block or section.

837,231. System of Electric Regulation. Joseph Bijur, New York, N. Y., assignor to the General Storage Battery Company, New York, N. Y. Original applications filed September 24, 1904. Divided and this application filed February 17, 1905.

A battery assists the source of supply and a regulator controls the charge and discharge of the battery. The regulator is adapted to move when the load on the source of supply begins to vary from the average and continues to move until the current is restored to average value by the action of the battery.



NO. 837,201.—AUTOMATIC CIRCUIT BREAKER.

837,241. Electric Switch. William J. Murray, Leavenworth, Kan., assignor of one-half to Herbert W. Wolcott, Leavenworth, Kan. Application filed May 2, 1905.

A plate journaled on a suitably supported spindle is provided with a socket. A ball fits in and projects from the socket, a holder to retain the ball being in the socket. Means are yieldingly projected beyond the face of the holder in the path of travel of the ball, and means actuated by the rotative movement of the spindle are provided for rotating the ball-carrying plate.

837,249. Apparatus for Making Welds. John C. Perry, La Junta, Colo., assignor to the Clinton Wire Cloth Company, Clinton, Mass. Original application filed March 23, 1901. Divided and this application filed July 16, 1904.

The welding jaw comprises a jaw member formed with grooves and a contact plate or jaw provided with work-engaging recesses and also provided with trunnions to be arranged in the grooves, and means are provided for retaining the trunnions in place.

837,251. Telephone Apparatus. Homer J. Roberts, Evanston, Ill. Original application filed September 18, 1902. Divided and this application filed October 1, 1903.

A selective instrument is normally in operative connection with the line wire and comprises a primary magnet, an armature controlled thereby, a contact lever actuated by the armature, a secondary magnet and armature, a contact lever actuated by the secondary magnet, a mechanical locking device for holding one of the contact levers in a definite position, and electrically actuated means for releasing the mechanical locking device.

837,256. Telephone Toll Apparatus. Edward P. Baird, Evanston, Ill., assignor to the Baird Manufacturing Company, Chicago, Ill. Application filed May 11, 1903.

The casing has a coin slot and a coin shifting means in it. Means operated by the insertion of a coin are provided to prevent the insertion of another coin into the coin slot while the first coin is engaged with the coin shifting means.

PATENTS THAT HAVE EXPIRED.

Following is a list of electrical patents (issued by the United States Patent Office) that expired on December 3, 1906:

416,169. Regulator for Electric Motors. N. S. Keith, San Francisco, Cal.
416,191. Electromagnetic Motor. N. Tesla, New York, N. Y.
416,192. Method of Operating Electromagnetic Motors. N. Tesla, New York, N. Y.
416,193. Electromagnetic Motor. N. Tesla, New York, N. Y.
416,194. Electric Motor. N. Tesla, New York, N. Y.
416,195. Electromagnetic Motor. N. Tesla, New York, N. Y.
416,234 and 416,235. Distributing Box for Electrical Conduits. E. S. Perot, New York, N. Y.
416,240. Electric Machine. A. Schmid, Allegheny, Pa.
416,277. Vehicle Spring. H. Springer, Mount Vernon, Ind.
416,289. Appliance for Insulating Electric Wires. A. E. Ellinwood, Akron, Ohio.
416,290. Secondary Battery. J. K. Pumpelly, Chicago, Ill.
416,339. Compensating Electric Meter. H. Lemp, Lynn, Mass.
416,350. Electric Meter. E. Thomson, Lynn, Mass.
416,360. Electric Heating Apparatus. M. W. Dewey, Syracuse, N. Y.
416,366. Hinged Pan for Protecting Electric Motors for Cars. T. L. Johnson, Cleveland, Ohio.
416,381. Electric Alarm. R. D. O. Smith, Mishawaka, Ind.
416,406. Electric Railway Signal. F. W. Frith, Lennoxville, Quebec, Canada.
416,443. Magnetic Electric Machine. W. H. Cooley, Brockport, N. Y.
416,444. Auxiliary Fire-alarm System. T. Cooper, New York, N. Y.
416,447. Suspending Device for Electric Lamps. E. C. Dawson, Greeley, Colo.
416,476. Telephone. E. H. Lyon, Needham, Mass.
416,483. Auxiliary Fire Alarm. J. P. McMahon, Buffalo, N. Y.
416,503. Thermostat. A. G. Sargent, Laconia, N. H.
416,572. Electrical Signal Apparatus. G. W. M. Conz, Ulm, Germany.
416,573. Secondary Battery. D. S. Covert and J. K. Pumpelly, Chicago, Ill.
416,604. Electric Meter. M. L. Hansen, Bridgeport, Conn.
416,605. Secondary Battery. T. J. Haslam, Jr., Dublin, Ireland.
416,611. System of Arc and Incandescent Electric Lighting. W. Hochhausen, New York, N. Y.
416,612. System of Arc and Incandescent Electric Lighting. Wm. Hochhausen, New York, N. Y.
416,632. Incandescent Electric Lamp. L. H. Leber, York, Pa.

WESTERN ELECTRICIAN

EVERY SATURDAY

Vol. XXXIX. CHICAGO, DECEMBER 15, 1906 **No. 24**

Electric Equipment of the Teltow Canal in Germany.

By Frank C. Perkins.

Electric canal towage in Germany has recently been demonstrated as commercially successful on the Teltow Canal, near Berlin, and the application of electricity to inland waterways has been shown to be desirable. The Teltow Canal is 38 kilometers long and connects the River Spree with the Havel at Glienicke Lake, the territory through which it passes being shown in the map, on the next page. At the River Spree, about 15 kilometers from Berlin, the canal starts with a width of 21 meters and a depth sufficient for canal boats drawing nearly two meters of water and having 1,200,000 pounds register. The boats usually employed are 65 meters long and 8.6 meters wide. The canal has a depth of 2.5 meters at low water in the middle and 2.1 meters in depth at the sides.

Between the Havel and the Spree there is a difference of level of about 30 meters, and a system of locks has been installed about 8½ kilometers from the Havel, consisting of two locks placed side by side with a wide masonry wall between them. A system of conduits has been provided within this wall for filling and emptying the locks with a minimum amount of water, the arrangement being such that the water used by a boat going down the canal may be emptied into the other lock for raising the boat going in the opposite direction. During the low-water season water is pumped from the lower to the higher level by means of a centrifugal pump, electrically operated, having a capacity of one cubic meter a second, and electric hoisting gates are used at the locks. Each of the four electric-hoist gates is operated by a 15-horsepower motor running at a speed of 600 revolutions a minute. The electric motors as well as the power station for supplying the necessary current were installed by the Siemens-Schuckert Company of Berlin. The motors are of the three-phase induction type operating at a pressure of 200 volts. The gates may be raised to their full height of 8.27 meters in one minute by means of electric power. Electromagnetic brakes are provided, and the gates are counterbalanced with variable weights, the electric motors being employed for both hoisting and lowering.

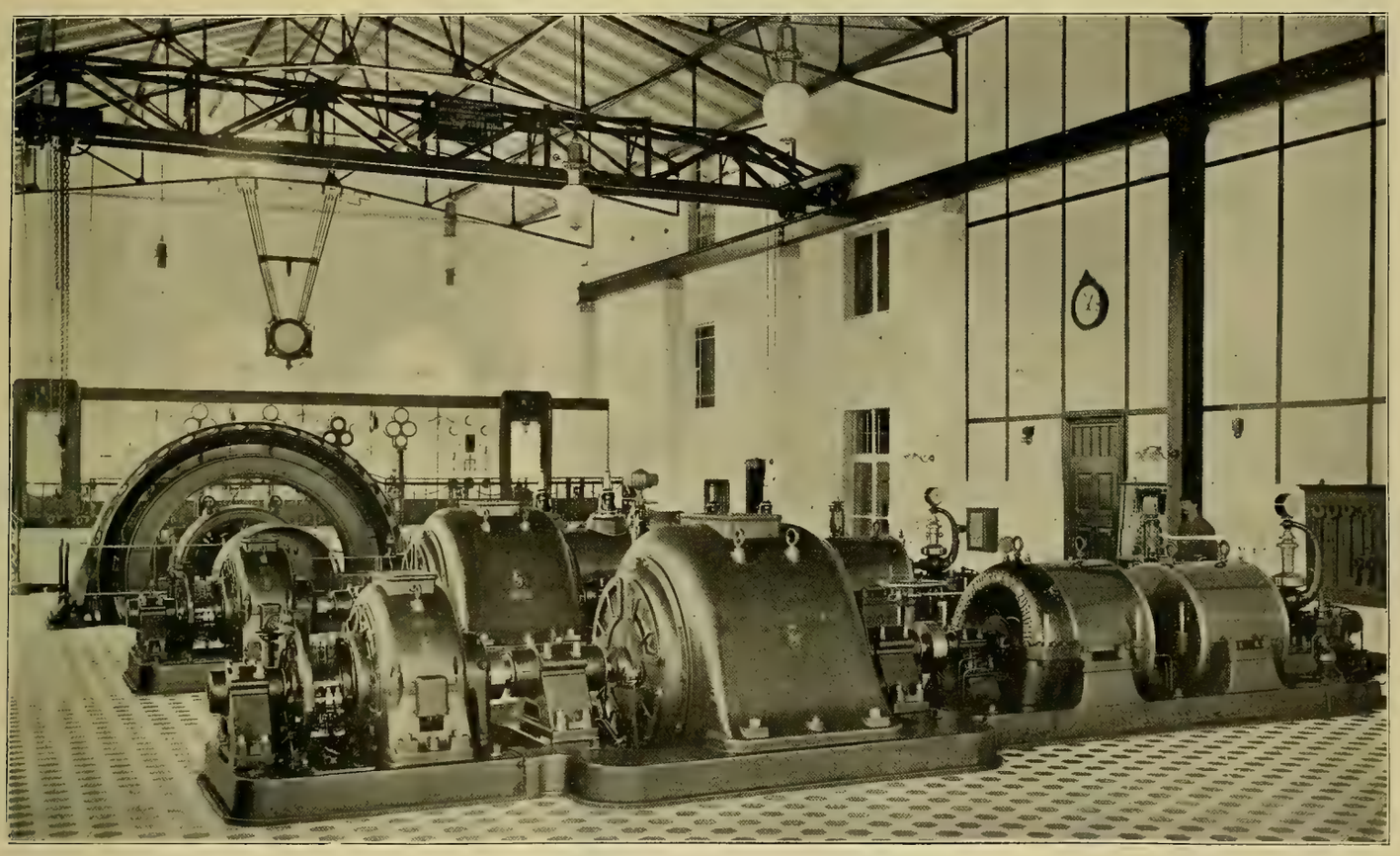
During high water it is necessary to conduct a portion of the water from high to low level, and this is done by means of a gate in the middle wall operated by an eight-horsepower induction motor operated from the power station at a speed of 580 revolutions a minute.

The accompanying illustration shows the interior of the power station of the Teltow Canal. It is equipped with a 300-horsepower reciprocating engine, shown in the background near the switchboard, and two steam turbines of the Zoelly design constructed by Escher, Wyss & Co. of Zurich, Switzerland. Each of the turbine units really consists of two steam turbines, a high-pressure and a low-pressure turbine being provided with five runner discs and developing a total of 1,000 horsepower, making a total capacity of 2,300 horsepower for the two turbines and the reciprocating engine. Space has been provided for other units to be added as additional power is required.

The reciprocating engine has coupled to it on the same shaft a large revolving-field alternator and a multipolar direct-current dynamo. Each of the 1,000-horsepower steam turbines is direct coupled to a three-phase alternator of the revolving-field type supplying a current of 6,000 volts at a frequency of 50 cycles per second, while on the same shaft is a Siemens-Schuckert compound-wound direct-current dynamo of the inner-pole type supplying a continuous current at a pressure of 600 volts. The turbo-alternators have a capacity of 650 kilowatts, and 230 kilowatts is the output of the alternator connected to the reciprocating engine. The direct-current machine driven by the engine has a capacity of 110 kilowatts, while the two continuous-current dynamos operated by the steam turbines are of 200 kilowatts each.

In connection with the steam turbines, jet condensers are employed, and three-phase motors are utilized for driving the pumps. A vacuum of 95 per cent. is maintained, as there is plenty of condensing water, and the steam is supplied to the high-pressure turbine at 12 atmospheres, superheated steam being provided at 300° C.

There are four water-tube boilers, each of which is provided with a superheater which can be utilized or not, as desired. Each of the boilers has a heating surface of 205 square meters and supplies steam to the turbines at the rate of 6.1 kilograms of steam per horsepower-hour, this being the consumption of the 100-horsepower turbines at full load.



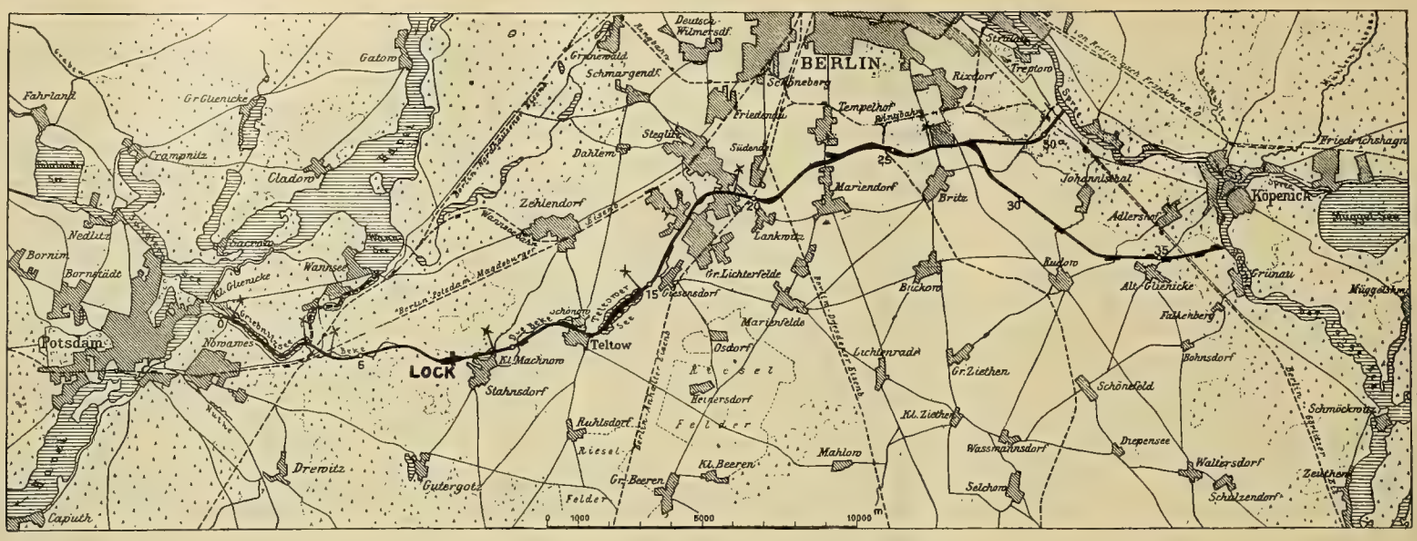
CENTRAL POWER STATION OF THE TELTOW CANAL IN GERMANY.

The exciter units in the power house consist of three-phase alternating-current motors of the induction type directly coupled to shunt-wound direct-current dynamos of 32 kilowatts' capacity, supplying the exciting current to the alternators at a pressure of 65 volts. The three-phase induction motor of each exciter set is supplied with an alternating current of 220 volts and drives the generator at a speed of 960 revolutions per minute.

A storage battery has also been provided for lighting the station and exciting the alternator fields when desired or in case of emergency. This accumulator plant consists of 36 storage cells, each having a capacity of 126 amperes for a period of half an hour, which is sufficient for lighting as well as exciting the two large alternators for that length of time.

At the east end of the canal a sub-station has been provided which is equipped with two rotary converters having a capacity of 150 kilowatts each and operating at a speed of 1,000 revolutions a minute. Space is also provided for a third unit when desired.

Direct current is used on the trolley line for operating the barge-towing locomotives and the towing carriages at the lock. For all auxiliary



MAP SHOWING ROUTE OF ELECTRICALLY OPERATED TELTOW CANAL IN GERMANY.

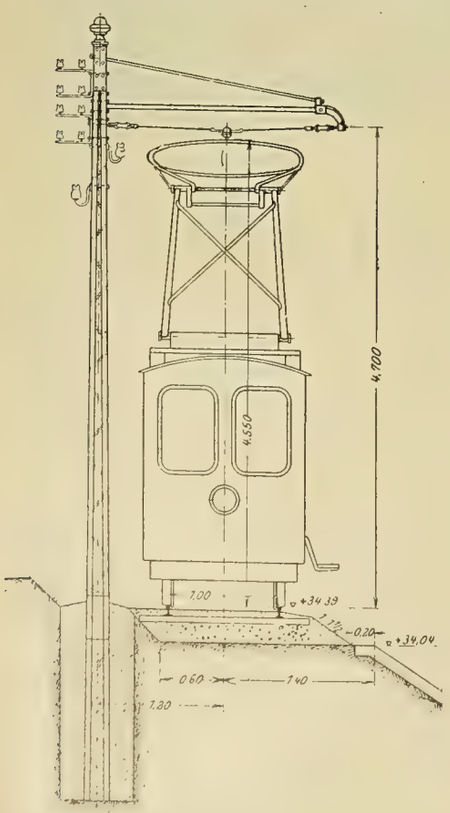
work and for lighting purposes the three-phase alternating current is utilized.

Various types of engines, motors and hauling methods have been tried on this canal. Alcohol engines and gas engines have been utilized on the boats, also steam engines with oil-fired boilers, and electric overhead trolleys with two collecting poles have been utilized, conveying current to electric motors in experimental boats.

A 60-horsepower Daimler alcohol motor, utilized in one of the boats, was found to take 0.01 kilogram of alcohol per ton-kilometer. This would result in a cost per ton-kilometer of one-twentieth of a cent, with alcohol costing five cents a kilogram.

With the oil-fired boiler and the steam engine the cost of operation when towing two boats with a load of 2,400,000 pounds at a speed of four kilometers an hour would be one-hundredth of a cent per ton-kilometer, with oil costing less than a cent per kilogram. The steam oil-fired boiler tug was found to take one-half kilogram of fuel oil per horsepower-hour, the boat taking 100 horsepower at the speed above mentioned.

An electric tug was also tried, and at a speed of four kilometers an hour the boat was found to have an efficiency of 22 per cent., the electric current consumption being nine kilowatt-hours per ton-kilometer. The efficiency was found to be so low and therefore the cost of operation so high that the electric-power tug was given up in favor of a locomotive to tow the boats from the side of the canal on a specially constructed track.



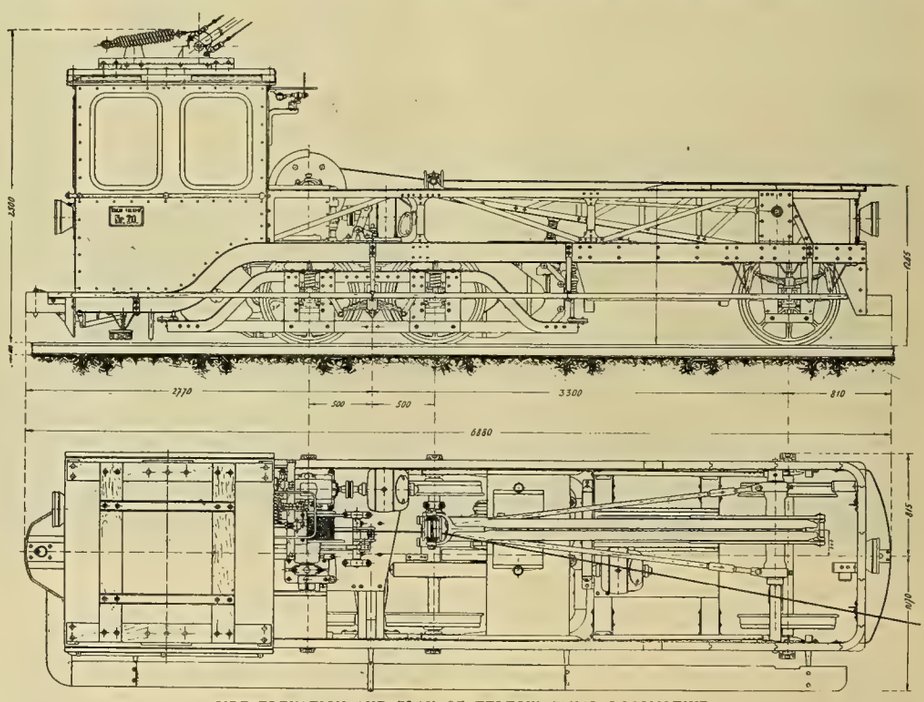
TROLLEY TOWING-PATH CONSTRUCTION ALONG CANAL.

The Siemens & Halske canal locomotive haulage, now used, was designed to operate on a track of one meter gauge hauling two loaded canal boats of 600 tons each at a speed of four kilometers per hour. A plan and side elevation of the locomotive are shown in the accompanying drawings, also a view of the trolley arrangement and track construction. This locomotive was found to require an electric current consumption at the speed mentioned of 3.5 kilowatt-hours per ton-kilometer, while with a speed of five kilometers per hour the energy consumed was found to be 5.25 kilowatt-hours per ton-kilometer. It is stated that the mean efficiency of the locomotive was found to be 65 per cent., the electric energy consumption being 4.25 kilowatt-hours per ton-kilometer when hauling the boats at a speed of 4.5 kilometers an hour.

This electric canal haulage locomotive is provided with a four-wheel truck equipped with two eight-horsepower electric motors of the series direct-current type and a trailing pair of wheels supporting the rear end of the locomotive which carries the guide arm and drum for the tow line. The hauling motors are connected by two sets of gears to the axles, operating at a speed of 800 revolutions a minute. These series motors are driven from a 500-volt overhead trolley line. The guide arm for the tow line is manipulated by a three-horsepower motor connected with a screw to the arm, together with a pair of bevel gears. This motor operates at a speed of 1,460 revolutions a minute, and is also used for driving the drum which winds up the towing rope, consisting of a 10-millimeter wire line. The coupling of the drum is of the friction type, so arranged that when 1,200 kilograms pull is exceeded slipping will occur; therefore, when starting a heavy load the locomotive will take its load gradually, as the 2,000-kilogram pull required in starting a 600-ton boat will cause the drum to slip until the boat is partially under way.

The locomotive weighs 7,500 kilograms, and the greater weight is carried by the wheels on the side toward the land, which is 1,900 kilograms for each driving wheel and 550 kilograms for the trailing wheel. On the side toward the canal the weight on the trailing wheel is 390 kilograms and on each driving wheel 1,380 kilograms.

The placing of most of the weight of all auxiliaries on the side of the locomotive away from the canal, as well as putting the driving motors as far as possible on that side, is on account of the tendency to tip the locomotive by the pull on the tow line; and in order to overcome this to a still greater degree the rail on the side nearest the canal is raised somewhat higher than the inland rail.



SIDE ELEVATION AND PLAN OF TELTOW CANAL LOCOMOTIVE.

For handling the boats at the locks special provision had to be made. Trestle construction was built, extending 140 meters along the middle of the canal, provided with two parallel tracks. For hauling the boats into and out of the locks electrically operated crane cars are operated on these tracks, each weighing 1,500 kilograms. Direct current is conducted to these crane cars at 600 volts, the motors operating at a speed of a trifle over 100 revolutions a minute. The cars or trucks are geared to the track by means of two sets of gears. Each motor develops from 10 to 12 horsepower, which is sufficient to haul a boat one-half hour from a point about 350 meters from one end of the lock to a similar distance at the other end.

The locks can be operated at the same time, with two boats in each lock, giving a tonnage of from 60,000 to 70,000 tons each 24 hours.

Electrical Work and Conditions in Cuba.

By R. G. Grayne.

The Signal Corps of the United States Army is once more in the field in Cuba. I arrived here with the first troops to land. Soon after the arrival the hurricane of the season blew across the island and the electrical wires went down. There was much work to do for several days after the blow to get the poles up and the lines in operation. This was our second introduction to Cuba. In 1898 some of us assisted in putting up the poles and wires in the camps and towns occupied by the American troops, only to find that the same were not to be cared for. For illustration, Camp Columbia was established by the Americans in 1898 and the buildings were thoroughly wired for electric lighting. Telegraph and telephone lines were put in. Then the American electricians and Signal Corps men turned the plant over to the Cubans. For a time everything went well and was kept up.

A few weeks ago conditions of war and transportation brought us to sunny Cuba once more. Today we are restoring to order some of the electric lines which were practically neglected and in some cases wholly abandoned during the interval in which the American Signal Corps men were absent. Regardless of this circumstance, I find that there is a very effective system of signaling and transmission of messages by wire and telephone in service.

There is a first-class electric-power plant in Havana, and although they are squabbling concerning prices the while, the light is good and the plant kept in order. Likewise there are good power plants for the operation of the electric-car lines. Then there are wires for the carrying of

ENGINEERS' CAMP NEAR HAVANA.

messages and wires for the telephone service. I find that the poles have increased in numbers throughout the city of Havana and vicinity. Also that a great many modern devices have been introduced to build up and modernize the plants.

But it is particularly of the Signal Corps man I wish to speak. As in the Philippines, I find him in readiness for duty in war or peace. He was well tested in the jungle of the Philippines, where he always took his lines of communication from the base to the front, carrying along with him the line of wire. He has his improved equipment, consisting of telephones which may be installed very quickly in the field. He has his outfit for conveying a reel of wire of many turns, carted between a two-wheel device hauled by a strong army mule. He has his full kit of tools and many contrivances which were unknown in the days of 1898. The result is that he is able to accomplish a great deal more good for the service. He is trained to a condition of field service. There are experienced men here now, hardened since the days of '98. The apparatus is vastly improved.

Some of the difficulties of work in Cuba may interest. The clay is a sticky substance which

METAL TRIPOD POLE USED IN CUBA.

clings to your shoes and makes traveling hard. It makes it difficult to sink a pole. You have to exert considerable pressure to get the point started. Then the first thing you know the point strikes a hard substance. There you quit, for you have contacted with the hard coral strata which prevails just below the surface of the earth. This coral strata causes the trees to topple over in the event of high winds, as the roots cannot get down into the ground very deep. With the fall of the trees the wires always get broken and tangled.

Another thing that bothers the electric linemen of this country is the premature decay of wood in the ground. Poles are rotted off very quickly. The result is that steel poles are employed quite largely. Most of these metal poles are constructed of series of pieces, arranged in a tripod plan, extending upwards to the required height. The base of the pole is sunk into cement. Many of the wood poles are likewise cemented up at the foot, and the cement prevents decaying of the lumber. First the hole is made in the ground and then the

CUBAN WORKMEN RESTORING BROKEN POLE.

base or foundation cement is put in. This is allowed to harden a little while and then the base of the pole is put in. When erect the cavity is filled with cement. When dry and hard, a very substantial foundation and support is obtained for the pole.

Electric linemen of Cuba are hindered to some degree by lack of supplies. Many of the appliances are shipped in from American manufacturing establishments. Delays and losses in shipping create more or less bother for the workmen.

Then, again, there are the annoyances experienced due to the necessity of engaging a proportion of native help. While the average Cuban is a better worker than the Filipino, he has his disadvantageous qualities. The natives eat a little bread and drink a little coffee in the morning. They expect to quit promptly at 11 o'clock for breakfast, just when you are getting interested in your work and want to keep on. The whole gang stops and you cannot get a thing done until one o'clock. Then they work until six o'clock. The Cuban lineman is agile and willing. He can go up the poles well and he can work if he wants to.

I have been asked questions concerning the likelihood of increased advantages for electrical men in this part of the world. Already some of our soldiers are arranging to purchase their discharges for the purpose of engaging in electrical work in this island. The electric-lighting and power branches are occupying considerable attention everywhere, and the industry promises to be an exceedingly large one within a few years.

Confidence has been restored in all lines of work. The planters are putting in more machinery. The electrical people are now placing orders for increased apparatus. More lights are being arranged for and additional electric-railway lines and the like are in progress. There is a better demand for electrically operated machinery. Telegraph and telephone lines are being developed.

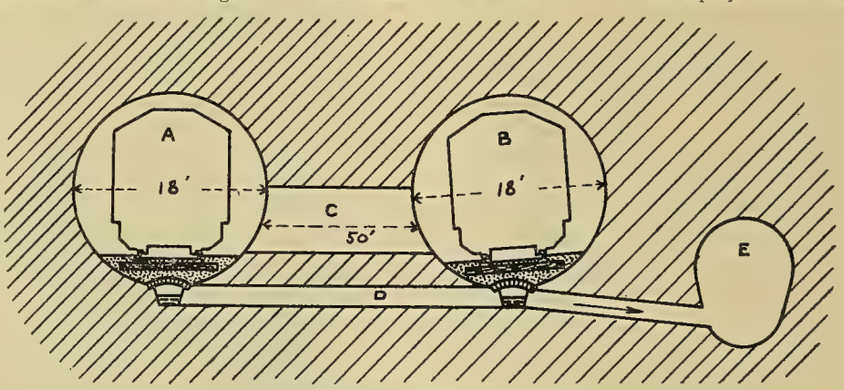
There are without a doubt increased opportunities for the electrical fraternity in this country, now that the American soldiers are here and quietude reigns.

English Channel Tunnel Project.

By A. De Courcy.

The project of a tunnel under the English Channel to connect France with England seems likely to come to a head very shortly, seeing that a bill to this effect is to be brought before the British Parliament in the near future. What may not be generally known is that on the French side not only are the plans of such a tunnel now laid out in a very complete manner, but a short length of tunnel has already been commenced, starting from a point near Calais, and the company which is carrying on the work is only waiting for the government decision in order to commence operations in earnest. There is no doubt that electric trains would be run in the tunnel.

After some preliminary projects which date even from the time of Napoleon, a stock company was formed in France in 1875 with a capital of $400,000, half of which was subscribed by the North Railroad Company and one-quarter by Rothschild Brothers, in order to draw up the designs of the tunnel and begin a trial section on the French coast. The government made a contract with the company, granting a concession for a line which should join onto a similar tunnel carried out by an English company. But on the English side the matter, although taken up by a similar company, the Channel Tunnel Company, which then lost its concession, and later on by the South Eastern Railway, was allowed to fall through, and it is not until now that the project is coming seriously upon the tapis. As the relations between the two countries are quite friendly at present, there seems some likelihood that the present bill may be carried through Parliament.



PROPOSED ENGLISH CHANNEL TUNNEL.

The French company has laid out the capital of $400,000 in preparatory work on the tunnel, such as shafts, galleries, rock soundings and similar operations, and has a number of buildings erected, the work being done at Sangatte, near Calais, under the direction of Ludovic Breton. Several shafts are sunk at this point. Starting from the shafts is a gallery which runs at a depth of 180 feet below the surface.

Two tunnels of circular section lying near together have been planned by the engineers of the company. The design will be noticed in the accompanying diagram. As to the total length of track, it will be about three times what is used in the Simplon Tunnel, or from 30 to 40 miles. Each of the tunnels (A) and (B) is very near 18 feet in diameter, carrying a single track, and the tubes

are spaced about 50 feet apart. A series of cross galleries (C) makes connection between them at the proper intervals.

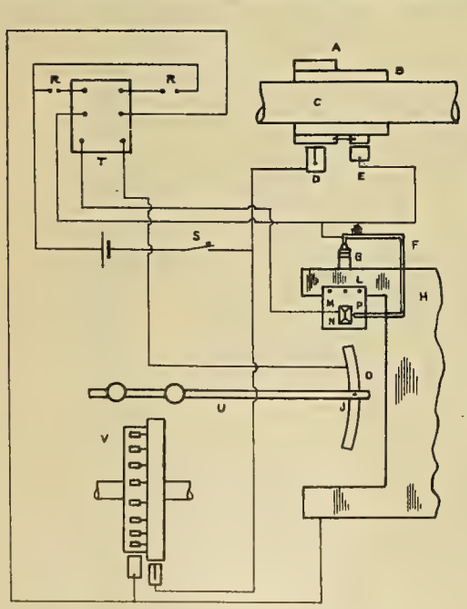
How to provide for carrying off the water was a leading point in the design, as there would always be considerable leakage into the tunnel. The method shown in the sectional view has been designed by Engineer Breton. It allows of running the whole tunnel on a level grade. First they would run a small gallery of elliptical section, as noticed to the right at (E), which answers as an advance tunnel for carrying out the construction. Laid on a slope, it would be used after the work is finished as a drainage tunnel, and a series of conduits (D) would lead off the water which collects at the bottom of the tubes. The cost of the enterprise is estimated in the neighborhood of $50,000,000, and it could be finished within seven years.

Speed Recorder for Dynamos and Motors.

A new form of recording device has been brought out in France for recording the performance of a dynamo or motor during each revolution by means of a series of sparks perforated in a moving band of paper. When running alternators in parallel, it is often difficult to determine whether the irregularities are due to the engine or lie in the dynamos themselves. The present instrument is intended for such cases.

The base of the device consists of a registering tachygraph, this being composed of the swinging arm (V), shown in the drawing, working by a centrifugal device on the shaft, to be tested and thus giving a swing in accordance with the speed of the shaft, together with a fixed plate or support (H). Under the pen (J) of the arm, a band of paper moves from left to right, drawn by a clockwork drum. A series of curves drawn by the pen thus show the speed variations of the shaft under test. Here the apparatus is connected with the shaft by a set of gearing instead of by belt, so as to avoid the damping effect which would be caused by the inertia of the pulley.

The curve upon the paper is formed by means of a series of spark holes in the latter. This is carried out by cutting out a portion of the plate (H) over which the paper moves, and the pen of the swinging arm is replaced by a steel point (J). On the other side of the paper is a curved metal piece (O) which corresponds to the arc traced by the point. Sparks can thus pass between the point and the plate at any position of the arm, and perforate the paper. While thus making the series of spark holes corresponding to different points in one revolution of the dynamo, it is necessary to have a check point so as to show each revolution, and the latter points are formed by a second set of spark holes, made in the paper band above the former set. The spark occurs between the upper point at



SPEED-RECORDING DEVICE FOR DYNAMOS AND MOTORS.

the end of the curved arm (F) (the latter being shown flatwise for the sake of clearness) and a small copper plate (N) of prismatic shape. The plate is attached to an insulating plate (M), which is in turn fixed to the main support at (L). As the paper passes along, it is perforated by a spark at each revolution of the dynamo, thus forming a line of holes along the paper. The upper arm (F) is well insulated from the support by the insulating piece (G).

The device for making the sparks at (P) consists of a metal ring (A) mounted on an insulating bushing (B) and fitted upon the shaft (C) of the machine. A single contact point on the right thus makes an instantaneous contact between (D) and (E) once in each revolution of the shaft, so as to give a spark at (P). To produce the second set of sparks at (J), the device shown at (V) is employed, consisting of a set of contact points mounted upon a drum so as to give a certain number of contacts per revolution of the shaft. Thus the spaces between the sparks made at (J) show the differences in the speed of the shaft during the revolution. When desired, this drum or the first-mentioned one can be mounted on a countershaft running at a different speed. The paper is unrolled according to the speed of the shaft, so as to have a good record. For instance, it moves eight millimeters per revolution, while there are eight contacts mounted on (V), and thus one millimeter distance between the sparks at (J).

Current is given by the spark-coil (T), using the rheostats (R). The device at (C) makes one contact on the secondary per revolution, while the drum (V) makes eight contacts for the same. The primary circuits give the sparks for perforating the paper. The instantaneous speed at any point can be obtained by shifting the drum (V) about the shaft.

Electrical Exports for October.

Electrical exports from the United States for the month of October, 1906, amounted to a total value of $1,607,036. This is the greatest value of one month's exports on record, and nearly double the figure for October, 1905, when it was $981,893; however, every month this year shows a good gain over the corresponding month last year. The total value of the electrical exports for the first 10 months of this year is greater by $756,145 than for the whole of last year. Comparing the first 10 months of the last three years, the value of the exports for that period are: 1906, $13,813,822; 1905, $10,437,366; 1904, $8,812,899.

Turning again to the month of October, the records of the Department of Commerce and Labor show a large gain both in electrical appliances and electrical machinery, as compared with October, 1905. Following are the figures: Electrical appliances—October, 1905, $454,224; October, 1906, $863,287. Electrical machinery—October, 1905, $527,669; October, 1906, $743,749.

Considering now the export of electrical machinery only, the following figures show the value of the purchases of the principal buyers for the month of October: Japan, $210,302; British North America, $165,094; United Kingdom, $89,564; Mexico, $68,905; Brazil, $35,123; British East Indies, $25,400; British Australasia, $24,675; Argentina, $18,584; Philippine Islands, $15,515; France, $13,429; Cuba, $12,551; Germany, $10,811; Central American States and British Honduras, $7,630; British Africa, $2,374.

The extension of the Northwestern Elevated Railway of Chicago has been completed to Ravenswood, so far as the main structure is concerned. The tie and rail gangs are following, and it is possible that the extension will be thrown open to traffic early in the spring.

A New Hydro-electric Plant in the Maritime Alps.

By A. De Courcy.

The Maritime Alps region in the south of France is well adapted for the development of hydraulic power stations, as the mountains contain a good number of streams having a reasonably regular flow, while at the same time the region lies not far back from the Mediterranean coast, so that the numerous towns along the coast can make use of a large amount of current, both for lighting and for the extensive tramway systems which are installed there.

I have already had occasion to speak of the extensive system of hydraulic plants and transmission

VIEW SHOWING THE SIAGNE POWER PLANT IN THE MARITIME ALPS DURING CONSTRUCTION.

lines which are under the control of the Société Energie Electrique, which is one of the largest and most enterprising companies of this kind in France. This company has recently completed a new hydro-electric plant on the Siagne River, which is intended to give an additional supply of electric power. It is designed especially to help out the Entraygues plant, which was built to send current to Toulon. At the same time the plant is designed so that it will give different voltages corresponding to the rest of the transmission lines of the region, which work at 10,000, 30,000 and 50,000 volts, and can thus be connected to any of these circuits. Power will even be sent as far as Marseilles from the new plant, and a 30,000-volt line will connect it near the city with a large sub-station, so as to give a supply for the surrounding district.

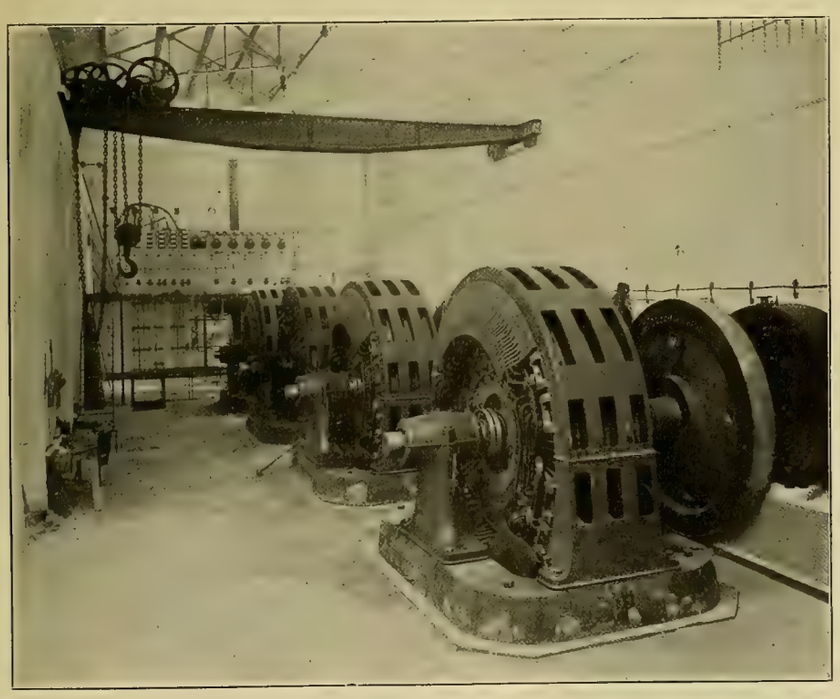
The Siagne is a mountain torrent. It has a rapid descent along its course, rising in the Lachens Mountains and emptying into the Mediterranean after covering a distance of 18 miles or more. Most of the water supply of this stream is given by the melting of the snow upon the mountains, as the range is of a great height. On the average, a supply of 800 gallons per second may be expected, but during the low-water season this will fall as low as 350 gallons. In the present hydraulic work it is possible to secure a net head of about 1,100 feet, which, with the use of high-pressure turbines, affords a total supply of some 4,500 kilowatts net for the generating plant.

In the present plant the hydraulic work has been carried out by Giros & Loucher of Paris. Across the stream, which runs in a narrow gorge between the mountains, is erected a dam formed of a masonry wall 65 feet in length. This wall rests upon a mass of beton, which forms the foundation of the dam, having a thickness of six feet or less. In order to reinforce the wall at the lower side, the designers used masses of rock or large cubical blocks of beton. From the side of the dam leads the main reservoir, into which the water comes first before passing into the flume. This reservoir is cut out of the rock in part, and for the remainder a masonry construction is used. A discharge gate allows of running off the water in case it is desired to empty the basin. Before going into the flume, however, the water passes into a large settling basin, which is situated some

A VIEW ABOVE SIAGNE POWER HOUSE, SHOWING THE BEGINNING OF THE PENSTOCKS.

700 feet below the dam. The floor of the basin is constructed of beton, and the water spreads out here over a considerable surface. Where the flume leads off from the basin there is an entry gate and also a grating, in order to stop the debris. A by-pass canal goes around the basin, so as to isolate it, if necessary.

Leading from the dam to a point above the turbine house, the main flume has a water section of four by five feet, and gives a flow of about 800 gallons per second. Most of it is built as a covered canal, using masonry vaulting for the roofing, although in some cases the flume is covered by flat slabs of beton. Where danger from falling rock is feared, two thicknesses of beton slabs are used. At a point where the flume has to cross a ravine of some depth, the water is taken across in a large steel tube some four feet in diameter, which acts on the siphon principle. This conduit has a total length of 980 feet. The remainder of the flume is formed of a metallic canal built of boiler iron and having a rectangular section. Here the flume rests upon masonry pillars, and it is covered with flat sheet iron, laid across the top.



INTERIOR OF SIAGNE HYDRO-ELECTRIC GENERATING PLANT.

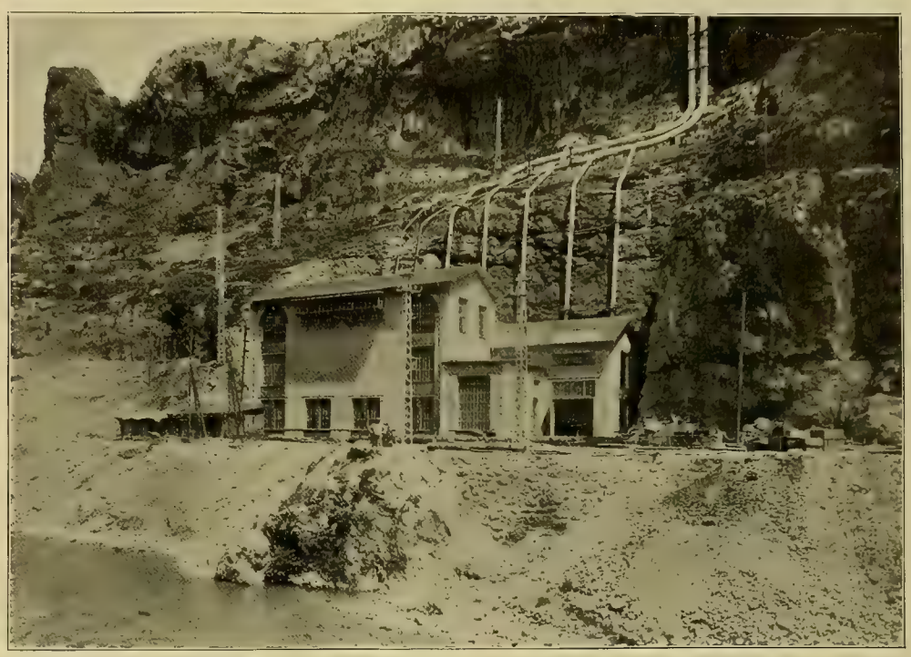
The total length of the sheet-iron conduit is about 330 feet.

Situated in the mountain spur which overhangs the valley containing the turbine house is a large reservoir which receives the water from the flume and serves as the starting point for the penstocks. The total capacity of this basin is some 15,000 cubic yards, which affords a good reserve supply of water. Built upon a rocky platform, the basin is constructed of masonry and beton. Where the flume enters it there is a gate for shutting off the water from the latter. Starting from the basin are the two penstocks, which run down for a considerable distance over the rocky slope to the generating plant. The penstocks, formed of sheet steel, are about 40 inches in inside diameter and run almost perpendicularly for a distance of 3,000 feet or more.

The power house is located not far from the village of Saint Cézaire, below the rocky cliffs which border the stream. It contains four principal turbine-alternator sets and two turbine-exciter groups. As will be observed, the two main penstocks coming from the basin branch off into a set of five smaller pipes just above the station, including also two others of much smaller size for the exciters. One of the main penstocks is used as a reserve, while each of the others leads to a Pelton waterwheel in the main generating room, beside its alternators. From these wheels is obtained some 1,500 horsepower each from an 1,100-foot water head and at a speed of 375 revolutions per minute.

Special attention has been given to the turbine regulation, so as to obtain a constant speed for the machines. Between the turbine and the alternator is mounted a four-ton flywheel. A system of hydraulic governing devices is used, so as to keep the water delivery constant at the wheel, or nearly so, and it is stated that the speed under the usual running conditions does not vary more than 15 revolutions per minute on either side of the normal point. For the exciters a smaller Pelton wheel of about the same general type as the large ones is used. These turbines are designed to give 150 horsepower, and operate at 900 revolutions per minute. Their shafts are horizontal, as in the former case.

Electrically considered, the plant, which was furnished by the French Thomson-Houston Company, consists of three-phase alternators, all of the same construction and having a capacity of 1,200 kilowatts each. When running at the normal speed of 375 revolutions per minute these machines will give 11,000 volts, at 25 cycles. They are of a recently designed type, and the internal-revolving field is mounted with a set of 10 projecting pole-pieces containing the usual wire-wound field coils. In a slotted laminated ring around the field is placed the armature winding, and the external casting which covers the latter and forms the main body of the machine is well ventilated by a set of air openings of large section.



POWER HOUSE OF SIAGNE HYDRO-ELECTRIC PLANT NEAR ST. CEZAIRE, FRANCE.

For the exciters, two compound-wound generators are used, working at 115 volts. These machines have a capacity of 80 kilowatts each. One of them alone is sufficient to give the current for all four alternators, and the second machine serves as a standby. The exciters operate at the turbine speed of 900 revolutions per minute, as they are direct-coupled.

Raising transformers, with a ratio of 11,000 to 30,000 volts, are used to connect with the switchboard and furnish the high tension for the overhead lines. At the same time the machine voltage of 11,000 volts can be used on another set of lines, in order to work in parallel with some of the existing circuits. For the 30,000-volt lines the station uses six single-phase transformers, coupled in two sets of three each. These transformers supply two 30,000-volt lines which leave the station. Three other transformers can be coupled as desired upon these lines. All of them are of the new Thomson-Houston water-cooled type.

A switchboard is installed in the plant for handling the alternators, exciters and high-tension feeders. There are five panels for the main alternator groups (with one panel in reserve for a new machine) and one panel for the two exciters. Of the transformer panels, which are three in number, two are used for the 30,000-volt connections. For the three-phase 10,000-volt overhead lines, two panels are used. There is, besides, one panel for the bus-bar connections of the 10,000-volt circuits and one for use with two small generators, which are mounted on the same shaft as the exciters, and are used for current on the premises.

The Siagne plant is now supplying current upon some of the overhead lines, and thus gives an additional amount of power to the network. As to the current which is to be used for the city of Marseilles upon the 30,000-volt line, the sub-station will be erected for this purpose at Allauch, near the city of Marseilles.

WESTERN ELECTRICIAN

EVERY SATURDAY.

PUBLICATION OFFICES:

507 Marquette Building, - CHICAGO.

TELEPHONE, MAIN 1746.

Eastern Office, 150 Nassau Street, New York.

Telephone, 5220 Beekman.

Trade Supplied by Western News Co.

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SUBSCRIPTION, in advance, postage prepaid, $3.00 for a full year of 52 numbers; in clubs of four or more, $2.50, with free extra copy for eight subscriptions; foreign countries, $5.00 a year; single copies, 10 cents. When change of address is requested, the **old address** as well as the new should be given.

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REMITTANCES.—All checks, drafts and other remittances should be made payable to the order of the publishers, the **Electrician Publishing Company,** and addressed to the offices of publication, Suite 507, Marquette Building (204 Dearborn Street), Chicago, Illinois, U. S. A.

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DATES AHEAD.

Chicago Electrical Show (second annual exhibition), Coliseum, Chicago, January 14 to 26, 1907.

Northwestern Electrical Association (annual meeting), Coliseum, Chicago, January 16th, 17th and 18th.

Central Electric Railway Association (annual meeting), Indianapolis, January 17th.

SWELLING in ever-increasing volume, the exports of electrical apparatus from the United States have now reached proportions which are gratifying to every American electrical man. The total value of such exports for the month of October, 1906, was $1,607,036, which is believed to be the largest for any month in the history of the country. For the corresponding month in 1905 the figure was $981,893, showing an increase of over $600,000 for the month. The United States is now selling to foreign countries electrical machinery and appliances at the rate of about $16,000,000 a year, and its electrical trade now forms a not inconsiderable proportion of the total exports of manufactured products.

Of the total of over $1,600,000 of exports for last October, electrical appliances, including telegraph and telephone instruments, was credited with $863,287, while electrical machinery makes up the remainder, or $743,749. In both classifications satisfactory increases are to be noted.

One interesting thing about the place of destination of the exports of electrical machinery is that Japan has come to the front as our largest customer, taking such exports to the value of $210,302 out of the total of $743,749. The next largest buyer is British North America, while the United Kingdom and Mexico are third and fourth. This appearance of Japan at the top of the column is probably a spurt, and it is to be feared that we must not expect that the Mikado's empire will continue to buy electrical machinery from us at this unusual rate.

TECHNICAL SOCIETIES are adopting the policy of forming sections or branches in all places where meetings are held. There is thus a sectional meeting, attended by local members, in the city having the headquarters of the association, instead of a meeting of the whole society. This, of course, refers to the monthly meetings during the season, the annual meeting remaining as before. While in some respects this change is more apparent than real, it is, nevertheless, made in furtherance of a wise policy, and is to be commended. It puts the local meeting in the headquarters city in precisely the same relation to the whole society as is the case with the sectional meeting at any other point. The Illuminating Engineering Society has already adopted this plan and the American Institute of Electrical Engineers is about to do so. The results should be beneficial to all concerned.

POOR as the service of the street-railway companies of Chicago undoubtedly is, an inventory of the actual property used in the operation of the street-railway lines amounts to a very respectable figure. This is shown by the figures of the engineering commission, composed of Bion J. Arnold, Professor M. E. Cooley and A. B. Dupont, which has made a report on the subject to the local transportation committee of the Chicago City Council. This commission values the tangible and intangible properties of the Chicago Union Traction Company and the Chicago City Railway Company at nearly $47,000,000. If the paving of rights-of-way is included, this valuation is increased to $51,000,000. The companies themselves put a valuation of $74,000,000 on their properties.

While there is a considerable divergence between these figures, there is reason to believe that the representatives of the city and of the companies will be able to arrive at a basis of agreement for an appraisal which shall be mutually acceptable. When the city and companies reach an agreement on the value of the properties the long-delayed settlement of the Chicago street-railway tangle will be appreciably nearer.

INCANDESCENT lamps of a different shape from those ordinarily employed have been recommended for the concealed lighting which so many illuminating engineers are now recommending. Thus Mr. L. B. Marks, speaking of the lighting of the library of the new building of the Boston Edison Company, says that the lighting committee of experts proposes to run a cove or a double cove along the center of the room, instead of along the sides. By doing this the objection which has been made to concealed lighting—that is, inefficiency, because half of the light is practically wasted—is overcome, for the illumination will emanate from two distinct lines of light. In addition to this arrangement the lamp which will be used will be a narrow tubular lamp about a foot long, with a linear filament. A line of lights made by lamps of this character will overcome "spotting," or bright points of light, to which objection is made. Mr. Marks thinks that the cost of this system of lighting will be less than that of anything used for this specific purpose in the past. However, it has not been put into service yet, and he says very sensibly that until it has been demonstrated in actual practice judgment as to the extensive employment of this system had perhaps best be reserved.

INSURANCE interests continue to show marked activity in the inspection of electrical installations throughout the West, and while this investigation is often a thorn in the side of the too-ambitious contractor or the too-economical owner, it should in the end work out beneficially to all engaged in the industry. Of course, the insurance men are interested from a purely selfish point of view; they want to get as much as they can in premiums on electrical risks and pay out as little as they can for fire losses. But anything that will in the end make the use of electric light and power more widespread, more safe, more secure in public confidence, should be welcome. Therefore, when the underwriters' electrical inspectors report, as they recently did in the case of a Wisconsin town, "Interior wiring is generally very poor; electricity is used in about 80 per cent. of the buildings in the business district; of this number 23 per cent. has been reported as 'fair;' 38 per cent. 'poor;' 15 per cent. 'hazardous,' and 24 per cent. 'very hazardous,'" it behooves somebody to take notice. Usually such conditions are due to the parsimony of owners, and the electrical interests owe it to themselves to use every effort to cause those responsible to remedy this condition of affairs, which can be easily done by the expenditure of money.

METRIC weights and measures did not meet with much approval on the part of the American Society of Mechanical Engineers at the annual meeting of that society held in New York last week. Nearly all of those taking part in the discussion were of the opinion that it is undesirable and impracticable to replace the time-honored system of units now used in the United States and Great Britain by the decimal system, even if the latter is more logical, more scientific and more convenient in making computations. It seemed to be the almost unanimous opinion that it would be so difficult to make the change that it might almost be regarded as impossible. However, the thought of the members was far from trending toward the position that no improvement could be made in our present cumbersome system of weights and measures. Indeed, it was thought that a resolute effort should be made to improve this system, and it was recommended that Congress be asked to pass a bill providing for a technical commission on weights and measures to represent, as far as practicable, every important scientific, industrial, agricultural, commercial, mechanical and maritime interest in the country. To this commission, it was thought, all questions relating to the standards of length, weight and volume in use throughout the United States might well be referred.

More conservative than the American Institute of Electrical Engineers, if we may judge by the recent vote taken on the question by the members of the latter organization, the American Society of Mechanical Engineers has undoubtedly taken the popular side of this important question. Whether it is a position indicated by the highest wisdom is another matter. The metric system is unquestionably superior to the English system of weights and measures as it exists at present, and if it could be substituted for the older system the ultimate result would be desirable and advantageous, no doubt. However, the change would be such a profound and sweeping one that it may well be dreaded. Better to make the metric system obligatory in the instruction in the public schools, and so hope to secure its adoption in the course of time by the gradual process of education. At any rate, whether the metric system is ever adopted in the United States, every fairly well-educated person should be familiar with it, because it is so largely used throughout the civilized world.

Annual Meeting of the American Society of Mechanical Engineers.

The twenty-seventh annual meeting of the American Society of Mechanical Engineers was held in the assembly rooms of the New York Edison Company, New York city, December 4-7, 1906.

President F. W. Taylor of Philadelphia called the meeting to order on the evening of December 4th and presented his annual address, which was on the subject "The Art of Cutting Metals." This address was a monumental work and is printed in the Proceedings of the society, occupying one entire number, of 248 pages, with 24 folding plates. With the diagrams and views the address gives a complete exposition of the art.

After the address was presented, the result of the election of officers was announced. The following-named officers were elected:

President—Professor Frederick R. Hutton of New York.

Vice-presidents—J. W. Lieb, Jr., of New York; P. W. Gates of Chicago, and Alex Dow of Detroit.

Managers—A. J. Caldwall of Bridgeport, Conn.; G. M. Basford of New York, and A. L. Riker of Bridgeport, Conn.

Treasurer—W. H. Woley of New York.

On Wednesday morning the written discussion of the president's address was read, and the paper was discussed by several members, after which the meeting adjourned until Wednesday afternoon.

Gas Power.

At the afternoon meeting the first paper read was on "The Evolution of Gas Power," by F. E. Junge, member of the Verein Deutscher Ingenieure, Berlin, Germany. Mr. Junge said:

"Who can help admitting that the employment of gas power has actually become a factor of consequence in the world's total energy output, when it is considered that in Germany, a small country of four-fifths the size of Texas, there are today in the iron and coal industry alone in active service or in contemplation, 136 gas-blowing engines with 161,300 horsepower, 200 gas dynamos with 205,300 horsepower, 11 gas-engine roll drives with 17,000 horsepower, and 47 coke-oven dynamos with 40,000 horsepower, besides four engines with 1,500 horsepower, for other purposes, or a total of about 400 large gas engines, with a combined capacity of 420,000 horsepower?

"Though the ideal after which we are striving is still far from what we have actually attained, it would be wrong to conclude that the present type of gas prime movers is not on a high level of excellence, not only as an economical, but as a reliable, machine. Just as the steam turbine cannot be regarded as having reached its highest state of perfection, and yet is a commercial engine of the greatest possibilities, so it is with the gas engine. After having passed out of the costly experimental state and after having reached a condition of standard design, its manufacture is now as profitable to the engine builder as its application is to the power consumer.

"In a recent address, delivered by Professor Riedler-Charlottenburg to the Verein Deutscher Ingenieure on the evolution of the steam turbine, the situation was characterized by the following remarkable words: 'A development of unprecedented rapidity of one of the most difficult motors in the history of mechanical engineering; a sweeping victory in the power-station field; a momentous advance of the highest importance, principally to electrical engineering.' If we consider that what was thus described is a new machine which transforms the energy of steam into useful power at a higher degree of mechanical excellence, with a saving in weight and bulk and cost of the prime mover and generator, and with a greater uniformity of turning effort, but with the same low economic efficiency, we are at a loss to give expression to the extreme importance which the evolution of gas power possesses as a factor in the field of industrial economics. It may suffice to draw attention to the fact that this is not the substitution, by a rotary type or prime mover, of a reciprocating engine of the same thermal characteristics, but the complete abandonment of a traditional and wasteful process of energy generation in favor of a direct and efficient method. It has not only extended the capacity of our fuel resources to double and more of their former value, but has also enabled us to profitably utilize material and property which was deemed utterly worthless even a few years ago."

The discussion which followed the reading of this paper was opened by Professor C. E. Lucke, who said:

"Gas power, to be worthy of consideration by power-plant engineers, must be considered in large sizes, and not be discussed in small sizes at all. Large gas engines have peculiarities and troubles not possessed by small engines, and a comparison of a steam engine and a gas engine becomes rather more difficult in the large sizes than the small.

"The gas engine, in its modern form, that is to say, the form in which it takes in large sizes, has been through a process of development of only about 10 years. We have today gas engines that will run; we have not a special design of gas engine for each particular series of circumstances under which gas engines have to work; therefore, this single gas engine, which can run under the conditions obtaining today, has been put out to the world as an engine to do anything, but it was speedily found out that it could not, and that is the state of affairs today with respect to its mechanism. We are in the process of adapting the mechanism to a particular condition, and we are in a position of trying to find out what does affect or should affect the difference in design of the steam engine.

"It has been found by hard experience that most unfavorable conditions will have a serious effect upon the ability of the gas engine to do its work; the kind of gas, even a small change in the kind of gas that can be attempted or devised, such as this question of pre-ignition. I do not know what makes pre-ignition, and I know absolutely no way of finding out.

"We have no engine especially adapted to pumping water, and yet we have an infinite variety of steam pumps, as differentiated from steam central stations. We have no engine especially adapted to shipwork; we have little boat gas engines; we have not gone into the question of space for horsepower, and there are a thousand and one things that those gas engineers and those who are doing work for them have not had time to develop in these few years—10 in number—of the development of the gas engine. One thing that has made the gas engine very much abused of late years—in America at least—is the large number of contract failures which have been reported and which have got into the courts. Those failures are in every case traceable to this very one thing, the fact that the conditions under which the engines are worked are not fully recognized by the builder, or, if they are recognized, their importance was not recognized. The builder did not know how to make it particularly adapted to the work."

After this discussion a paper on "Producer-gas Power Plant" was read by J. R. Bibbins, Pittsburg, Pa. This paper described the operation, efficiency and construction of a typical modern industrial plant near Buffalo, N. Y., equipped with a central gas-power plant.

Miscellaneous Papers.

There was no oral discussion, and the next paper, on "The Design of Improved Boiler Setting," by A. Bement of Chicago, was read by title, and the written discussion by A. A. Gary, E. McLean, J. C. Parker and J. M. Whitton was read.

Professor William Kent of Syracuse University, William H. Bryan of St. Louis, D. S. Jacobus of Stevens Institute and Embury McLean took part in the oral discussion of Mr. Bement's paper.

A paper entitled "A High-duty Air Compressor" was next read by Professor O. P. Hood, the reading being followed by a reading of the written discussion of the paper, and oral discussion by F. V. Henshaw of Brooklyn.

A paper by Professor R. C. Carpenter of Ithaca, N. Y., entitled "The Steam Plant of the White Motor Car," was next read. The assistant secretary announced that an appendix to the paper by Professor Carpenter and a written discussion of it by Professor Carl C. Thomas appeared in the November Proceedings of the society.

The Wednesday evening session was opened by the reading of a paper entitled "A Plan to Provide Skilled Workmen," by M. W. Alexander. Written discussions of this paper, by Mr. Higgins, Professor C. A. Richards, President Taylor, Mr. Hathaway and A. L. Williston, were read.

L. D. Burlingame of Providence, R. I., H. F. J. Porter of Pittsburg, George R. Henderson of New York, Professor Lanza of Boston, Mr. P. W. Gates of Chicago, W. S. Huson of Derby, Conn., and Professor Robinson of Columbus, Ohio, took part in the oral discussion of the paper.

"Ventilation of the Boston Subway," by H. A. Carson of Boston, was the next paper, and as it had been published, and the time was getting limited, only the written discussion, by Francis Fox, was read. Mr. Theodore Weinshank discussed the paper orally.

The next paper was on the "Flow of Liquids in Venturi Tubes," by Mr. E. P. Coleman of Buffalo, N. Y. Written discussion by Professor Carpenter, Stanford A. Moss and Clemens Herschel, was read. The paper was discussed orally by A. L. Williston of Brooklyn.

At the morning session of December 6th several papers were read and discussed, among them being "Tests of a Plunger Elevator Plant," by A. J. Herschmann, and an oral discussion of the paper by Mr. R. P. Bolton; "Test of a Rotary Pump," by Professor W. B. Gregory; "An Improved Transmission Dynamometer," by Professor W. F. Durand, and "Saw-tooth Roof Construction," by F. S. Hines.

The Metric System.

The paper by Henry R. Towne of New York, on "Our Present Weights and Measures and the Metric System," brought forth some interesting discussion. At the end of the paper Mr. Towne sums up as follows:

"Decimal Notation.—The advantages of a decimal system are conceded for purposes of computation, but denied for the ordinary uses of the people. For the latter, binary division always has and always will prevail. Decimal notation is feasible with any system. If finally we decide not to adopt the metric system, let us then reform our scales or tables, and in so doing decimalize them so far as found expedient.

"Absolute Units.—The metric units are no better than, if as good as, the units of the British-American system, and are equally arbitrary. The most important metric unit, that of length, is inconvenient. What is essential is that the units shall be definite and fixed. Next to this in desirability is that they shall be such that binary division shall be available for common uses, and decimal division for purposes of computation. The metric system fails to meet this requirement.

"Measures of Length.—These are organic, and are 'linked irrevocably to the past.' Many of them practically are immutable, such as those relating to land ownership, to construction, to screws, to interchangeable couplings, etc. Without great difficulty, we may change our units of weight and of volume, but not those of length or of area. To attempt to change the latter would entail vast losses, and would bring no compensating gain. The metric system is now legal in the United States, and yet unused. Of the organized bodies which have voted on this question, 44 are on record as opposed to the adoption of the metric system in the United States, as against 14 in its favor. The adoption of the metric system would mean, for a century at least, that we would have two systems of weights and measures where now we have only one. In reply to the argument for a change, the plea of organized industry is 'Let us have peace.'

"Uniformity.—We now have absolute national uniformity, and except as to measures of volume, international uniformity with the British Empire. No other nation in the world, save Great Britain, enjoys today such absolute uniformity as to weights and measures as the United States. We may change our scales, if we retain our present base units, without losing this national blessing, but if we change our units of weights and measures, we shall substitute, for a hundred years or longer, confusion in place of the absolute unity we now enjoy. Other countries have changed their system to secure uniformity; we now have uniformity, but would lose it if we should change our system. Let us make sure that the benefits to be secured by change would outweigh the difficulties and objections which any change of units implies, or else let us keep our present units.

"Influence on Domestic Operations.—The law of 1866, which legalized the use of the metric system, is all that is now justified; any further legislation would imply coercion, and this is contrary to the spirit of our laws. American manufacturers are free today to use the metric system, but do not employ it, nor do they wish to be coerced into so doing. American scientists are equally free today to use the metric system, and are doing so. Let each respect the rights and interests of the other. No public demand for a change exists, and without it the change should not be made. The change, if made and if enforced, ultimately would involve a loss or injury to American manufacturers of probably more than $1,000,000,000, with no compensating benefit which they can perceive. The old units would persist in popular use for 100 years or longer, during all of which time we would have confusion where we now have unity.

"Influence on Foreign Operations.—The enforced adoption of the metric system would not assist our export trade, but more probably would hinder it. Available statistics do not show that the non-use of the metric system has retarded our exports of American manufactures, nor that the use of the metric system in foreign countries has decreased our imports of manufactures from such countries. No demand for the change has been made by our export merchants. Of our export trade in 1905, 49 per cent. was with the British Empire, and in this trade the adoption of the metric system, if of any influence, would be harmful, not helpful. The net result of the change would be increased confusion, without any compensating gain.

"Influence on Government Operations.—The proposed change would greatly increase the operating expenses of all departments of the government, would almost destroy the value of government statistics for popular use, and would bring no compensating benefit of any kind. It would substitute confusion for the perfect uniformity which now prevails. Save the plea that it would give the people a basis of experience on which later to make a final decision, the proposal to compel the use of the metric system in all government work has no argument to its credit, all of the arguments appearing on the debit side of the account. If investigation by a competent commission shall prove the contrary, the change may be justified, but until then we should hold fast to the national unity which we now enjoy in our weights and measures."

After the paper was read several written contributions to the discussion were read. Mr. Towne in closing said: "I want to say, however, briefly, that my own personal belief at the present time, and so far as my understanding of this subject

goes, I am in favor of the retention of our present system of weights and measures, and I am opposed to the substitution of the metric system. I believe, also, that our present system can be simplified and improved."

Social Features.

The social features of the convention were made especially enjoyable by the exertions of President Hutton of the local committee. On Thursday evening the members of the society were tendered a reception at Sherry's in Fifth Avenue.

In the afternoon of Thursday the members and guests enjoyed a trip to the large power station recently erected by the New York Central Railroad at Port Morris, where the electrical connections and appliances for operating the road by electricity were fully explained and exemplified.

On Friday a special train over the New Jersey Central Railroad carried the engineers to the Sandy Hook proving ground and Fort Hancock. The working of the great 12-inch guns was shown to the visitors by General Murray, and exhibitions of target practice and a land-mine explosion were shown. Visits were also made to some of the old batteries which were in use several years ago.

The society was enabled to have the pleasure of witnessing the demonstrations at the fort through the efforts of Professor Hutton, president-elect, who prevailed upon General Crozier, chief of the United States Bureau of Ordnances, and General Murray, chief of artillery, to make the display.

Chicago Illuminating Engineers.

A meeting of the Chicago branch of the Illuminating Engineering Society was held at White's Cafe on December 6, 1906. The meeting was preceded by a dinner, immediately after which the members discussed three papers, being those read at the November meeting of the Illuminating Engineering Society in New York, abstracts of which appeared in the Western Electrician of November 17th. The papers were "Location of Lamps and Illuminating Efficiency," by Preston S. Millar; "Fixture Design and Location," by Major E. L. Zalinski, U. S. A., and "Fixture Location in Residence Lighting," by F. N. Olcott.

Mr. George C. Keech occupied the chair and opened the discussion. Mr. Keech was followed by Mr. C. W. Pendel, who said that in lighting factories and large areas he places all the lights about eight feet high and from eight to 10 feet apart, using three or four-light clusters in the center and five-light clusters around the outside of the room. He varies the degree of illumination by placing lamps of different candlepowers in the clusters. He uses white porcelain reflectors.

J. R. Cravath said that one thing that surprised him is the remarkable reflection from the walls and ceiling in the case of bare lamps as shown in Table III. of Mr. Millar's paper. This kind of definite measurement is necessary before illuminating engineering can become an exact science. The case of the chandeliers as mentioned in that table is instructive, showing how poorly the ordinary chandeliers are arranged. Mr. Cravath was gratified to see that Mr. Olcott says that, "The fixture with the light at an angle has practically been done away with in the better residences"—because, at an angle, ordinary reflectors cannot be used without offense to people near.

Albert Scheible said that the faulty design of fixtures has often been due to the way in which the sockets are constructed—with the wire entrance opposite the lamp. A socket with an entrance at the side is useful in designing fixtures, and such a socket has been recently brought out in Chicago. (Mr. Scheible then exhibited the socket, passing it around for inspection.)

A. C. Strosser was of the opinion that the engineer has no chance to suggest plans in lighting residences until it is too late; the architect is followed by the fixture designer, and both work for effects without especial regard to best illuminating economy. Mr. Strosser gave an interesting personal example of this difficulty.

Mr. George H. Lukes described a fixture for dining rooms in which his idea was that there should be a central light, reflected downward for the illumination of the table, and two outside lights placed pointing upward for general illumination.

In speaking of the use of art glass, Mr. Cravath said that a better effect can be procured by placing a prismatic reflector inside of the art-glass shade, the reflector allowing enough light to pass to illuminate the art glass.

In the opinion of Mr. E. D. Alexander, gas fixtures should be separate from the electric fixtures, because the combined fixture cannot be used effectively in many cases. The combined fixture has to be placed according to the gas piping, and the gas-piping system is the same now as it was 25 years ago, without improvement.

Mr. Edward Johnson of Mandel Brothers said that, for show-window lighting, the source of light should be entirely hidden from the passerby and should be thrown upon the goods. No light should be thrown onto the sidewalk, and the floor of the window should not be of a reflecting nature. Mr. Cravath spoke of the different types of reflectors, saying that in a high and narrow window the concentrated light from the cone reflector is good, but that in the lower, wider windows the trough-shaped reflector may be used to an advantage.

George B. Johnson of the Chicago Edison Company, in defending a case where lights are exposed, said that in some cases it is desired to attract people, especially those from out of town, in which case a brilliant, glaring effect accomplishes the purpose.

In the case of showcase lighting, Mr. Ed. Johnson said that the problem is difficult. The light must be concealed, so that the eye is not blinded, and undue heating must be guarded against. At present the cost is enormous, miniature lamps of the candelabra type being best at present, but having poor efficiency.

In regard to jewelry showcase lighting, Mr. Cravath believes that the arc light is better for the display of diamonds, but that incandescent lights are better for showing gold. Mr. Ed. Johnson thought that frosted lamps should be used for fine arts and jewelry and should be placed directly over the showcase.

After the discussion it was voted that the next meeting should be held in the Coliseum Annex Hall on January 17th. Papers will be presented, the subjects of which will be announced later.

Chicago Street Railways Valued at $51,000,000.

The surface street-railway systems of the Chicago Union Traction Company and the Chicago City Railway Company are estimated to be worth $50,994,782. This is the value placed upon the two systems by the commission of experts employed by the city and composed of Bion J. Arnold, Mortimer E. Cooley and A. B. du Pont. The figure includes paving and assumes the franchise values (not included in accompanying table) as running 18 months.

The companies some time ago placed a value of $73,555,776 on the properties, a difference of over $22,000,000. Of the total amount submitted by the city's commission, $28,625,714 represents the value of the Union Traction system and $22,369,068 the City Railway. The traction companies' figures are, respectively, $43,119,512 and $30,436,264.

Comparative values of the physical values are shown in the accompanying table. Compared with the Arnold valuations in 1902, the present estimates are several millions larger. The commission of engineers explained the difference by reminding the aldermen that cost of material and labor is higher now than then, and that new construction, equipment and related expenses also are relatively far greater.

With the completion of this report rapid progress is expected in the negotiations for a settlement of the franchise question. While there is a large difference in the figures presented by the companies and those of the city's experts, it is said that the prospects for an agreement between the council committee and the traction officials are good.

Valuations of Street-railway Properties in Chicago.

		Chicago City Railway Company.			Chicago Union Traction Company.		
		Commissioners' Estimate.		Company's Estimate of Present Value.	Commissioners' Estimate.		Company's Estimate.
		Cost to Reproduce.	Present Value.		Cost to Reproduce.	Present Value.	
1	Track	$ 6,455,462	$ 4,568,062	$ 6,401,837	$ 8,047,783	$ 5,747,806	$10,184,008
2	Electric-power-distribution system	1,750,478	1,448,259	1,735,639	1,763,046	1,407,043	2,019,207
3	Cars and car equipment	5,784,875	4,550,137	4,489,842	5,225,367	3,398,796	3,794,291
4	Power plants	2,359,582	1,609,469	2,319,543	3,234,872	2,027,437	3,078,308
5	Tools, implements and machinery	247,407	198,183	197,452	100,798	100,798	215,499
6	Office furniture and fixtures	46,180	46,180	46,180	32,050	32,050	32,050
7	Horses, wagons and miscellaneous	29,110	29,110	38,740	29,593	29,593	42,708
8	Buildings and miscellaneous structures	1,309,704	1,149,205	1,583,426	3,781,046	2,845,262	3,717,890
9	Real estate (land)	1,095,366	1,095,366	1,446,395	2,866,178	2,866,178	3,479,374
10	Patent rights	41,268	41,268	41,268	14,925	14,925	14,925
	Totals of items 1 to 10, inclusive	$19,119,432	$14,735,239	$18,300,122	$25,905,658	$18,469,888	$26,578,260
11	Stores, supplies and floating tools	521,258	521,258	505,000	487,630	487,630	545,314
	Totals of items 1 to 11, inclusive	$19,640,690	$15,256,497	$18,805,122	$26,483,288	$18,957,518	$27,123,574
12	Legal expenses, carrying charges, brokerage and contingencies at 10 per cent	1,964,069	1,525,650	... ...	2,648,328	1,895,751	2,712,357
	Totals of items 1 to 12, inclusive	$21,604,759	$16,782,147	$18,805,122	$29,131,616	$20,853,269	$29,835,931
13	Add paving	2,283,826	1,832,558	2,091,280	3,201,402	2,509,477	3,037,752
	Totals	$23,888,585	$18,614,705	$20,896,402	$32,333,018	$23,362,746	$32,873,683

Engineering English Discussed at Cornell.

At a meeting of the Cornell University branch of the American Institute of Electrical Engineers, G. A. Wardlaw, who is an assistant secretary of the Institute, presented an address on "Engineering English."

Mr. Wardlaw, in his address, analyzed the characteristic features of the expression of engineering activity in technical literature and found many faults and few virtues. The involved, bewildering sentence is one characteristic. There are too many "buts" and "don'ts." A remedy for the evils is suggested. At the close of the address Mr. Wardlaw told how to test for efficiency of expression, so that if the discourse meets the tests it will be proved to have both substance and form.

After the address an informal smoker was held in order that the members and visitors might become acquainted.

Electricity's Part in the San Francisco Fire.

In the official report of the San Francisco fire, made by S. Albert Reed, consulting engineer of the National Board of Fire Underwriters, which has recently been made public, the following remarks are made in connection with electricity:

"Rocking effects (from the earthquake) might occur without fracturing the house connections of electrical and gas services; but displacement effects could hardly have failed to produce fractures inside of the house lines. Some crosses occurred of the 550-volt trolley wires with other wires from the falling of portions of walls across them. South of Howard Street other high-voltage overhead wires existed. It seems to be clear that the electric-service current was not shut off for some minutes after the shock.

"In Oakland, where the earthquake damage was mainly of the rocking and but slightly of the displacement character, the earthquake damage was about on par with that in San Francisco outside of the displacement district, and the Oakland electric current was shut off more promptly. These two facts may account for there having been only one outbreak of fire in that place. It is possible that National Code Standard service cut-outs would have fused safely and protected the buildings in which they might have been installed."

University of Illinois Branch Meeting of the Institute.

The University of Illinois branch of the American Institute of Electrical Engineers held its regular monthly meeting at the electrical laboratory of the university at Urbana on the evening of December 5th, with an attendance of 56 members, associates, students and guests. Mr. P. Junkersfeld and F. H. Smith of the Chicago Edison Company, Mr. Wiemer of the Wagner Electric Company of St. Louis and Messrs. F. D. Smith and Bunn of the Illinois Traction System were visitors.

The lighting papers of the November New York meeting were presented; that of Dr. Steinmetz, on the "Transformation of Electric Power into Light," by Professor Carman, that of Mr. Sharp, on "New Forms of Incandescent Lamps," by Professor H. P. Wood. Through the courtesy of Mr. Junkersfeld, samples of metallized filament, of tantalum and of tungsten lamps, were exhibited and compared. This was the first exhibition of the tungsten lamp at the university. Discussion was animated, and the influence of the new lamps upon the problems of electric lighting and production were considered.

Refreshments were then served, when the meeting adjourned to the laboratory proper, where was given a demonstration of the method of self-synchronizing of alternators, invented by Messrs. Brooks and Akers, as described in their Milwaukee convention paper. Apparently reckless closing of alternator switches was shown to be perfectly safe, and proper synchronizing to be invariably free from noticeable disturbance of the lamp load.

The Institute branch sessions this season have had a large attendance, the number present on this occasion being restricted by the very bad weather that prevailed. The meeting was quite informal, and was greatly enjoyed by all. This branch has been put on a strong and aggressive footing. Owing to the Christmas holidays, the January meeting will occur the second Wednesday in January, instead of the first Wednesday of the month, as is usual.

There are now 292 students registered at the University of Illinois in electrical engineering alone, 1,100 in engineering, and over 4,000 in the entire university.

WIRELESS OR RADIO-TELEGRAPHY.

By D. McNicol, A. M., A. I. E. E.

CHAPTER III. (*Continued.*)

Waves and Wave Motion.—Hertz Waves.

There is considerable diversity of opinion among scientists regarding the manner in which electromagnetic waves are propagated. An English scientist holds to the belief that the waves during their journey are several times reflected by the surface of the earth or sea and by the conducting strata of rarefied air to be found in the upper regions of the atmosphere. Another hypothesis, that of Blondel, is that the layers of the ether nearest the earth have a maximum electric density which might be likened to a kind of electric mist extending upward from the earth's surface to a distance of about 200 feet.

Other authorities hold that the waves are propa-

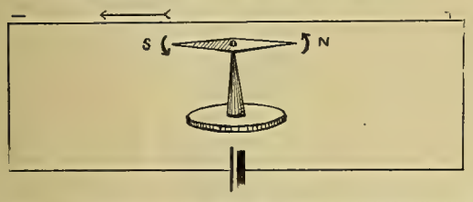


FIG. 5. DEFLECTION OF COMPASS NEEDLE BY DIRECT-CURRENT FLOW.

gated by diffraction, increasing as the waves become longer. This hypothesis is interesting, but in the case of long-distance transmission, say across the Atlantic Ocean, it should be remembered that the waves must surmount an obstacle over a hundred miles in height, representing the curvature of the earth. The extensive experiments conducted by Emile Guarani convinced that gentleman that an electric field can traverse obstacles only with loss of energy (deviations and absorptions), while a magnetic field traverses the earth's crust without serious difficulty, and with very little loss.

The theory of Blondel seems the most attractive. According to his hypothesis, "Electrical oscillations are produced along the wire and in the neighboring ether in the space between the radiator and the earth. From the seat of this disturbance orig-

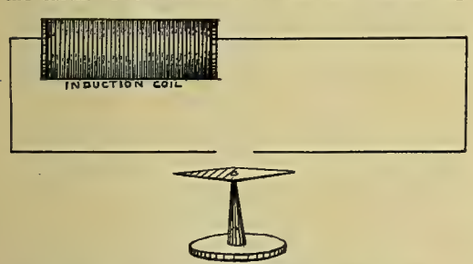


FIG. 6. ARRANGEMENT FOR EXPERIMENT WITH ALTERNATING CURRENT AND COMPASS NEEDLE.

inate the waves, which are propagated in all surrounding space. These waves are polarized, and form surfaces of revolution around the radiator. The lines of electric force are in meridianal planes and connect perpendicularly with the earth; the magnetic lines of force are in circles having the radiator for a common axis. But, as a result of this polarization and the effect of concentration, well known in the propagation of waves along wires or metallic surfaces, the electric density is much greater at the surface of the earth, directly connected with the oscillator, than in the atmosphere; and in large part the magnetic lines appear to slip along the earth. This concentration, moreover, is the greater the more perfect the conductivity of the surface over which the waves proceed, and the loss of energy in this transmission is thereby lessened. Yet this concentration does not prevent the diffusion of an important part of the energy into all space, under the form of hemispherical waves, the effects of which are less intense than those near the earth, but, nevertheless, noticeable."

By far the most interesting and instructing experiment which may be performed with simple apparatus to show the existence and presence of electromagnetic waves is that which may be shown with a small induction coil, a few cells of battery and an ordinary compass. In the study of electromagnetism we learn that when a conductor conveying a current of electricity is brought near a freely suspended magnet needle, the needle will tend to place itself at right angles to the conductor, as shown in Fig. 5.

This, of course, is the case when a battery current or other direct current traverses the wire. Should we, however, connect the wire shown in Fig. 5 into the secondary circuit of an induction coil and then place the wire over the magnetic needle as before, we will find that there is no deflection of the needle, although a much more powerful current is affecting the wire. This is because the current from the coil is an alternating one, the polarity being reversed many hundreds of times per second, there being no active magnetic flux created around the wire, as in the case of direct current.

Now, should we cut the wire, as shown in Fig. 6, and force the alternating current from the induction coil to jump across an air gap, we shall find that magnetic flux is now being created in the space between the separated ends of the conducting wire, and the magnetic needle is deflected, thus clearly showing that electromagnetic waves are present.

Should we reverse the current by means of a pole-changing switch the needle will be deflected in the opposite direction. Should we insert between the conducting wire and the needle a piece of glass or other solid, we shall observe that the needle is affected as if the solid were not interposed

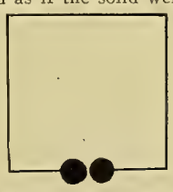


FIG. 7. HERTZ RESONATOR.

in the path of the magnetic waves. This fact makes possible X-ray photography and wireless telegraphy.

The ease with which Hertz rays penetrate solids has, since the discovery of the phenomenon, been a source of great wonder to the average individual, but if we remember that solids of all densities are divisible into atoms, and that atoms are so small that there is a space between them of the one-hundred-millionth part of an inch, we can readily understand that Hertz rays, having a wave length anywhere from a few inches to many miles, will have no difficulty in getting through the minute spaces between the atoms of a solid.

Light waves, on the contrary, cannot penetrate through a stone wall or other solid obstacles, because light waves are about the same length as the space between the atoms, and are therefore broken up on the surface of the solid. X-rays get through on account of their length being so much shorter than the space between the atoms.

After Hertz, other eminent scientists, among them Professor Poynting, Dr. Oliver Lodge, Prof. J. J. Thomson, Branly, Sarasin, De La Rives and

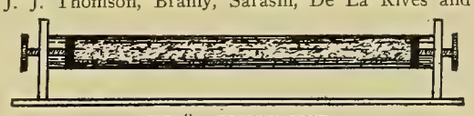


FIG. 8. BRANLY TUBE.

others took up the subject, and we are indebted to these gentlemen for a mass of information concerning the intricate characteristics of electric waves. But as the greater part of these investigations have taken practical form at the hands of later workers, who have applied the knowledge to practical purposes in perfecting systems of wireless telegraphy, we shall spare the reader from devoting time to the consideration of complex theory except in elucidation of the principles involved in the operation of the various devices already devised for generating and intercepting Hertz waves, and to be described later.

In order that we may detect electric waves at any point in space, we must employ some sort of device which is capable of giving direct indications of the presence of wave signals, or a device so constructed that its operation under the influence of electric waves will actuate a mechanical or electrical indicator.

The simple detector employed by Hertz consisted of a metal wire bent into a rectangle and terminated by two small metal spheres, between which the sparks played when the resonator or detector was subjected to the effects of electric waves. (See Fig. 7.)

This form of resonator was early discarded, except for laboratory experiments. Other forms of wave detectors were devised which had greater range of action. Among these, the first, and one of the most efficient, was due to Professor Branly of the Catholic University of Paris, the result of whose investigations was published in 1890. Professor Branly made the discovery that conducting power was imparted to metallic filings, which had been placed in loose contact, by the resultant effects of electric discharges in their vicinity. Further he discovered that the conducting power could be destroyed by simply disarranging the filings. Dr.

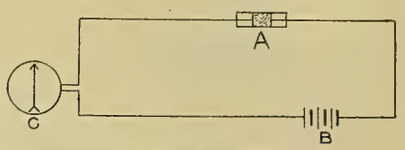


FIG. 9. DIAGRAM SHOWING OPERATION OF BRANLY TUBE.

Lodge constructed one of these Branly tubes, which consisted of a glass tube seven inches long and one-half inch in diameter, fitted at each end with copper pistons, which were so arranged that any degree of pressure might be exerted upon the particles of metal in the tube. (Fig. 8.)

The operation of this tube when subjected to a bombardment of electric waves may be graphically seen in Fig. 9, in which (A) is a Branly detector, (B) a cell of battery, and (C) a galvanometer. In their original condition the filings offer so much resistance to the current from the battery that the galvanometer in the circuit is not affected, but the moment that electric waves attack the filings in the tube, the resistance of the circuit is lowered and the battery is enabled to send its current through the entire circuit and the galvanometer needle is deflected.

Various physicists, in different countries, repeated the same experiments with arrangements similar to those of Lodge. Popoff, in Russia, particularly made the action of the tube automatic by employing a telegraph relay in the circuit with the tube and battery, the relay in turn actuating a telegraph sounder. However, at this time Popoff simply used the device to register

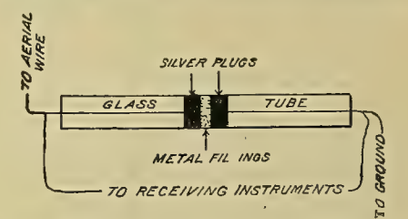


FIG. 10. ORIGINAL MARCONI FILINGS COHERER.

lightning discharges. For this purpose one terminal of the filings tube was connected to a lightning rod, the other terminal being grounded.

Dr. Lodge gave the name "coherer" to the tube form of wave detector. This term has passed into general use as applied to any loose collection of metallic particles, the conductivity of which is affected by electric waves.

To Guglielmo Marconi, at that time a student at the University of Bologna, Italy, and a pupil of the eminent Italian Professor Righi, belongs the honor of first conducting extensive experiments with electric waves which had for their object the introduction of wireless telegraphy for practical purposes. The coherer used by Marconi is illustrated in Fig. 10.

This, of course, is a theoretical diagram, and the reader will observe that the principal difference between this instrument and the Branly tube is the reduced section of the space between the electrodes in which the filings are placed. This modification gives us a more sensitive detector, on account of the decreased amount of filings to be acted upon by the waves, and also permits a more accurate regulation of the current strength in the local telegraph circuit.

In the construction of the coherer Marconi uses a glass tube about 2.5 millimeters internal diameter, and about four centimeters in length. Two silver pole-pieces or electrodes are snugly fitted into this tube, and are separated by a gap of about one millimeter, containing a mixture consisting of 96 per cent. nickel filings, and four per cent. silver, not too finely granulated, and worked up with a trace of mercury. The filings must not be packed too tightly between the plugs or the action will be irregular and oversensitive to parasitical disturbances; while, if too loose, it will not be sufficiently sensitive. The tube is then exhausted by a mercury pump until the pressure

Note.—This series of articles was begun in the issue of December 1, 1906. It will be complete in ten chapters. In reference to the repetition in the title it may be explained that wireless telegraphy is the popular name for the transmission of intelligible signals through space by Hertzian waves, while the term radiotelegraphy was officially adopted by the Berlin International Wireless Conference and promulgated November 3, 1906.

falls to about a millimeter, when the tubulure left for exhausting it is sealed off. (See Fig. 11.)

If the tubes are not exhausted, they gradually become less sensitive, on account of the oxidation of the metal particles. The author has obtained very gratifying results from a coherer constructed on the multiple principle (Fig. 12), in which (A) (A) are metal electrodes fitted with circular silver faces, the same diameter as the glass tube inside. (B) is an insulation support, securely separating two silver partitions placed within the tube, each of which has soldered to it a wire

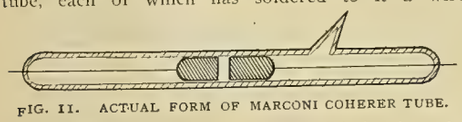


FIG. 11. ACTUAL FORM OF MARCONI COHERER TUBE.

which passes out through a hole (D) in the tube and connected to the electrode at the opposite end of the tube. (C) (C) are filings chambers. The fact that there are two sets of filings in the one tube doubles the responding capabilities of the instrument, while adding nothing in the way of difficulty in mechanically disarranging the particles after the passage of a wave or train of waves.

In addition to the coherer method of detecting electric waves, a number of other ingenious methods have been devised for securing the same result. But, as these methods are the distinctive features of the different systems of wireless telegraphy now in operation, we shall defer the description of these until we consider them in connection with the apparatus of which they form a part.

A question which naturally arises in connection with the operation of coherer-controlled circuits is that pertaining to the methods of decoherence,

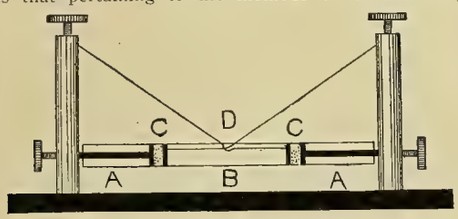


FIG. 12. MULTIPLE COHERER.

or shaking apart of the filings, after they have cohered by virtue of the wave having affected them.

Referring again to Fig. 9, we may consider that an arriving electric wave has reduced the resistance of the coherer and allowed the battery current to affect the galvanometer so that the needle (shown in a vertical position in the diagram) is deflected. Unless something is now done to disarrange the filings, the current will continue to flow through the circuit, and the needle will remain deflected permanently, or at least until the battery has been exhausted. If, however, we tap the tube gently with a pencil, the particles are jarred or decohered, and high resistance is restored; the battery current is unable to affect the galvanometer through the increased resistance, and the needle swings back to zero.

[*To be continued.*]

Features of the Chicago Electrical Show.

Managing Director Niesz announces the following special days for the January Electrical Show at the Coliseum, Chicago: Formal opening (invitation), 14th; Northwestern Electrical Association's annual meeting, 16th, 17th and 18th; Ben Franklin day (souvenirs), 17th; Illuminating Engineers' Society, 18th; Telephone day, 21st; Sons of Jove, 22d; Thomas A. Edison day (souvenirs), 23d; Electrical Salesmen's Association, 24th. The new storage battery which Thomas A. Edison has just completed will probably be exhibited and demonstrated for the first time. Mr. Edison has been invited to attend the exposition.

The management announces an "Electric Midway" as one of the features for the coming show, for which the main floor of the Coliseum annex will be divided into four small theaters. One of these will be devoted to new demonstrations with static apparatus and high and low-frequency current, showing many new inventions along these lines. Another theater will have a new electrical and mechanical creation called the "Aurora Borealis," which will show some beautiful lighting effects, invented and arranged by Edgar Healey of Chicago. In the third theater will be an electrical musical act.

Thirty thousand square feet of space have been sold for general exhibits on the main floor of the Coliseum, but four spaces remaining unsold. Encouraged by the interest the trade and the public took in last year's show, the exhibitors, as a whole, have this year put more money and effort in the arrangement and installation of their displays. The 200 concerns represented completely cover the electrical field.

New Types of Incandescent Lamps.[1]

By Clayton H. Sharp.

For a number of years the standard of electric lighting has been set by the carbon-filament lamp consuming initially 3.1 watts per candlepower. Progress there has been; but it has been chiefly in the way of minor improvements in the process of manufacture, rating of lamps, and in the way of a more general adoption by electric-lighting companies of the 3.1-watt-per-candle lamp. This watt-per-candle consumption has been recognized as the minimum practicable under good operating conditions. Any radical or considerable improvement in the lamp itself has seemed improbable of attainment. The effective life at the present time is substantially 2½ times as great as the life in 1888.

Within the last two years the situation has altered materially. A marked improvement in the process of manufacture of carbon filament lamps which has been announced and described by Mr. John W. Howell before this Institute has resulted in the commercial production of lamps which operate on a 2.5-watt-per-candle basis, instead of a 3.1-watt-per-candle basis.

A German firm, going back to the class of materials employed in the earliest attempt at the manufacture of incandescent electric lamps, has produced a lamp with a wire of tantalum as the glowing body and with an efficiency greatly in advance of that of the established carbon filament. More recently still, various experimenters have succeeded in producing lamps with a filament of metallic tungsten which carry the standard of efficiency to a point far beyond that obtainable with either carbon or tantalum.

Processes of Manufacture.

The metal tungsten (German "wolfram"), while ordinarily reckoned as one of the rare elements, yet is from the point of view of lamp manufacturers quite plentiful enough for all practical purposes. While its price per pound is high, yet, considering the weight of the metal entering into an incandescent lamp, it is not especially expensive. One of its most important uses at the present time is the production of tungsten steel. The metal is infusible by any ordinary process. The melting point of tungsten filaments has recently been given by Waidner and Burgess at 3,200° C. The metal is commercially obtainable in the form of a fine powder. Tungsten does not seem to be ductile, so it is imposible to draw it directly into a fine wire, as is done successfully in the manufacture of the tantalum filament. Tungsten unites readily with oxygen and with carbon at high temperatures. These peculiarities have made the problem of the production of tungsten filaments a rather difficult one. It has been attacked from several sides, and different processes for the manufacture of tungsten filaments have resulted therefrom.

The earliest process to be brought to public attention was that of Dr. Kuzel. Kuzel's process consists in the production of a colloidal solution of tungsten by forming an arc between terminals of the metal under the surface of water. The colloidal solution, when it has been brought to the proper consistency, is squirted through a die into filaments, which, after being dried, are converted from the colloidal condition into the crystalline condition by the passage of an electric current through them. In this way the filament is produced without introducing any carbon, which would unite with the tungsten to form tungsten carbide, a compound which is readily formed and which is very detrimental to the quality of tungsten filaments.

Another process is the substitution process of Dr. Just and Hanaman. This process seems to be very similar to one patented by Lodyguine some 10 years ago. In this process a very fine carbon filament is heated in an atmosphere of a chloride of tungsten and hydrogen. Under proper conditions of the experiment, tungsten is deposited upon the carbon filament, the hydrogen acting as a reducing agent. By heating the filaments by means of a current, the whole filament is converted into tungsten carbide. The carbon made is then removed from the filament by heating the same in an atmosphere of steam and hydrogen. The steam is decomposed, its oxygen uniting chiefly with the carbon of the carbide. Whatever tungsten is oxidized in this process is reduced again by the hydrogen which is present.

The manufacture of filaments of osmium presented a problem similar to that of the tungsten filament. It is, therefore, natural that the process of Dr. Auer von Welsbach should, by proper modification, be adapted to the manufacture of tungsten lamps. Experiments along this line have been carried on by the companies in Germany and Austria which have been engaged in producing osmium lamps. To the tungsten lamp manufactured by the Osmium Lamp Company of Vienna has been given the name of the Osmin lamp. The tungsten lamp of the Auer company of Berlin is called the Osram lamp. While it is reasonably certain that the details of the processes of manufacture of these two lamps differ from each other, yet they are probably alike in their general features. The method consists in forming a paste of finely divided tungsten with a binder of organic material, such as, for instance, sugar solution, and squirting the same into filaments through a die. The carbon is then removed from the filaments by heating the latter in an atmosphere of steam and hydrogen, or by the use of some similar process.

Still another tungsten lamp is known as the "Z" lamp. The process by which it is manufactured involves also a squirting of a paste consisting of finely divided tungsten with an organic binder, but differs from the other in the method employed to remove the carbon.

It has also been announced that Mr. John A. Heany has been successful in producing tungsten lamps, but details as to his method of operation are also entirely lacking.

It will be seen from the foregoing that the possible methods for producing tungsten lamps are probably quite numerous, and that the prospects are that we shall have, in the near future, a number of competing processes of varying degrees of merit.

Physical Characteristics.

Tungsten-lamp filaments manifest all the ordinary properties of wires of pure metals. They have high conductivity and a large positive temperature coefficient. The high conductivity of the material requires that the filaments shall be very fine and quite long if they are to be used in producing lamps giving a reasonably low candlepower on 110-volt circuits. The degree of fineness to which it has been possible to reduce these filaments is indicated by the following table:

	Diameter.
Tantalum, 110-volt 22-c. p.	0.052 mm.
Osmium, 16-volt.	0.103 mm.
Z { New	0.1 mm.
Z { After burning	0.055 mm.
Osram, after burning	0.044 mm.

A fine hair may have a diameter of about 0.06 millimeter. In view of the extraordinary degree of fineness which has already been attained in the manufacture of these filaments, it does not seem probable that very much more can be looked for in this direction.

Tungsten filaments, when at the temperature of full incandescence, are quite soft. It is, therefore, not feasible to produce them and mount them in lamps in any other form than in loops.

The first tungsten lamps produced were intended for low voltages. In consideration of the high conductivity of the material, the production of a low-voltage lamp is a more simple problem than the production of one of higher voltage, since for low voltages a shorter length of the filament may be employed. It would also seem that it is easier to produce a lamp of high candlepower than of low candlepower, since a stouter filament may be employed in the high-candlepower lamp.

As far as the writer knows, no 110-volt lamps have been produced as yet for lower candlepowers than 25, and no lamps have been produced for higher voltages than 220. The fineness of the 110-volt, 125-candlepower filament is such that it would seem to be difficult to produce such a lamp as a regular commercial article. The 220-volt lamps are probably only experimental as yet. The properties of the tungsten filaments are such that it would seem to lend itself very readily to the production of most excellent lamps for street lighting by the series incandescent system. Lamps for 110 volts are likely to have, when commercially produced, a watt consumption of 50 watts or more. If tungsten lamps are to be made for small candlepowers, such as are commonly employed in domestic lighting, they would probably need to be made for 50 volts or under, and consequently either burned in series or connected to low-voltage mains.

One of the chief disadvantages of the tungsten lamp lies in the extreme fragility of its filament. Blows or shocks given to the lamp are quite likely to cause a rupture of the filament. A ruptured filament may, however, mend itself by the parts welding together once more, but where the filament has become welded it is quite likely to break loose again.

Electrical Characteristics.

The feature which differentiates the electrical behavior of the newer lamps from the ordinary carbon lamp is their positive temperature coefficient. The temperature coefficient of the ordinary treated carbon filament has been shown by Mr. John W. Howell to be very nearly zero at the temperature of ordinary incandescence. At lower temperatures its coefficient is negative. The term "metallized" has been given to the carbon filaments treated by the high-temperature process on account of the fact that these filaments at their temperature of incandescence have a positive coefficient. The tungsten and tantalum filaments have also positive coefficients, which are, moreover, much larger than the positive coefficient of the "metallized" carbon. The temperature coefficients of tantalum, osmium and tungsten filaments have been determined by measuring the resistance of these filaments at room temperature and again at 100° C. The coefficients as found were as follows:

1. Abstract of a paper presented at a meeting of the American Institute of Electrical Engineers, New York, November 23, 1906. Dr. Sharp is the test officer of the Electrical Testing Laboratories of New York. An abstract of the discussion of this paper and of the paper by Dr. Charles Proteus Steinmetz on "Transformation of Electric Power Into Light," which was read at the same meeting, will appear in a subsequent issue of the Western Electrician.

Tantalum	0.234 per cent. per degree
Osmium	0.372 " " "
Tungsten (Osram lamp)	0.438 " " "

It will be noted that the temperature coefficient of the osmium filament corresponds very closely to the temperature coefficient of pure platinum. The temperature coefficient of the tungsten lamp is higher and that of the tantalum filament is lower than the average coefficient for pure metals. In accordance with the general law that the presence of impurities reduces the temperature coefficient to a very marked degree, it would appear that the tungsten of the Osram lamp was very pure, while the tantalum of the tantalum lamp either contained some slight trace of impurity or that the metal was in such a condition, due, possibly, to crystallization or to lack of annealing, that its coefficient was abnormally low.

The effect of the positive coefficient is to give the metal-filament lamps considerable inherent regulation. That is, the change of current through the lamp is no longer proportional to the change in voltage, but is smaller proportionally than the change in voltage. Consequently in watts, candlepower and watts per candle these lamps undergo smaller changes with the change in the line voltage than is the case of the carbon-filament lamp. The following table shows the change in candlepower and in the watts per candle of carbon, metallized, tantalum and tungsten lamps with five per cent. rise in the voltage:

CHANGE WITH FIVE PER CENT. INCREASE IN VOLTAGE ABOVE NORMAL.

	Candlepower.	Watts per Candle
Carbon	+30%	−15%
Metallized	+27%	−13%
Tantalum	+22%	−11%
Tungsten	+20%	−10%

The quality of the lamps here pointed out is a very valuable one, since it must have two important results:

1. The light of the lamps is less affected by bad regulation of the circuit. This means that with a given degree of regulation of the voltage on the circuit, the service must be more satisfactory to the user, and has a direct bearing on the amount of copper required in feeders.

2. The life of these lamps is probably less affected by the momentary or even continued application of excessive voltages.

Another interesting consequence of the positive temperature coefficient is that at the instant of closing the circuit the current through a metallic filament is much greater than it is a fraction of a second later, when the current has had time to heat the filament to its normal temperature. In other words, there is an initial inrush of current similar to that experienced in an arc lamp or in a motor, but enduring for a much smaller period of time. The behavior of the ordinary carbon filament is the reverse of this.

DISTRIBUTION OF LUMINOUS INTENSITY.

The distribution of luminous intensity in the horizontal plane for both tantalum and tungsten lamps must be on the average a circle, due to the method of construction of the lamps. This circle contains in each case a number of narrow maxima, which are due to reflections from the opposite side of the bulb.

The spherical reduction factors for 20 tantalum lamps are extremely variable, falling as low as 0.69 and rising as high as 0.76. The cause for this is probably in the difference in the degree of polish of the surface of the filament. A lamp having a filament in the form of a straight cylindrical rod of perfectly black surface would show a theoretical reduction factor of 0.785. Practical carbon-filament lamps never have a factor smaller than this. A lamp of this character would give no light through the tip. The fact that the tantalum lamp shows smaller reduction factors than this value indicates how comparatively feeble is the radiation of this polished wire in other directions than normal to the surface. The value of this reduction factor shows, however, a very large increase during the life of the lamp. This is leaving out of consideration lamps which show an abnormal change in reduction factor, due to short-circuits among the spires of the filament. These changes represent the combined influence of the roughening of the filament and of the deposit of the zone of black on the bulb so as to intercept the horizontal rays. An important conclusion from the facts here noted is that it is absolutely necessary, if we are to obtain any adequate idea of the performance of the tantalum lamp, to make measurements of the mean spherical rather than of the mean horizontal candlepower. Measurements of the horizontal candlepower alone, the spherical reduction factor being unknown, are likely to be misleading and fallacious. This is not the case with the carbon filament, in which the spherical reduction factor is quite a definite and unvarying quantity for a given type of filament.

USEFUL LIFE OF METAL-FILAMENT LAMP.

It has been customary to consider as the useful life of a carbon-filament lamp its life up to the time when its candlepower has fallen to 80 per cent. of its initial value. Beyond this point it has been considered cheaper to discard the old lamp and replace it with a new one; in other words, this has been taken to be the proper "smashing point" of the lamp. It should be pointed out that this relation does not hold with the metallic-filament lamps. The smashing point of a lamp is determined by considerations of initial cost of the lamp, the cost of electrical energy and the rate of decline of the candlepower of the lamp. In the metallic-filament lamps we have lamps of much higher economy, not only initially, but throughout their life; they are lamps of higher candlepower and necessarily of higher initial cost. It would seem that the data at present available regarding such lamps are not sufficient to permit of the proper determination of the smashing point. Certain it is, however, that where such lamps are used they are likely to be burned until they fail. This is the condition which is almost necessarily brought about by their relatively high cost.

A feature which marks both the tantalum and the tungsten lamp is the ability of the filaments sometimes to repair themselves after having been broken. If the broken end of a filament becomes crossed with another portion of the filament, so that the electric circuit is completed, the lamp once more lights up. In the case of the tantalum lamp, a junction of this kind may result in a very strong weld, so that a point of this sort does not necessarily constitute a point of especial weakness in the filament. Welds of this sort between tungsten filaments operated at normal voltages are much less secure and are quite liable to break apart. After a repair of this sort the candlepower of the lamps is usually higher than before, due to the decreased length of filament which the current must traverse. The occurrence of breakages and repairs accounts for irregularities in life-test curves such as are not seen in the curves of carbon-filament lamps.

LIFE HISTORY.

Some of the earliest tests of tantalum lamps made in this country showed a much poorer behavior than was claimed for the lamp by its makers. In these tests the lamps were burned on alternating-current circuits. Since there was no reason to suspect that the lamps were suffering

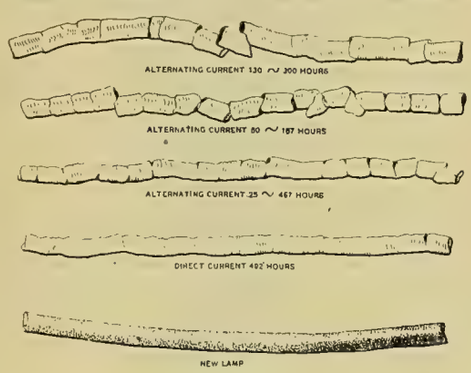


FIG. 1. THE TANTALUM FILAMENT.

on account of incorrect voltage or rough handling, the conclusion was almost inevitable that the nature of the current might be influencing their life. On trial it was found that tests made on direct current instead of alternating gave results which were in general agreement with those which had been published abroad. Since that time the effect of alternating current in shortening the life of a tantalum lamp has become well recognized.

A microscopic examination of the tantalum filaments, new and burned on direct current and alternating current of different frequencies, is extremely interesting. A free-hand drawing of such filaments as seen under the microscope is given in Fig. 1. It will be seen in this figure that the unused filament is smooth and polished, with only slight pittings on the surface. The filament which has been burned on direct current is much less regular; its surface shows deeper pittings and, in places, it is cut and notched as if with a knife blade. Some parts of the filament are much more irregular than others. The filament on 25 cycles shows still stronger markings of the same character as shown on the direct current, but shows also, in places, a jointed structure looking like the jointed structure observable sometimes in basaltic rocks. This latter effect is even more marked in the case of the filament which has been run on 60 cycles. Here, parts of the filament look as if they were made up of blocks which had been irregularly piled one on the other. The length of these jointed sections in the filament is about equal to the diameter of the filament itself. It looks, in some places, as if one of these sections had been almost expelled from the row. The appearance, too, is very much as if, where these joints occur, the filament had actually separated and had welded itself together instantly. The filament which had been operated on 130 cycles had the same appearance, perhaps somewhat exaggerated. In short, the increased wear and tear of the filament, due to the use of the alternating current, is very apparent. The reason for it, however, is obscure. The conclusion is inevitable that this lamp at the present time is essentially a direct-current lamp.

No such effect is observable with the tungsten lamps. Tests of the Electrical Testing Laboratories show quite definitely that their life on direct current and alternating current is the same. This has also been proved by elaborate experiments to be true of carbon filaments.

[Twenty tantalum lamps of German manufacture were tested, and data of representative lamps, the performance of which may be considered as characteristic of the 20 tantalum lamps, are plotted in Fig. 2.]

From the foregoing it will be seen that the life

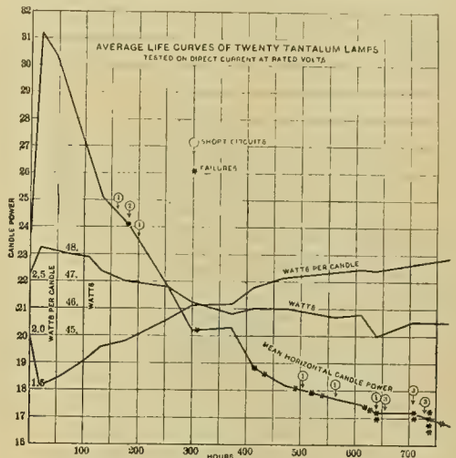


FIG. 2. LIFE CURVES OF TANTALUM LAMPS.

history of tantalum lamps is characterized by a large initial increase in candlepower and a corresponding decrease in watts per candle, the extreme values being reached at the end of about 25 hours. From this point on, the candlepower decreases at a moderately rapid rate and the watts per candle increase. For purposes of ready comparison, life curves of representative tantalum and of a carbon lamp burned at 3.1 watts per candle are shown in Fig. 3. The candlepower of both is on a mean spherical basis. The exaggerated initial rise of the candlepower of the tantalum lamp is very apparent. Curves for watts per spherical candlepower give an opportunity for a comparison of the relative electrical economy of the two kinds of lamp.

COLOR OF LIGHT AND EFFICIENCY.

The color of the light from the tantalum lamp is whiter than that of the carbon lamp, and the color of the tungsten lamp is still whiter than that of the tantalum lamp. The light of the tungsten lamp resembles quite closely that of the acetylene flame. The increased whiteness of the light, which is produced evidently largely as a temperature effect and which does not involve a preponderance of certain colors, such as green or violet, constitutes a point of real superiority in the tungsten lamp. Time has been lacking to made a regular spectro-photometric study of these lamps. A simple experiment, however, has been made which gives some idea of the increased radiation of the shorter wave lengths, both of tungsten and tantalum lamps, as compared with the carbon lamp at 3.1 watts per candle.

The metal-filament lamps were photometered against the 3.1 carbon lamp directly and then with a red, green and blue glass interposed between the eye and the eyepiece of the photometer. The intensities so measured, expressed in percentages of the intensities measured without colored glasses, are given in the following table:

	Tantalum Lamp. Per Cent.	Tungsten Lamp. Per Cent.
Total light	100	100
Red light	90.5	83.
Green light	100.3	101.8
Blue light	109.2	126.5

FLICKERING ON ALTERNATING CURRENT.

It has been established, as a result of practice, that in general it is not possible to operate incandescent lamps on 25-cycle current with satisfactory results. This statement is made with a knowledge of the fact that in certain cities a large amount of lighting is actually being done on 25-cycle circuits. Yet, under some circumstances, 25-cycle current produces such marked flickering of incandescent lamps that its use is absolutely impossible. It is an interesting question whether the tungsten lamp presents any advantages over the carbon lamp for use on low-frequency circuits. A few preliminary tests have been made in an attempt to gain some information on this question. It was very quickly discovered, however, that the question is so very complicated that a considerable research will be required to ascertain definitely the facts of the case. Eleven tungsten lamps were attached to the ceiling of a small room, producing a brilliant illumination in the room. Three observers attempted to determine the presence or absence of flickering. With the lamps at their normal voltage of 115 and with a frequency of 25.5 cycles per second, L. found the flickering marked; M. found the flickering marked; S. could see a flickering intermit-

tently, as when his head was moved suddenly. With the same lamps, but with the voltage reduced to 100, the flickering was imperceptible to all the observers.

As the voltage was raised successively to 105 and 110 volts the flickering became perceptible. When five of the lamps were removed, leaving only six lamps in position, it was the consensus of opinion of the three observers that the flickering was less marked than when all the lamps were in. In other words, the intensity of the sensation of flickering seems to be a function of the illumination. The flickering was imperceptible when looking directly at the lamps, but could be

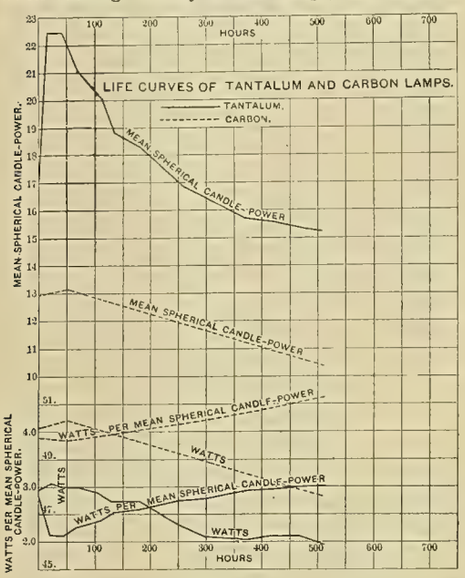


FIG. 3. LIFE CURVES OF TANTALUM AND CARBON LAMPS.

observed only through light which is not focused directly on the fovea of the eye.

In view of the very considerable advantages which would be gained if it could be shown that it is feasible to operate incandescent lamps on alternating-current circuits of frequency low enough to permit of the easy operation of synchronous converters, that is to say, a frequency of 25 cycles or slightly greater, the question of the variation of the light of incandescent lamps during a half cycle of the alternating current has also been subjected to an experimental investigation by the use of a stroboscope. To the axis of a small synchronous motor was attached a disk, with narrow radial slots cut in it, one for each pole of the motor. The lamp was placed behind this disk, while close to it and in front of the disk a suitable photometer was arranged. The motor was driven from one of two alternators, having their shafts coupled together, and the lamp was supplied from the other alternator. The phase of the current passing through the lamp with respect to the current in the motor could be shifted through known angles by shifting the armature ring of one of the coupled generators. This generator arrangement, which was planned originally chiefly for meter tests, proved itself to be extraordinarily convenient for such stroboscopic measurements as are here described. With the use of this arrangement, curves have been plotted showing the variation in the intensity of the incandescent lamps as the current through the lamp rises from zero to its maximum value and decreases to zero once more. A set of curves of this kind relating to the metallized-filament lamp operated at 2.5 watts per candle are reproduced in Fig. 4, and serve to illustrate the nature of the data obtained. Similar curves were obtained for ordinary eight and 16-candlepower lamps, operated at a series of different values of the watts per candle.

To discuss these results, the percentage variation of the light of the lamp per cycle was taken under all the different conditions. [These percentage variations were plotted and curves for the 16-candlepower lamps are shown in Fig. 5, using frequencies as abscissas.] The percentage variation seems from these curves to be expressible by two linear relations, with a point of sharp curvature occurring between 25 and 30 cycles per second. That is, as the frequency is increased from 15 to 25 cycles the diminution in flicker is very rapid. Above 30 cycles the diminution in flicker is very slow. Since it has been found possible in some places to operate incandescent lamps on 25 cycles, it would seem probable that a comparatively small increase in the frequency, which would carry the lamps beyond this apparently critical point in the curve, might make feasible the general operation of incandescent lamps from alternating-current power circuits.

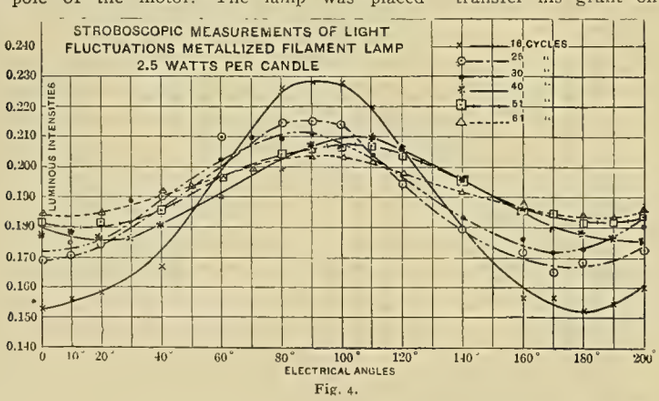


Fig. 4.

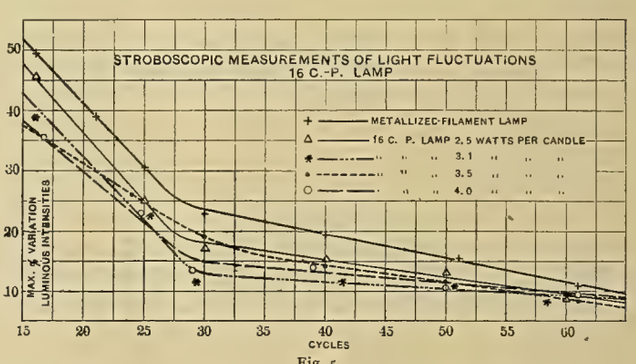


Fig. 5.

CURVES OF LIGHT FLUCTUATIONS OF INCANDESCENT LAMPS.

Conclusion.

From the data given above it seems certain that the electric-lighting industry is face to face with a change of almost revolutionary character. The standard of incandescent-lighting efficiency will be brought by the tungsten lamp to a point about three times as high as it is at present. The efficiencies of all other incandescent lamps and of enclosed arc lamps are exceeded by that of the tungsten lamp. In other words, with the possible exception of some forms of vacuum-tube lighting and of the magnetite and flaming-arc lamps, the tungsten lamp is the most efficient electric illuminant. Combined with its virtue of high efficiency it has the other advantages of incandescent lamps in being perfectly simple in its character and construction, and in being capable of subdivision into small units.

Cleveland Electric Railway Gains a Point.

Judge Phillips of the Common Pleas Court at Cleveland, Ohio, has overruled the demurrer of the Forest City Railway Company to the petition of the Cleveland Electric Railway Company, asking for the protection of its property on the ground that the franchises granted the new company are illegal. As the court takes it, if the mayor acted in the interests of the new company by making himself liable for money owed by the company, which he admits, it is difficult to understand how he could be serving the best public interests at the same time.

The history of the new company was reviewed from the time the first franchise grants were made to Albert E. Green to the organization of the Municipal Traction Company, which now holds the property under lease. It is alleged that the mayor procured Mr. Green to apply for the franchises, procured the council to grant them, was instrumental in the organization of the Forest City Railway Company and in procuring Mr. Green to transfer his grant on Denison Avenue and other grants to the new company. It is assumed that it would have been impossible to formulate and organize a system of three-cent-fare lines in Cleveland had it not been for the aid of the mayor.

In summing up his finding, the court said that the members of City Council and the officers should be entirely free to exercise their best judgment in granting franchises. The public is represented by the mayor. It is not supposed that he has any other interest than that of the public under consideration. The mayor of a city should not be interested, directly or indirectly, in the welfare of any street railroad. The case will now be tried on its merits, the hearing being set for December 17th.

The Cornell University branch of the Institute of Electrical Engineers announces the following programme for future meetings: On January 4th a paper will be presented on "Action and Efficiency of Choke Coils," by Ray Philips Jackson. On January 18th, a union meeting will be held with the Cornell University Electrical Society. Abstracts from the following papers will be read: "New Types of Incandescent Lamps," by Clayton H. Sharp; "Transformation of Electricity into Light," by Charles P. Steinmetz.

Death of Arthur V. Abbott.

Arthur Vaughan Abbott, well known as an engineer and author, and whose knowledge extended to many branches of engineering, died at St. Luke's Hospital in New York city on December 1st. At the time of his death he was engineer for Westinghouse, Church, Kerr & Co. Mr. Abbott was born in Brooklyn in 1854. He graduated from the Brooklyn Polytechnic Institute in 1875. Entering engineering at once, he took charge of the cable construction of the East River Bridge. Then he built testing machines for a large scale firm and soon after gave his attention to the designing and installing of central-station heating plants. Later, in shop work, he designed and constructed dynamos and motors. After this he planned and built a large number of important electric railways. In 1892 Mr. Abbott came to Chicago and for many years was in charge of construction for the Chicago Telephone Company as engineer.

ARTHUR V. ABBOTT.

Mr. Abbott was the author of some excellent engineering works, among which may be mentioned books on "The Electrical Transmission of Energy," "The Evolution of a Switchboard," "History and Use of Testing Machines" and "A Treatise on Fuel." The first-mentioned book is used as a textbook in many American and European universities, it having been translated into German. Mr. Abbott was a man of high ideals and believed it the duty of engineers to do faultless work. In all his work are evidences of integrity. Mr. Abbott was vice-president of the American Institute of Electrical Engineers for two terms, from 1899 to 1902, and was a member of the Institutes of Mining and Civil Engineers.

City Lighting Plant a Failure.

A dispatch to the New York Times, dated at Wilkesbarre, Pa., December 3d, says in part: "After trying for 18 years to make their street-lighting plant give satisfactory and economical service, the people of Easton, near here, are now demanding that the City Council take measures to abandon the plant and procure a lighting service from a private corporation. Mayor March, who advocates municipal ownership when it can give efficient service, has declared that the condition of the streets of the city through defective lighting is dangerous from a police point of view and unbearable from the point of view of the citizen, and favors private service.

"Offers have been made by private corporations to provide the city with efficient service at a cost of $15 a year less per lamp than it now costs the city for the service which is causing constant complaint. It is estimated that the city throws away from $4,000 to $5,000 a year in maintaining the plant. It is no unusual thing for half the street lights to be out at one time.

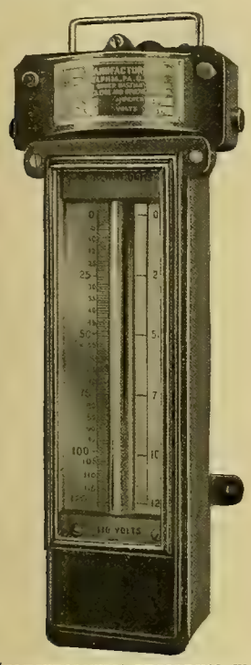
"Mayor March says of the existing conditions: 'If we intend to continue lighting the city by our own plant we must run the plant as a private corporation would run it, not only with economy, but also by constantly repairing and renewing the machinery to keep up its efficiency.' Select Councilman David W. Nevin says: 'A private company can light our streets at a much lower figure than the city can. In my opinion the operation of municipal plants amounts merely to the creation of a number of places to be filled by local politicians. These men get salaries, but have no interest in the plants as long as they continue their "pulls" and hold their jobs.'"

Meters [1]

By Robert C. Lanphier.

Part I.

A few years ago the use of meters was by no mens so universal as it has now become, for there were still at that time many stations that considered the investment in a meter equipment greater than the increased revenue to be obtained by the introduction of meters warranted; but I take it that nearly all stations have now realized the absolute importance of using integrating meters for the



BASTIAN (ELECTROLYTIC) RECORDING WATTMETER.

sale of light and power if they desire to get full returns on their station investment. No flat-rate system has ever been devised which was fair and satisfactory both to the central station and the consumer; but an installation of modern meters, properly inspected and tested from time to time, is certainly fair to all concerned.

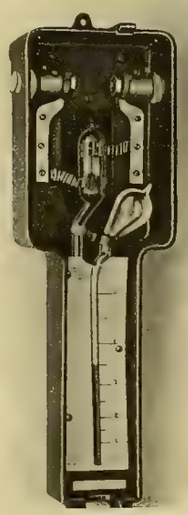
In addition to giving the station a record of the actual amount of electricity used by a consumer, a complete installation of consumers' meters, taken in connection with main station meters, gives the best possible check on line and distribution losses for all systems, but particularly in the case of an

WRIGHT DEMAND INDICATOR.

alternating-current system, where transformer losses are liable to be of much greater magnitude than realized unless shown by the differences in the primary and the secondary meters. I believe that in every instance where stations have changed from the flat-rate system to the meter system the customers have been much better satisfied, although, of course, there has been more or less complaint in many instances just after the introduction of the meter system, for many persons do not observe their agreements as to the use of current on a flat-rate system and consequently find their bills higher than expected when a meter is put in.

Granting, under existing conditions, that a meter system is desirable for practically all conditions of service for nearly all stations, it may be interesting to note the various types of meters which are now in use and the advantages and characteristics of the different types.

Broadly speaking, all meters in use in the United States today may be divided into three classes—motor meters, in which a delicate and very small electric motor drives an integrating train mechanism so as to record the amount of electricity passing at all times, summing up the total on the dial of the train. Second, electrolytic meters, which may be further subdivided into several groups, but which are little used in this country now, and may be included under two heads, either those in which the passage of current decomposes a chemical solution so as to show by the height of the liquid in a tube the amount of current used, or those in which the current, passing through an electrolyte, deposits metal from the solution upon one plate of the electrolytic cell used in such meters, so as to show by the increase in weight of the plate the amount of current used. The third type of meter is what may be called on the fluid-expansion principle. Practically the only meter in use in this country depending on this principle is the Wright demand meter, in which the heating of a wire expands liquid contained in the glass reservoir, so as to show by a self-registering device carried on the column of liquid



A liquid is hermetically sealed in a U-shaped glass tube having a bulb at each end. A band of resistance metal is placed around one bulb. The passage of the current through this metal heats the air in the bulb and causes it to expand forcing the liquid through the tube and causing it to overflow into an indicating tube. The liquid deposited in the indicating tube remains there until the indicator is reset. The amount of liquid in the indicating tube will at all times show the maximum current that has passed since the last resetting. The meter is used in connection with a wattmeter, and the discount given to the customer is based on the demand reading.

WRIGHT DEMAND INDICATOR WITH COVER REMOVED.

the maximum amount of current that has passed through the demand meter at any time since the previous reading.

There are several other types of meters in use abroad, such as clockwork and pendulum meters, but these have no interest for American users.

Under the head of motor meters are included commutator-type, induction-type and mercury-type meters, each one of these groups having characteristics very much alike in the various meters of different manufacture.

The commutator-type meters now in use include the old-style Thomson and the new type C Thomson of the General Electric Company, the Duncan, Westinghouse and Scheffer meters.

Generally speaking, any commutator-type meter is simply a small shunt-wound motor, usually without iron, in which, however, the shunt winding is on the armature or rotating part, whereas the series winding is fixed. The armature, therefore, is energized by a small current traversing a resistance in series with the armature and introduced to the latter by means of the commutator and brushes of one form or another. The series coils, embracing the armature, exercise a torque or turning effect upon the latter, due to the attraction between the field which they create and the field of the set of windings energized at any given time through their connection to the commutator bars in contact with the brushes. Inasmuch as the current passing through the armature winding is constant for constant potential, the torque exerted by the series fields will be proportional to the product of the strength of the armature field by the strength of the series field. The latter will vary with the load, so that it is evident the armature will be rotated by a force proportional to the amount of load in watts.

This is absolutely true for a direct-current circuit, but when commutator meters are used on alternating current some error will be introduced on an inductive load, owing to certain difficulties introduced by the displacement in phase of the load current.

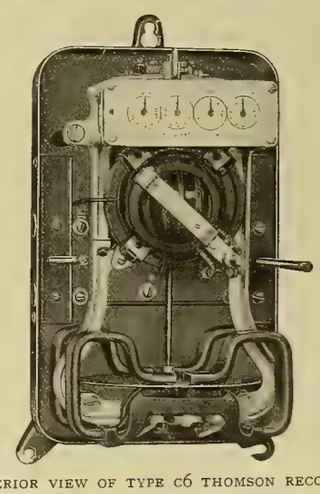
The armature, being driven, therefore, by forces proportional to the power, will record the product of the power by time, that is, watt-hours, if geared up properly to an integrating mechanism. If not governed or retarded in some way, however, the

EXTERIOR VIEW OF TYPE C6 THOMSON RECORDING WATTMETER (REPLACES TYPE C).

speed would be so great that there would be no immediate response to changes in load; in other words, the meter would run away with itself; therefore, the damping disk acted on by the permanent magnets is introduced as a load on the meter motor, for the purpose of obtaining an immediate and accurate control of the speed.

The damping disk acts simply as a small electric generator. As the shaft is turned, due to the torque exerted upon the armature, the disk of copper or aluminum is caused to sweep through the strong magnetic field of the damping magnets, thereby having currents induced in it, which currents are in turn attracted by the field creating them, so that there is a constant retardation, tending to check the speed of the rotating system.

The retarding effect of such a magnet system on a damping disk is in exact proportion to the increase in speed. Therefore, if the increase in the driving torque is in true proportion to the power, the resulting speed of the armature will be in exact proportion throughout to the power, thereby recording correctly on the dial. Of course, in saying this, I am not taking in account all such errors as may be introduced by friction, etc., which always tend to give more or less deviation in accuracy from the theoretically perfect condition.



INTERIOR VIEW OF TYPE C6 THOMSON RECORDING WATTMETER.

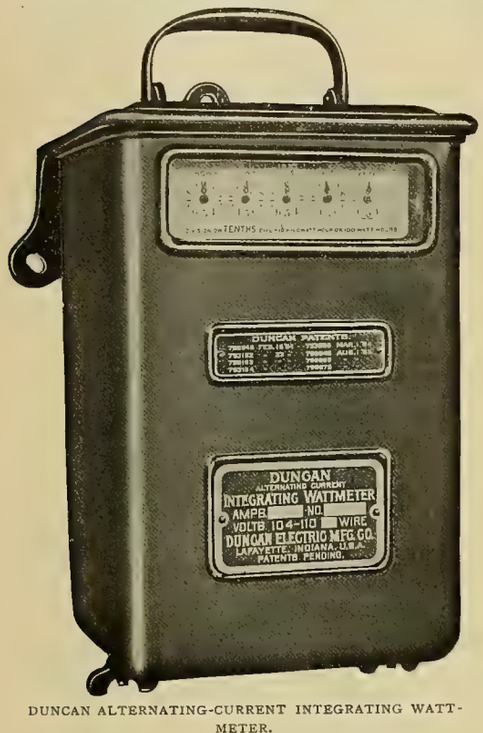
In all commutator-type meters a starting coil is provided to overcome initial friction on the bearings and to cause the meter to record accurately on a light load. The starting coil is simply a coil of fine wire in series with the armature, so that the same current passes through it which goes through the main resistance and through the armature. This coil, if held in proximity to the armature, like the series coils, will evidently give a certain amount of torque or rotative effect when no load is passing through the series coils, and by adjusting its effect with respect to the armature in any one of several ways, as mentioned below,

1. A paper read before the Illinois State Electric Association at Springfield, September 19, 1906. The author is secretary of the Sangamo Electric Company. For the illustrations the Western Electrician is indebted to a number of meter manufacturers, to whom thanks are returned.

the meter can be properly adjusted on light load.

The Thomson meter is, of course, familiar to all, and I will simply describe some of the important features of the latest type C Thomson, without referring particularly to the older type.

In the type C meter the armatere is spherical instead of the older flattened shape, and it is claimed this construction gives a very strong and substantial armature, with very little weight. The commutator is very small, reducing in this way the frictional effect on the brushes, and the brushes themselves, instead of being held in contact on the commutator by their own spring ten-



DUNCAN ALTERNATING-CURRENT INTEGRATING WATTMETER.

sion, are held on counterweighted supports, so their pressure is dependent upon the adjustment of the little counterweights. This is intended to take up any slight inequalities which may exist on the surface of the commutator or brushes and also to prevent having an undue amount of pressure, thereby making the meter more sensitive on light load and keeping the commutator in better condition.

The type C meter has its starting coil set at an angle to the armature with respect to the series coil and so arranged that it can be swung back and forth from the armature, varying by its distance the starting effect. The resistance in series with the starting coil and the armature is of new form, being tubular instead of flat, as it is claimed this arrangement gives a more substantial resistance than that formerly used.

The mechanical construction of the type C meter is excellent, and the jewel bearing at the lower end of the armature shaft is improved in the large-sized meters by being a cupped diamond instead of sapphire, as used in the smaller meters. The torque or turning effect upon the armature is higher in the type C meter than in any other meter now made, being about 160 to 170 millimeter grams, this being the term in which meter torque is usually expressed. I may say that a millimeter gram means a pull of one gram weight on a lever one millimeter long, or, to put it in more familiar units, is 1/700 of the pull which would be exerted by a weight of one ounce on the end of a lever one inch long.

The high torque in the type C meter necessitates the use of four damping magnets to keep the speed within proper limits. The Duncan meter is exactly the same in principle as the old and new-type Thomson meter, and is now very widely in use. This meter has also an excellent torque, though not quite so high as the Thomson, and its rotating element is about the same weight as that in the Thomson meter.

The light-load adjustment in the Duncan meter is not obtained by moving the starting coil, but the latter is wound in a number of sections which have their terminals brought out to a little rheostat, very easily accessible, and by cutting in more or less turns of the starting coil with this rheostat a very nice adjustment is obtained on light load.

The Duncan meter has an improved lower bearing, called a visual bearing, so arranged that, by turning a little sleeve, the tip of the lower spindle and the jewel can be inspected without removing the armature from the meter.

The Scheeffer direct-current meter is somewhat similar in construction to the other commutator-type meters, but the damping magnet is arranged somewhat differently with respect to the damping disk, and the rotating element has a considerably shorter shaft.

The Westinghouse direct current meter has been recently placed upon the market. It is the same in principle as the others, and of very good construction, being improved by the ball bearing.

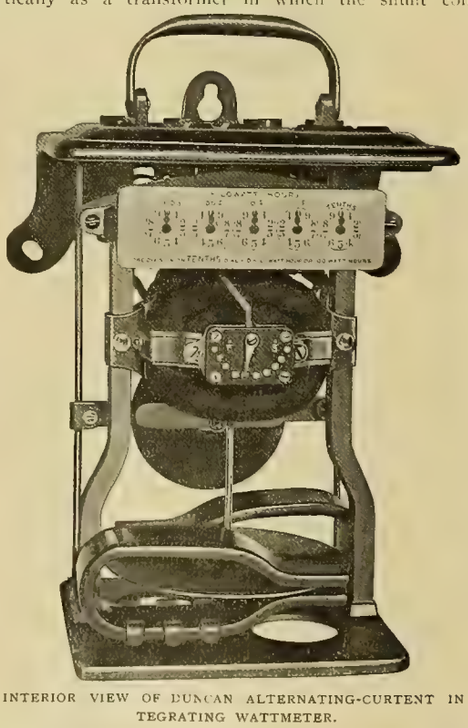
The second division of motor meters, those of the induction type, is, of course, of most interest to stations operating alternating-current systems.

Induction meters of one form or another have been in use for 17 years. The earliest form of induction meters were the ampere-hour meter of Shallenberger, made by the Westinghouse company, and that of Slattery and Duncan, made by the Ft. Wayne Electric Works. These meters were in use for several years, and gave quite good satisfaction, considering the state of the art at that time. As the use of alternating current developed, however, and inductive loads, in the form of fan motors, arc lamps, etc., came to be more common, disadvantages were found with ampere-hour meters on alternating current, in that they did not take proper account of inductive load, recording far too high against the customer, and thereby giving dissatisfaction. Furthermore, an ampere-hour meter is used with the assumption that the voltage will remain practically constant, for, in obtaining a rate on a basis of ampere-hour meters, a station has to take this factor of the voltage into account, but as a matter of fact very few alternating-current circuits have the same voltage at all times during the day and night, and with the use of an ampere-hour meter, leaving aside the question of inductive loads, there is either loss to the customer or to the station by making the assumption of constant voltage.

The first induction-type watt-hour meters were those made by the old Scheeffer Meter Company and by the Ft. Wayne company, about 1894 and 1895. These meters, while not accurate on inductive loads, and under other conditions, as the meters now on the market, were an improvement in many respects on the earlier ampere-hour meters and were introduced quite widely, but the induction meters now in use are practically all of the types which have been brought out within the last seven years, and include the Westinghouse types A and B, the General Electric old-style high-torque meter, and new-style type I Thomson meter, the Ft. Wayne types K and W, the Stanley of several types, the Scheeffer of several types, and the Gutmann meter.

Like the commutator-type meter, any induction meter is simply a small delicate motor, driving an integrating train, with the speed varying in proportion to the watts of power passing so as to record true energy in watt-hours upon the dial, but the principle of operation is totally different from that of the commutator meter.

Broadly speaking, any induction meter consists of a shunt or pressure coil connected across the supply circuit and wound upon a laminated iron core and having one or more gaps in it, embracing a metallic disk or cylinder, so as to induce in the latter secondary currents proportional to the pressure-passing current through the shunt coil. Up to this point the device may be considered practically as a transformer in which the shunt coil



INTERIOR VIEW OF DUNCAN ALTERNATING-CURTENT INTEGRATING WATTMETER.

is the primary, the iron core is the core, as in a regular transformer, and the armature of the meter is practically a short-circuited secondary, but energized by standing in gaps of the core instead of surrounding it in the form of a coil, as is the case in the secondary of an ordinary transformer.

In the meter the currents induced in the armature circulate in the disk near the poles of a properly arranged core, energized by a pair of series coils or in proximity to openings of series coils without any core, the practice differing in the different meters referred to.

When no current is passing through the series coil or coils to load beyond the meter, there is no turning effect or torque exerted upon the currents induced in the armature by the shunt field, and the meter should stand at rest. As soon as the load current passes, however, the magnetizing effect of the series field exerted upon the magnetizing effect of the current in the armature causes rotation proportional to the product of the strength of the two fields. Since the currents in the armature are constantly circulating and are proportional to the pressure, and since the magnetizing effect of the series field varies with the amount of load, the rotation caused by the reaction between the currents in the armature and the series field will be proportional to the power. In a properly constructed induction meter this is true, both upon non-inductive and inductive loads, for when the main current lags on account of the load being inductive, the torque will be diminished in proper proportion and should cause the meter to record true watt-hours and not actual volt-ampere-hours. I mean by this that on a non-inductive load the actual watts are equal to the product of the volts by the amperes, but when the load is lagging the watts are equal to the product of volts by amperes by the power factor of the load. Thus, if an arc lamp is connected to a meter at a voltage of 104, and the current passing is six amperes, while an indicating wattmeter connected in circuit shows only 400, the power factor is 400 divided by 624, that is about 0.65. For such a load as this a correct induction meter would record at the rate of the true watts, and not at the rate of the volt-amperes.

[To be continued.]

Indiana Telephone Items.

The Flora Telephone Company has been purchased by a company headed by F. P. Lyons. The company proposes to improve the plant.

The Home Telephone Company of Fort Wayne has declared a two per cent. semi-annual dividend. The capital stock of the company is $250,000 common, on which this dividend is to be paid.

The Central Union Telephone Company at Muncie has moved its exchange into the new terminal building, and is making extensive improvements to the system, involving an expenditure of $100,000 or more. The underground-conduit system has been completed.

At the recent annual meeting of the stockholders of the Decatur County Independent Telephone Company of Greensburg the financial statement for the last year showed total receipts of $20,416.45, and expenditures of $14,448.62.

The Cumberland Telephone Company has suspended its free out-of-county service and is charging 25 cents to talk to points in the adjacent counties. Some months ago the City Council granted the Luce Telephone Company a franchise, but required that the company place its wires above the wires of the Cumberland company. The latter company then set the highest poles that could be secured, rendering it impossible for the new company to comply with the franchise, and also introduced the out-of-town service, which has just been discontinued. Interest in the Luce company has been revived, and it is said a new underground system may be installed.

The City Council at Kokomo has entered upon the investigation of the alleged consolidation of the local exchange of the Citizens' and Central Union telephone companies. There is a suspicion that a complete merger of the interests of the two companies has taken place. The City Council charges that such a merger would render the entire equipment of the Citizens' company liable to forfeiture to the city.

The Richmond Home Telephone Company is building a new office structure in Richmond which will house one of the most complete and modern telephone plants in Indiana or the West, and will put in the automatic system. The Central Union is reconstructing its entire system, and will make an effort to increase its patronage by making the rates more attractive. For the last eight years telephones in homes have been rented to Central Union patrons as low as 50 cents per month. Many other patrons have for two years or more been receiving service free, having signed a contract to keep the Central Union telephones in their homes or places of business, and to pay the established rates whenever a certain number of patrons were obtained. Early last spring the Central Union people made a proposition to buy the Home plant, but the offer was rejected. More than $100,000 is being expended by the Home company on its new plant.

S.

Telephone News from the Northwest.

The Northwestern Telephone Exchange Company is about to open the new Highland exchange in North Minneapolis. It is designed to care for 8,000 subscribers.

The North Dakota Independent Telephone Company, which has been refused admission to Fargo for toll-line service, contemplates making a toll station at the city limits, for service to that city,

building west to Bismarck. The company has been granted admission to Jamestown.

The Mesaba Telephone Company will establish a direct long-distance circuit between Duluth and the towns on the Mesaba Range. The company will also expend $45,000 in improvements to its system on the range.

The Farmers' Mutual Telephone Company has organized at Ord, Neb., with S. J. Botts as president and H. M. Davis secretary. H. E. Crawford will be manager.

The Prospect (Wis.), Guthrie and Big Bend Telephone Company has reorganized with C. R. Guthrie as president and Charles Rose of Big Bend, secretary.

The state auditor of South Dakota has announced that the telephone companies doing business in the state would pay $19,507 in taxes this year. R.

Southeastern Telephone Developments.

The Southern Bell Telephone Company will expend about $34,000 in the town of Charlotte, N. C., for extension of cables and other work. The company now has nearly 2,000 telephones in the town.

The Shelby County (Ky.) Telephone Company has been incorporated with $120,000 capital by W. J. and B. A. Thomas of Shelbyville and associates.

The Scottsville and Liberty Telephone Company is a new chartered incorporation in Kentucky. E. H. Reynolds of Scottsville and others are interested.

An interesting comparison has been made of the telephone business in Louisville, Ky., with other businesses. It is shown that the telephone system (Bell) added 500,000 in its entire territory last year, making a total of 2,500,000 telephones. The rate of increase is 25 per cent. The Cumberland company has 146,000 telephones in operation, an increase of about 25,000 for 1905, it being a licensee of the Bell but at the same time a home industry. This company has provided for its large growth by issuing stock that is offered to its stockholders at par, although many new stockholders appear on the books after an issue of stock.

The Common Council of Richmond, Va., has adopted a resolution for an investigation of rates charged by the Bell Telephone Company in the city and country, by the committee on electricity, to ascertain whether or not the company is holding to the schedule filed with the city, giving its rates and schedules, according to the company's franchise.

Argument will be heard in Federal Court on December 21st in the case of the Cumberland Telephone Company vs. City of Louisville, Ky., to prevent the enforcement of a resolution regulating rates by the general council of the city. The company will base its argument on federal rights, and holds that the new rule will mean, in the end, a confiscation of the property of the telephone company.

Géo. A. Holderness of the Carolina Telephone Company states that some $25,000 will be expended on the Fayetteville (N. C.) exchange, in pursuance of recently acquired privileges from the town government.

The Sylvester Telephone and Telegraph Company has been chartered in Georgia to operate in Worth, Dougherty and other counties, with $2,500 capital. T. A. Spurlin is interested. Sylvester will be headquarters.

It was reported that the Bell and Interstate companies in Raleigh would be merged December 1st, but nothing resulted, and the Merchants' Association will make inquiry why the merger was not effected. L.

GENERAL TELEPHONE NEWS.

Mr. P. Fitzsimmons of Cincinnati, writing to the Western Electrician, says he has a telephone franchise in Cincinnati running to 1921. He has already strung 100 miles of wire, installed 3,000 telephones and erected trunk lines to the outskirts of the city. He now desires to interest persons and capital in the organization of an Independent telephone company and the project of bringing Independent long-distance lines into the city. Mr. Fitzsimmons says that the field is an excellent one.

Independent telephone men interested in the taking over of the automatic-telephone system of the Illinois Tunnel Company in Chicago have been active the last week. Many of them have been in the city discussing future plans. At a meeting in the Auditorium it was decided to incorporate as the Chicago Independent Telephone Company to carry out the project of developing the automatic system and giving connection to the thousands of Independent subscribers outside the city. The president of the new company, it is said, will be Roland R. Conklin, director of the National Bank of Cuba, and the vice-president, E. L. Barber, who is interested in several western telephone companies. Others interested are J. D. Powers of Louisville, vice-president of the American Bankers' Association; John M. Shaw, president of the Atlantic Telephone Company; Samuel M. Jarvis, and Martin W. Littleton.

CORRESPONDENCE.

Continental Europe.

Paris, November 28.—A new form of automatic circuit-breaker which is said to be very efficient is brought out by the Brown-Boveri firm. It has been adopted in the new St. Denis plant at Paris. Based on the Ferraris principle, it is a slow-acting circuit-breaker, and in its essential point consists of an aluminum disk of six or eight-inch diameter, running between the poles of a laminated electromagnet. A small transformer on the main line feeds the electromagnet and the current is proportional to the main current. On the shaft of the disk is a pulley which carries a cord and weight, so that when the current is normal the rotation of the disk is balanced by the weight and there is no movement. Should the current rise too high the disk begins to rotate and in a short time the weight is made to close a circuit which operates the switch break on the main line. In a desk switchboard such an apparatus is mounted below and inside the casing, with a glass plate flush with the surface to show its movement.

A new system of block signals is being tried on the Paris Subway. It is the invention of Bérard, Dardeau and Detroyat, and is a semaphore signal. It is illuminated at night or in the tunnel as usual, and it is also used on the overhead part of the line. Current at 500 volts from the third rail is used to work the signals. Contact bars are placed on the track at the right of each signal and are operated when the train passes by means of the contact shoe. First tried at the Villiers underground station, the system is now used on the south line, which has a total length of 5.6 miles. Over this distance there are 72 signals, using four per station, two for the entrance and two for the exit. Here the trains run at 2½-minute intervals, and the signals are required to work no less than 1,000 times during the day.

This year the Paris Automobile Show promises to bring out a larger number of exhibits than ever, and in order to accommodate them the large space of the Esplanade des Invalides, which lies near the Grand Palace, is to be used, and a large temporary structure will be put up. The main electrical features of the show, outside of electric automobiles, will consist of petrol motor and dynamo sets, both stationary and portable, electric ignition devices, spark plugs, etc., for motor cars, storage batteries, induction coils, etc. The show is to be held during the last two weeks of December.

The new hydraulic plant which is now building in the Lower Alps region of France at La Brianne, is to use the highest voltage which has been yet employed in this country for overhead lines. It is proposed to erect a pole line from the station as far as Marseilles, a distance of 58 miles, and 50,000 volts three-phase current is to be used. A still longer line, with a lighter load, however, will run for 75 miles to the city of Arles. At both these points there will be large sub-stations. As to the power plant itself, it forms part of the Alpine system belonging to the Société d'Energie Electrique, which uses apparatus built at the Paris shops of the Thomson-Houston Company. Five main turbine sets of 2,500 horsepower each are being erected in the power plant, using a 70-foot water head and working at 7,500 volts three-phase current.

Among the systems of space telegraphy, the Telefunken seems to be the most active on the Continent just at present. This company is erecting a number of large stations, not only in Europe, but also in Asia. In Holland it has put up a large plant at Scheveningen, which is now operated by the government postal department. Used mainly for signaling from the coast to ships, it has an average reach of 200 miles, but in fine weather it can send messages over 500 miles. In Asia a new station has been erected at Batavia, so as to operate with a second post located in the port of Cheribon, some 110 miles off, and messages can be sent to vessels in these waters. The station is said to cover a distance of 150 miles.

In a recent report as to the state of the electrical industry in Italy, it is noted that electric traction is flourishing, especially in the north Italian region, and there are no less than 23 tramway systems in operation in the whole country. As yet electric-railway work is represented by only two systems, the Lecco-Sondrio-Chiavenna and the Milan-Gallarate-Porto Cerisio lines, but both of these are important and are using a number of electric locomotives upon standard-gauge tracks. Narrow-gauge roads in different parts of Italy are preparing to use either locomotives or motor cars. It is estimated that there are now not less than 700 miles of track, counting all the tramways and railroads. Hydraulic power is used for 13,500 horsepower in the stations, which have a total of 43,500 horsepower. A. DE C.

Great Britain.

London, November 28.—The official notices concerning electrical engineering schemes which are to be promoted in the 1907 session of Parliament do not point to anything of a sensational order, although notices, and even the bills themselves, frequently fail to tell the whole story. At this early stage it is quite evident that we are destined to see another session of private-bill legislation, devoted almost solely to a further attempt at solving the problem of who should have the authority to supply electric power in London. Any engineer may make up his mind that little which is new to him technically will be forthcoming; but the subject possesses endless possibilities for local politicians—who know nothing either of engineering or the economics of electric supply—to dilate upon the "policy" of municipal control or otherwise. This being so, I will merely record the facts as to the schemes which it is proposed to bring before Parliament.

In addition to the London County Council, there is once more the Administrative County of London Company, which now seeks to incorporate a company to enter into agreements with the London County Council, either undertaking a partial supply in the London area, or leasing the whole undertaking from the London County Council for a period of years. Again, for the second time, comes the proposal to amalgamate all the existing electric-supply companies. This, however, must surely only be put forward on tactical grounds, for although they are insuperable, yet there surely will be technical complications which weigh against economy of supply from this direction. A new company is also in the field with the name of the London and District Electric Power Company.

Two interesting schemes are the working by electricity of the trains in the proposed Channel Tunnel between England and France, and also in a new tunnel under the River Thames well below all bridges.

The Griffiths-Bedell surface-contact system of electric traction is proposed for the cathedral city of York and its suburbs. The tramway question here has been a keen one for several years, and it is about time that the wretched-looking horse cars were superseded.

The absence, practically speaking, of any distribution costs in connection with electric power supply to colliers from small plants erected on the spot is a strong inducement for colliery owners to continue to put down small isolated plants rather than to support the power companies. How far this feeling is taking root is shown by the following figures which have come under my notice: No less than 200 collieries, of varying size, have been electrically equipped by one firm of plant makers alone, aggregating a total of some 20,000 horsepower. In addition, a striking example of the economies to be effected in this manner is the erection of a large turbine-driven power station in Durham—in the very center of the group of Newcastle power companies' territory—for supplying a batch of collieries which lie close together.

Electrical power on the Rand has been the subject of much comment in the financial press, in view of the possibility of an appeal to the public in connection with the project at no distant date. The provisional arrangement seems to be—although no one appears very clear on the point—that temporarily a steam station shall be built at Vereeniging, and ultimately a waterpower station at Victoria Falls. One financial paper seriously urges the cautious consideration of any Rand power scheme. Victoria Falls is regarded as an unsound proposition, and Vereeniging is regarded as doubtful, owing to the limited supply of water which may be extracted for condensing purposes, and its high price. Indirectly, a steam-power station in the very center of the Rand mining district is suggested as the most likely remedy. Special inquiries have been made in order to arrive at these conclusions, and for that reason they are worthy of quotation.

Experienced by the scare which took place a few years ago—when many shareholders sacrificed their holdings on the announcement of a successful daily-news wireless service across the Atlantic—the cable companies' stockholders have been unmoved by the results of the wireless-telegraph conference in Berlin. All along, the cable experts have preached the doctrine that there was nothing to fear, from their point of view, in wireless telegraphy, and it is satisfactory that their prophecies have come true, and their advice taken heed of. G.

Dominion of Canada.

Ottawa, December 8.—The Ontario Hydro-electric Commission has furnished 21 municipalities in the province with estimates of the rates for which the commission will undertake to supply electric power. The rate per horsepower for Toronto is $14.15 minimum and $16.61 maximum; Hamilton, $13.97 and $16.25; St. Thomas, $21.10 and $23.76; others range between these extremes.

The International Waterways Commission has filed a report with the Dominion government which rejects the application of the Minnesota Canal Power Company of Duluth for permission to divert certain waters from the Birch Lake drainage basin in St. Louis and Lake counties, Minnesota. The application was resisted by the city of Winnipeg, Man., and the town of Fort Francis, Ont., and also by the Rainy River Improvement Com-

pany, the Rainy River Navigation Company, the Ontario and Minnesota Power Company and E. W. Backus, who held certain concessions from the Ontario government. The commission recommended a treaty to govern diversion of international waterways.

A delegation from the City Council of Montreal has received from Sir Wilfrid Laurier a promise that the government would lease or sell the power of the Beauharnois Canal to Montreal at a reasonable figure, on condition that $60,000 was immediately expended on the repair of the canal; $20,000 for maintenance, and $1,000,000 to establish a plant. He said that Beauharnois and Valleyfield would have to get power for municipal purposes and Montreal would get the remainder. The construction of the works and the rates for electric power would be under the control of the Railway Commission of Canada. If Montreal fails to accept this proposition and undertake the work, the government will lease to a private company on the same conditions.

The management of the Montreal Street Railway Company has about completed the details in connection with the contemplated extensions and improvements to its system throughout the island of Montreal. The managing director states that the terminal-railway system will be taken over by the company on January 1st.

The Capital Power Company of Deschenes, on the Quebec side of the Ottawa River, opposite this city, has sold out to the Canadian Pacific Railway Company for the sum of $240,000. The railway company owns the Hull electric-railway line, running from Ottawa to Aylmer, Que., a distance of eight miles, and proposes to electrify its suburban branches and other short lines. The Capital Power Company was formed about six years ago, with a capital stock of $400,000. A total revenue was secured amounting to $25,000 or $30,000 per year. Expense of operation was comparatively light, being only about $8,000 a year. W.

Winnipeg, Man., December 8.—The city engineer of Edmonton, Alberta, has reported to the City Council that the electric-light plant must be enlarged at once, as it is being run to its maximum capacity and power is not sufficient to supply all customers. J. G. Kinnaird is treasurer of Edmonton.

The Crows Nest Pass Coal Company has decided to build a large power plant at Elko. B. C. A. Aberill, hydraulic engineer for the Allis-Chalmers Company, Montreal, and J. O. Gallice have been engaged in connection with the work. General Manager Lindsay of Fernie, B. C., is in charge.

The floating ice in the Lac du Bonnet River has interfered with the power plant of the Winnipeg Electric Company, and consequently Winnipeg has been short of power for several days past. Wilford Phillips, Winnipeg, is general manager of the company.

The Winnipeg Electric Company is being sued by the city of Winnipeg in connection with the bringing of power into the city limits, the city claiming that the company's charter does not permit of this. The company has filed a defense. The case will be carried to the higher courts.

The Saskatchewan Telephone Company is now engaged on a long-distance line to Milestone, and when the system is installed there they will push on to Lang, Saskatchewan. The company has plans for a number of long-distance lines and local systems, which will be installed as rapidly as possible. R. R.

New England.

Boston December 8.—M. W. Alexander, engineer with the General Electric Company, delivered an address on the needs of education from the manufacturers' standpoint before the Social Education Congress at its meeting in Boston on December 1st. Mr. Alexander is vice-president of the National Society for the Promotion of Industrial Education. He declared that the educational system had not yet answered the industries' demands for skilled hands and that skill among the trades had not developed with the development of the system of industries. The manufacturer helped to solve the problem, he said, by providing shop schools or training rooms to initiate the boys into the trade, and this worked to the equal advantage of employer and employe.

The Boston aldermen have granted the Boston Independent Telephone Company leave to withdraw its petition for a franchise, it having been represented that the company would not be ready to do business this year. This is the second time this action has been taken on this petition—the previous vote having been reconsidered. The Metropolitan Home Telephone Company's petition for a franchise has been on the table since the board reconsidered its vote granting leave to withdraw.

The Danbury and Bethel Gas and Electric Company is planning improvements to its plants at Danbury and Bethel, Conn., which will cost $50,000.

Middletown and Meriden (Conn.) business men have appointed a committee to secure a legislative charter for an electric railway between the two cities, via Middlefield, with a branch to Guilford, via Durham, which will connect with the Shore Line electric railway at Guilford.

The final transfer of the control of the Ray system of electric railways to subsidiary companies of the New York, New Haven and Hartford Railroad Company was made on December 3d.

West End politicians and property owners are strongly opposing the Boston Elevated Railway Company's latest route for an elevated structure between the North Station and the Charles River Dam—a portion of the Boston and Cambridge rapid transit line.

Among the securities sold at auction in Boston last Wednesday were five shares Salem Electric Light Company's stock at 201⅛; 59 shares West End Street Railway Company's common stock at 93½; 32 shares American Telephone and Telegraph Company's stock at 136, and Massachusetts Electric Company's common stock scrip amounting to $75 for $16. B.

New York.

New York city, December 8.—Attendance and business done at the automobile show at the Grand Central Palace, this city, show great interest in the exhibition, given by the New York Motor Club. At a smoker, President W. J. P. Moore of the club welcomed the guests, and brief talks on the show and its influence upon the automobile industry were made by A. G. Batchelder and Alfred Reeves. All of the out-of-town agents and manufacturing representatives expressed general satisfaction at the successful opening of the Grand Central Palace exhibit. The official records show that 12,000 persons inspected the cars last Saturday night. No less than five high-powered cars, the least expensive being priced at $7,000, were sold, a record for the first day of a motor-car exhibition. Of the smaller and less expensive cars many orders were booked. Even the accessory manufacturers, who make exhibits merely to offset the show of their competitors, and who expect no immediate results, were highly pleased at the business done.

John G. Carlisle, counsel for the Atlantic Telephone, which has applied for a franchise to operate an Independent telephone system, declares that if the Board of Estimate grants to the New York Telephone Company and its subsidiary concern in Brooklyn the exclusive right to the telephone business in this city, as has been requested, it would establish a monopoly in direct violation and defiance of the state law. The question raised by Mr. Carlisle has compelled the board to refer the matter of the franchises until the correctness of the statement can be determined.

The Rapid Transit Commission will probably advertise for bids for five new subways within the next month. The joint sub-committee of the Board of Estimate and the Rapid Transit Commission met this week and approved the routes planned by the latter body for subways on Seventh, Eighth, Third and Lexington avenues, as well as for the so-called Coler subway, which, if built, will run from the Bronx downtown, across the new Manhattan bridge when it is finished, and under Fourth Avenue, Brooklyn, to Coney Island. The action of the sub-committee of the two bodies was brought about by Controller Metz, who was asked at the last meeting of the Rapid Transit Commission to expedite the approval by the Board of Estimate of the plans of the Rapid Transit Commission. Work on one or more of the new subway routes may be begun in April next, according to an estimate made Thursday by Chief Engineer Rice to the Rapid Transit Commission. This, of course, providing bidders appear in response to the commission's invitation. The board at Mr. Rice's suggestion passed a resolution to have pipe galleries planned and built in all future subways.

The second annual dinner of the men of the construction, engineering and maintenance departments of the New York Central was held at the Hotel Astor Wednesday night. These dinners were established by the New York Central men a year ago to bring the departments into closer touch and keep alive the friendships between the workers in each. About 175 men were seated. Among them were Vice-president W. J. Wilgus, General Manager A. H. Smith and Chief Engineer G. W. Kittridge. The dinner was elaborately planned, the grand banquet hall of the Astor being used. The speeches were on railroad topics of immediate interest to the diners. The menus were in blue print, typical of the work of the engineers. C. I. C.

Ohio.

Cleveland, December 8.—J. R. Nutt, representing the Citizens' Savings and Trust Company of Cleveland, purchased the property of the Toledo and Western Railway Company for $337,574.75, his being the only bid offered. In addition to the purchase price, Mr. Nutt will have to meet interest on the bonds due last July, and amounting to $37,500. The sale was made subject to three mortgages. It was expected that several other bids would be submitted, but no others were offered.

An application has been made for a franchise in Newark by the Ohio Central Traction Company, which was formed to build a line from that place to Lancaster. It is said that the men backing this enterprise are in position to build the road without help from outside people, if they so desire. The president is W. P. Cosgrove of Zanesville, and Attorney E. C. Irvine of Columbus is the secretary.

The November statement of the Toledo Railways and Light Company shows an increase in gross receipts of $11,000. This is an excellent showing for the month. The statement of the Northern Ohio Traction and Light Company shows a gain of $15,700 in gross receipts. This road is making an excellent showing since the Canton-Akron roads were taken over.

The Columbus and Lake Michigan, the Schoepf steam road that is to be electrified, has made arrangements with the commissioners to cross the Second Street bridge over the Auglaize River at Defiance, thus gaining an entrance to the business portion of the town. A franchise was granted for this purpose some time ago. Contracts have been let for electrifying the line, and it is believed that interurban cars will be in operation between Lima and Defiance by early spring. This is the first electric road for the town.

At a meeting of the stockholders of the Cleveland and Sharon Traction Company, which was incorporated a few weeks ago with a capital stock of $2,500,000, the following-named officers were chosen: President, F. B. Morgan, Cleveland; vice-president and secretary, James Blake, Brooklyn, N. Y.; treasurer, C. F. Clendenning, New York; assistant secretary and treasurer, P. F. Morgan, Cleveland.

Henry A. Everett, H. Clark Ford, R. A. Harman, E. G. Tillotson and H. P. McIntosh have been selected by the bondholders as a committee to look after their interests in the Eastern Ohio Traction Company, whose property will probably be sold by order of court within a short time.

At a meeting in Findlay a few days ago business men of that place, Norwalk and Tiffin effected a preliminary organization of the Cleveland and Interurban Company for the purpose of building an electric road from Norwalk to Bluffton, Ind., where it would connect with other lines operating into Indianapolis.

Citizens of Chillicothe and Hillsboro have taken the preliminary steps toward the organization of the Cincinnati, Bainbridge and Chillicothe Traction Company for the purpose of building an electric road connecting these points.

In a case against the old Mt. Auburn Cable Company of Cincinnati, the Supreme Court has held that the purchasers of bonds who receive stock as a bonus must pay the face value of the certificates in case the company needs money. The holders of stock cannot be assessed until bondholders have paid up for what they get in the way of stock bonuses.

The new electric plant in the City Hall at Cleveland is now furnishing lights for all the city departments. For a time current was purchased of M. A. Bradley, who operates a plant for lighting the Bradley buildings.

Application has been made for a franchise at Norwood by the Cincinnati Gas and Electric Company on the basis of 11 cents per kilowatt-hour for lights for public buildings and private consumers for the first 10 years after the passage of the ordinance. If a reduction is made in Cincinnati at any time within the life of the franchise, the same reduction shall be made at Norwood. A minimum charge of $1 is provided for.

The Cleveland Alcohol Company has been incorporated with a capital stock of $100,000 for the purpose of making denatured alcohol. J. J. Phillips and others are interested. O. M. C.

Michigan.

Grand Rapids, December 8.—The Board of Public Works at South Haven, Mich., has renewed a contract with the General Electric Company for supplying the electric-light plant with transformers. Meters will be supplied by the Fort Wayne company.

The Edison company of Detroit is seeking a franchise in Mount Clemens to supply the city with light at 12½ cents, as against a present price of 20 cents. The rate will be cheaper than the Detroit rate for some classes of business. It is talked among members of the Detroit council that a rival company may invade the field of the Detroit Edison Company. However, that city is now getting a cheaper rate per arc light than any other place where conditions may be compared. Detroit consumers are paying $34.99 annually, while Grand Rapids, with a municipal plant, is paying $35.14. In other cities the cost exceeds $50. Columbus, Ohio, with municipal ownership, pays $49.15.

Houghton is considering the installation of a municipal lighting plant. The Houghton County Electric Light Company is asking for a renewal of its contract with the city. The company agrees to furnish arc lights on a 10-year contract for $76 a lamp per year; five-year contract, $81; three-year contract, $84. Incandescent lighting, 10-year contract, seven cents; five-year, 8.1 cents; three-year, 10 cents Gem lamps are to be furnished

under the contract, where arcs are not necessary, at proportionate prices of $20, $24 and $26.

The Northern Light and Power Company is ready to build two dams on the Flint River, between Saginaw and Flint, and is now seeking a franchise to sell its power in Bay City, at $30 per horsepower per annum, on a 10-hour basis.

General Manager W. B. Woodberry and Long-distance Manager G. M. Lathrop of the Home Telephone Company of Detroit have been in Grand Rapids the past week examining the Citizens' system here and consulting with Secretary Fisher and General Manager Tarte. About $500,000 has already been expended by the Detroit company. One million feet of conduit has been laid, and 3,500 distributing poles placed.

W. D. Kauffman and C. O. Wilhelm of Elkhart, Ind., are planning to establish an Independent telephone system in Dowagiac. A franchise for such a system is held by Lyman Rodgers, George W. Moore, Eugene Gilbert, David Blish and R. N. Connine. It is proposed to sell stock among the citizens of Dowagiac and to have the line connect with the Independent system for long-distance service. L. W. B.

Indiana.

Indianapolis, December 8.—The 1907 interurban map of Indiana, to be issued within a week or two by the American Engineering Company, will show 1,650 miles of electric railway in operation in the state, 746 miles under construction and 570 miles projected. The projected mileage does not include that of the proposed Chicago-New York Air Line. Ten traction roads are shown entering the Traction Terminal Station in Indianapolis. Three more will be added to this number during the coming year. These are the Indianapolis, Crawfordsville and Western, the Indianapolis, Newcastle and Toledo, and the Indianapolis and Western. Data collected by the Engineering company show that by next July electric lines will be completed between Indianapolis and Louisville, Indianapolis and Terre Haute, Lafayette and Logansport, Peru and Wabash, Indianapolis and Newcastle, Indianapolis and Crawfordsville, Rockport and Evansville, and Princeton and Vincennes, and that by the following January lines will be completed between Crawfordsville and Danville, Ill., Shirley and Anderson, Greenfield and Maxwell, Newcastle and Muncie, Newcastle and Richmond, Newcastle and Winchester, and Winchester and Portland.

The official timetables of the Indiana interurban lines, in a neat folder, printed in two colors, has just been issued. This is the official folder of all the interurban lines running into Indianapolis. No other folder will be allowed to be distributed on these lines. It is published by the Electric Railway Advertising Company, Traction Terminal Building. A feature of the folder is a map of the interurban lines of Indiana and Ohio.

It recently became known that the Toledo, St. Louis and Western Railroad, known as the Clover Leaf, issued a new junction tariff sheet, for both passenger and freight traffic, which formally recognizes the so-called merger traction lines of Indiana and provides for an interchange of business with them. Special permission to issue the new tariff was given the Clover Leaf by the Interstate Commerce Commission. The tariff was filed with the commission on Novemer 10th, and became effective 15 days later. The action of the Clover Leaf is regarded by other steam roads as being almost revolutionary in character, as both the Western and Central Passenger associations have on their records resolutions that the steam roads shall not in any way recognize their electric competitors, either by issuing joint tariffs with them or exchanging business by tariff agreements. These resolutions were adopted when the electric lines first began to present formidable opposition.

The Indianapolis and Eastern and the Dayton and Western Traction companies are applying for a new franchise to operate their cars through the city of Richmond.

The City Council of Connersville has granted a franchise to the Connersville Street and Interurban Railway Company to build and operate a street-railway system in Connersville.

Plans have been ordered by the Fort Wayne and Wabash Valley Traction Company for the enlargement of its power house in Lafayette. Sufficient new machinery will be added to give this plant at least 2,200 horsepower.

A franchise has been granted to the Goshen, South Bend and Chicago Railroad Company by the commissioners of Laporte County, to build an electric line northeast from Laporte to connect with the main line of the Chicago and New York electric railroad, the first section of which is now being built.

The Board of Public Works of Evansville has refused the Evansville Street Railway Company the right to change its name to the Evansville and Southern Indiana Railway Company, unless the company agrees to pave the street 18 inches on each side of the track, in addition to paving between the tracks. The company refuses to agree to this additional liability, on the ground that it would invalidate its bonds. The syndicate owning the road and also the Evansville and Princeton traction line says it stands ready to expend $150,000 on the city lines and $275,000 on the traction line if the change of name is made.

The Newcastle Union Railway Company is the name of a new company recently incorporated with a capital stock of $50,000 to build and operate an electric line to connect Newcastle, Sulphur Springs and Middletown, a distance of 16 miles. The incorporators are C. S. Hernly, C. W. Mouch, T. B. Millikan and A. D. Osborn.

The Fort Wayne and Wabash Valley Traction Company is stringing high-tension copper wire along its entire system, to take the place of the high-tension wire now in use, the latter being too light to transmit the increased voltage of the electric power generator at the new power house in Fort Wayne. All the minor power houses will be abandoned; sub-stations are now being rebuilt, enlarged and newly equipped, while the heavier wire is being installed.

A party of surveyors has reached Bluffton, Ind., laying out the route for the new Cleveland-Indianapolis traction line between Tiffin, Ohio, and Bluffton and Decatur in Indiana.

The Indiana Railroad Commission reports that in Indiana during the year ended June 30, 1906, 342 people were killed and 4,313 were injured by railroads, or in connection with the business of railroads. There was a total of 27 killed and 300 injured on account of collisions, which the commission claims was wholly due to the lack of a block system. The commission will ask the Legislature for a law requiring block systems and a rigid penalty for the non-observance.

The Western Union Telegraph Company is complaining because the traction company's high-tensioned wires are putting the telegraph company out of business in the vicinity of Connersville. Mr. B. Bishop, an authority on such matters, says the 13,000 volts is sufficiently powerful to affect parallel wires within 500 feet of it.

D. H. Talbert of Indianapolis has secured a patent on the concrete railroad tie, which is attracting favorable attention from steam and traction railroad men. The tie is made of concrete, about the size of an ordinary wooden tie, with a hollow pipe running through it lengthwise. The rail is fastened to the tie by iron spikes, which run down through the tie and enter the hollow pipe, where the spikes are held in place by a key driven through a mortise in the spike. The rail sets directly on a block of wood, which is embedded in the cement tie, and forms a cushion. J. M. Lail has secured an interest in the patent and insists that the tie has a great future. S. S.

Illinois.

Peoria, December 8.—Senator Henry N. Evans of Aurora, president of the Interstate Independent Telephone and Telegraph Company, and E. R. Conklin, manager of the company, were in Peoria this week. Senator Evans said he expected his company would soon have a long-distance line between Peoria and Chicago.

The Standard Electric Storage Battery Company of Chicago has been incorporated with a capital of $15,000 to manufacture electric supplies. Incorporators are A. C. Torbett, Louis E. Otto and A. W. Underwood.

The Peoria, Bloomington and Champaign Railway Company has filed a big mortgage to secure an issue of $3,000,000 worth of bonds. The mortgage is made out to the Central Trust Company of Chicago. By the terms of the agreement $2,000,000 is to be forthcoming at once and $1,000,000 is held in reserve for construction purposes and extensions. This is a part of the Illinois Traction Company's system.

The Cullen Construction Company has finished the concrete work on the Illinois Traction Company bridge here, and the Stroebel Construction Company has started the steel work.

The electric road of the Galesburg and Kewanee Electric Traction Company was opened this week between Galva and Kewanee. The road between Galva and Galesburg will be started in the spring.

Mayor Devereaux of Springfield has signed the ordinance recently passed by the City Council granting the Springfield and Southeastern a franchise in that city. The ordinance calls for much paving and a compensation of 10 cents per car-mile after the third year, and 12 cents after the tenth year. It is a 50-year franchise, and allows other interurbans to enter the city over its tracks by prorating cost of operation, interest on investment included as a cost item. To give a three-cent local fare and give and take transfers on that basis, when arrangements can be completed, are required.

The Illinois Traction Company expects to open the line between Lincoln and Springfield by December 15th.

The Chicago and Alton has taken off the interurban service between Pontiac and Bloomington. These are the last of the interurban competitive trains, which were put on about a year and a half ago. All on the south end have been off for some time. V. N.

Mexico.

Mexico City, December 6.—The federal government has granted to the Inde Gold Mining Company a concession for the installation and operation of a hydro-electric plant on the Sestine River in the state of Durango. It is stated that this plant will be one of the largest enterprises of its kind in Western Mexico. The company will not only supply its own mines and mills with electrical energy, but it is proposed to construct transmission lines to a number of towns and mining camps in that section. A large dam will be built across the Sestine River near the town of Inde to supply the initial power. H. D. Crowder, superintendent of the Inde Gold Mining Company, will be in charge of the installation work.

The plant of the Lerdo and Torreon Electric Light and Power Company at Torreon is being enlarged and improved.

A. C. Nash, general manager of the street-railway system in Chihuahua, has obtained a concession from the state and municipal governments for the construction of a complete system of electric street railways in the city. It is understood that Mr. Nash is acting as the representative of the owners of the existing street-railway system and that the mule-car lines will be converted into electric traction and the system extended to cover many more miles of streets.

The Puebla Tramways, Light and Power Company, the Canadian concern which recently purchased the properties of the City and Industrial Railways and the Electric Lighting companies of Puebla, will begin the work of changing the existing street-railway system of Puebla to electric traction as soon as the waterworks system, now under construction, is finished. It is expected that the reconstruction can be commenced early next month. In addition to changing the mule-car system into electric lines, extensions will be built to important suburban towns and industrial centers.

This company is also preparing to install a hydro-electric plant at the Tuxpango Waterfalls on the Rio Blanco, near Orizaba. These waterfalls were purchased from Messrs. Oscar Braniff and George Braniff of Mexico City, and a complete survey has since been made for the proposed hydro-electric plant. It is planned to develop 20,000 horsepower, which will be transmitted to Puebla, Orizaba and other cities by transmission lines. The electric-lighting plant in Puebla which the company purchased will also be enlarged and improved. The company has a capital stock of $6,000,000 gold. W. D. H.

Pacific Slope.

San Francisco, December 5.—The United Railroads has accomplished a great deal during the last month in the way of opening up new electric lines and rushing reconstruction work. About 3,000 men are at work, and the force will be increased to 4,500 if possible. There is still complaint, however, as to insufficiency of cars, although the operation of new lines has relieved the congestion of cars on Fillmore and other streets.

This company's Polk and Larkin Street line, which was formerly a cable road, has been placed in operation as an electric road extending from Ninth and Mission streets to Polk and Pacific Avenue. The Hayes Street trolley line is now in operation, being a reconstructed cable road as far west as Fillmore Street.

A new Pacific Coast record has been set by the government wireless-telegraph station at Point Loma, near San Diego, Cal., which exchanged messages on December 4th with the naval station at Bremerton, Wash. The distance covered was 1,200 miles, which has never been equaled on the coast since wireless plants were established.

The Los Angeles Interurban Company, which operates electric railroads radiating from Los Angeles, has closed a contract with the Allis-Chalmers Company for three 1,000-kilowatt motor-generator sets, which are to be installed in outlying sub-stations in the Los Angeles district.

It is reported that the Central Light and Power Company, which had a steam-power station in the Parrott Building in San Francisco before the great fire, will soon close a deal for the sale of its system to the Pacific Gas and Electric Company instead of carrying out its plans for the installation of a new generating plant in the southern part of the city. There was some salvage claimed on the burned machinery and boilers, and a good deal of the underground distribution system could be utilized again if necessary.

The Colusa County Telephone Company, which was recently incorporated, with Williams, Cal., as the place of business, by C. L. Donohoe and his associates, will soon commence the construction of its lines throughout the county.

It is announced that the American Bell Telephone interests propose to secure franchises in Nevada and buy out the existing private telephone lines, which are of limited extent and need good long-distance connections with all the mining camps and the outside world.

An interurban electric-railway system of considerable scope is projected by Stone and Webster of Boston, which firm owns the street-railway

system of Seattle, Wash. The expenditure of $2,000,000 is contemplated during 1907 for the construction of electric lines connecting the towns of Snohomish, Skagit and Whatcom counties.

The Sierra Power Company has been incorporated in Los Angeles, with a capital stock of $2,000,000, by J. W. Swanwick, George Chaffey and Walter M. Rose.

The San Bernardino Interurban Railway has been incorporated by Victor Smith, H. E. Harris and A. G. Kendall, with a capitalization of $1,000,000, for the purpose of building an electric road connecting San Bernardino, Cal., with Rialto, Ontario, Riverside and Redlands.

The Pacific Auxiliary Fire Alarm Company, operating the Gamewell system, had, before the fire, the largest number of customers of any auxiliary company in the country excepting the Manhattan, operating in New York. It had about 2,500 auxiliary stations in operation, nearly two-thirds of which were destroyed in the conflagration. The Pacific company has decided to reconstruct its system in San Francisco and extend its business with the growth of the new city. It is doing this rapidly and expects to have in service within six months fully 1,000 new stations. A.

PERSONAL.

The death of Richard Emory, former general manager of the Appleyard electric-railway properties in Ohio, is reported as having occurred recently in San Jose, Cal.

Albert Sloan of Spencer, Ind., has been appointed manager of the telephone system of the House of Representatives in Washington, D. C., and has entered upon the duties of his new position.

The Electrician of London understands that Professor Mascart is retiring from the directorship of the Central Bureau of Meteorology in Paris, and will be succeeded in January by Mr. Angot.

S. E. Leonard, assistant superintendent of the Third District, Western Division, Western Union Telegraph Company, at Denver, Colo., has been promoted to be superintendent at Omaha, Neb., of that district, filling the vacancy caused by the death recently of Mr. C. B. Horton.

Prof. J. J. Thomson, professor of experimental physics at the University of Cambridge, England, has been awarded the Nobel prize for researches into the nature of electricity. H. Moissan, professor of chemistry at the Sorbonne, Paris, was awarded the Nobel chemistry prize for his experiments in the isolation of flourine, his researches regarding the nature of that element and his application of the electric furnace to the service of science. President Roosevelt received the Nobel peace prize.

It is reported from Akron, Ohio, that Mr. H. B. Camp of that city is about to retire from business at the age of 68 years. Mr. Camp is the founder of the well-known H. B. Camp Company, which manufactures vitrified conduit in Akron, but has not been connected with the company for the last four years. He is president of the Colonial Sign and Insulator Company and other concerns and is director in several other companies. The management of his interests will be taken up by his sons, Henry H. and Louis W. Camp. Mr. Camp has the good wishes of the electrical fraternity, in which he is well known.

A wedding that is of interest to the electrical fraternity was celebrated in Chicago on December 12th, when Miss Gwendolin Shaw was married to Mr. Godfrey H. Atkin, at St. Paul's Episcopal Church, Chicago. Mr. Atkin is the Chicago manager of the Electric Storage Battery Company of Philadelphia, and has been connected with the electrical industry since 1890, when he entered the service of the Thomson-Houston Electric Company. He is one of the directors of the Chicago Electrical Show, and is one of the most widely known and best liked of the electrical men of the Middle West. He is the recipient of hearty congratulations.

ELECTRIC LIGHTING.

The city of Blue Springs, Neb., has granted an electric-light franchise to H. T. Clark.

Herbert Wadsworth is seeking a franchise for an electric and gas-lighting plant in Davenport, Iowa.

The Hennessey Electric Light and Power Company has been granted a franchise in Hennessey, Okla.

An electric-light plant is being installed in the yards of the Sioux City Paving Brick Company of Sioux City, Iowa.

The Hamilton Electric Light Company of Hamilton, Texas, has been incorporated with a capital stock of $10,000.

On December 30th bids will be received for furnishing and installing electric-light machinery in the pumping stations of the Kinnickinnic River (Wis.) flushing works. Peter Koehler, Milwaukee, Wis., may be adddressed.

The plant of the Clearfield (Pa.) Light and Power Company has been damaged by an explosion. The loss is $75,000.

The Medford (Wis.) Light and Heating Company has increased its capital stock from $20,000 for the purpose of making improvements.

With the aid of the Legal Digest on gasoline lighting permits, prepared by Victor L. Scott of the commercial department of the San Antonio (Tex.) Gas and Electric Company, it is said that that company in 60 days secured an annual revenue of about $7,000 which formerly went to gasoline plants. A member of the San Antonio company says that he does not think that gasoline lights can ever rival electricity at any price, where the position of the insurance underwriters and the United States Supreme Court decisions are laid bare to the public as in Scott's Legal Digest.

The Treasury Department of the United States government recently contracted with the Moore Electrical Company of Newark, N. J., to light the entire west side of the mezzanine floor of the New York postoffice with the Moore light. This installation will consist of more than 1,000 feet of Moore tubing, and is to replace about 525 16-candlepower incandescent lamps formerly used. The Moore tubes will not use more than 20 kilowatts per hour, but will produce an illuminating effect at least five times brighter, it is said, than the whole system of incandescent lamps, although the incandescent lamps were using about 27 kilowatts. This installation will be interesting from both scientific and commercial standpoints. The contrast between the Moore light and the mercury tubes on the opposite side of the same floor will be noted.

ELECTRIC RAILWAYS.

W. F. Vieverman has petitioned the council of Traverse City, Mich., for a franchise to build and operate an electric railway.

The directors of the Rock River Construction Company, Prophetstown, Ill., are arranging to issue $2,000,000 in bonds for the purpose of constructing electric roads.

The Edison Electric and Illuminating Company of Cumberland, Md., which controls the Cumberland electric railway, is making improvements to the plant to the value of $50,000. A large turbine engine, of the condensing type, 750 horsepower, has been installed.

The Puyallup (Wash.) Valley Northern Electric Rapid Transit Company has been organized with a capital stock of $3,000,000. Fred J. C. Chamberlain and W. Fullmer are among the organizers. The company proposes to build a direct line from Tacoma to the valley.

The Nevada, Mason and Los Angeles Railway Company has been organized at Yerington, Nev., with a capitalization of $1,000,000. Newton Evans of Los Angeles is president of the new company, which has projected an electric road from Wellington to Wabuska, Nev., connecting with railroads running south to Los Angeles. The proposed line will traverse a rich mining district and will secure electric power from the Truckee River General Electric Company.

POWER TRANSMISSION.

The Desert Water Power Company of Kingman, Arizona, has closed a contract for an Allis-Chalmers 1,500-kilowatt three-phase engine generator for its new electric plant for supplying power in the mining regions. About 1,800 horsepower in Edgmoor water-tube boilers will also be installed there.

A company of New Mexico and Missouri capitalists is being organized to install a large hydro-electric plant on the Penasco River at a point about 50 miles west of Artesia, N. M. Among those who are interested in the project are J. B. Quigley, an electrical engineer of St. Louis, Mo., A. L. Ross of Versailles, Mo., and D. M. Ross of Artesia. A survey for the proposed plant has been made under the direction of William Benson, and a supplementary survey is now being made by A. M. Meyers of Kansas City. It is estimated that the proposed plant will cost about $250,000. Transmission lines will be built to Artesia, Roswell, Carlsbad, Hagerman, Lakewood and a number of other towns of the Pecos River Valley.

An important consolidation of all the waterpower interests that are claimed by private persons along the line of the Chicago Drainage Canal and the Des Plaines River down as far as the head of the Illinois River has been effected, according to a dispatch from Joliet, Ill., and was made public a few days ago, when deeds were recorded transferring to the Economy Light and Power Company all the lands purchased by the Munro-Gaylord syndicate and carrying with them the riparian rights along the channel and river. The capital of the Economy company has been increased to $3,500,000, and $2,000,000 will be expended at once in developing the 15,000 horsepower that is possible at Lake Joliet and the Channahon Fall.

PUBLICATIONS.

Continuing its up-to-date advertising literature, the latest thing in this line from Pass & Seymour, Solvay, N. Y., has reference to P & S standard brass wall sockets—the ones with the double pole. This company is confident that its electrical specialties will not only please the buyer, but will save him money.

The Sprague Electric Company of New York has issued two new bulletins. One of them gives illustrated descriptions of the different types of electric hoists and cranes built by the company. The other is a well-illustrated bulletin describing the electrical equipment of the Hotel Gotham, New York city. The illustrations include views of the generator, laundry, vacuum-cleaning and pumping equipments.

A new weekly electrical engineering journal with the title "Electrical Engineering" is being launched in London, England, and will make its first appearance on January 3, 1907. Mr. F. Charles Raphael, for 10 years associated with the London Electrician, is the editor and managing director of the new journal. Among the contributors will be H. F. Parshall, A. P. Trotter, Philip Dawson and many others.

Bulletin No. 1510 has been issued by the Allis-Chalmers Company of Milwaukee, Wis., and contains information concerning Allis-Chalmers direct-connected Reynolds Corliss engines, heavy-duty pattern. The bulletin is illustrated with cuts of the various types of engines, direct connected to generators. A short comparison is made between the relative advantages of direct-connected and belt-driven units and a list of the information that is required in making estimates is given.

The last of the 14 papers covering the progress of stream measurements for the calendar year 1905 has recently been issued by the United States Geological Survey, so that the series is now complete. They are listed under the head of Water Supply and Irrigation Papers and range in number from 165 to 178 inclusive. A limited number of these papers are held by the Geological Survey for free distributions. Applications sent to the Survey should be addressed to The Director, United States Geological Survey, Washington, D. C.

The General Electric Company has sent out bulletins Nos. 4466, 4470 and 4473. Bulletin No. 4466 supersedes No. 4398 and describes and illustrates remote-control field rheostats for railway generators and rotary converters. Bulletin No. 4470 describes the electric motor in sawmill work and contains illustrations showing induction motors in operation driving various classes of machinery used in sawmill equipments. Bulletin No. 4473 contains a complete description of the GE-81 railway motor, giving illustrations of the complete motor and parts. Diagrams are included giving characteristic curves of the motor and its dimensions.

A very complete description of electric mine locomotives is given in Bulletin No. 4468, issued by the General Electric Company of Schenectady, N. Y. The bulletin contains a short history of the electric mine locomotive and a description of the salient features of the mine locomotives made by the General Electric Company. The cost of mine haulage by electric locomotives and the approximate cost of equipments are set forth. The bulletin is profusely illustrated with views of many different equipments in various parts of the world and the details of standard equipments are shown. Besides being interesting, the bulletin is full of good information.

SOCIETIES AND SCHOOLS.

At a recent meeting of the Ohio Fire Prevention Association, held at the Hartman Hotel in Columbus, the law and ordinance committee, which has been investigating the advisability of attempting to secure the adoption of an electrical code in the towns and cities of the state, reported favorably and suggested that the Chicago code be examined. Some advised that the National Code be used. They are much alike. After considerable discussion the matter was left with the law and order committee and the executive committee to report at the next meeting. The state will be districted and the work of presenting the Code, when decided upon, will be done by special committees. Indications are that some important work will be done by the association.

In the interest of the National Electric Light Association, Mr. Paul Lüpke, editor of the Question Box, requests the prompt forwarding of all questions recently accumulated or that may occur to friends of the association within the next month. If at all possible it is desired to have the material early enough so that the questions may be properly arranged in rational sequence and embodied in one single list. The value of the Question Box could be enhanced by so arranging the subjects as to make practically continuous reading. This was tried to some extent last year, but the period over which the receipt of returns extended prohibited a consistent

carrying out of the plan. For this reason Mr. Lüpke is supplying blanks upon which questions can be entered and then sent to him at 222 East State Street, Trenton, N. J. Prompt co-operation of all friends will bring success.

In connection with the fifteenth annual convention of the Northwestern Electrical Association in Chicago next month, arrangements have been made whereby the association badge will admit members to the Electrical Show at the Coliseum. The convention will be held in the Coliseum Annex January 16th, 17th and 18th. Mr. B. C. Adams of Lincoln, Neb., is secretary.

TRADE NEWS.

The directors of the Alexandria Light and Power Company of Alexandria, Ind., have decided to enlarge the plant and purchase additional machinery.

F. T. Manahan has purchased the electrical supply business of the M. & M. Electric Company in South McAlester, I. T.

Bids will be received December 26th for the furnishing and erection of apparatus to completely equip the heating, lighting and power plant for the Capitol Building and other buildings. The apparatus will consist of engines, generators, switchboards, boilers, pumps, condensers, steamfitting and all other necessary appliances to connect the same in several parts, and for complete sub-station apparatus for the various buildings. Elliot Woods, superintendent, United States Capitol Building and Grounds, or E. A. Hitchcock, secretary, may be addressed. This is the plant for which the original plans and specifications were rejected and new ones ordered, details of which have appeared in the Western Electrician.

Bids will be received until January 9, 1907, by the postmaster-general, Adelaide, Australia, for 10,000 No. 5 porcelain insulators, 5,000 No. 6 porcelain insulators, 2,000 No. 8 porcelain insulators, 10 tons hard-drawn copper wire (100 pounds to the mile), four tons phosphor-bronze wire, five tons galvanized-iron wire (400 pounds to the mile), one ton galvanized-iron tie wire (60 pounds to the mile), 10 miles No. 18 wire insulated with vulcanized india rubber, 5,000 copper tapes for 100-pound wire and No. 6 insulators (to be in bundles of 100 each), 5,000 copper binders for 100-pound wire and No. 6 insulators (to be in bundles of 100 each). Part of order to be placed by agent-general for South Australia, 1 Crosby Square E. C., London, England. Bids will also be received until January 14th by the postmaster-general at Melbourne, Australia, for 9,000 magneto wall telephone sets.

E. S. Prindiville, well-known in Chicago for his energetic and aggressive work in behalf of the Chicago, Burlington and Quincy Railway Company, has recently been appointed traveling passenger agent for his road and transferred to Pittsburg, with headquarters at 506 Smithfield Street. Mr. Prindiville succeeds J. P. Drake in the Pittsburg appointment.

BUSINESS.

The Electric Storage Battery Company of Philadelphia, manufacturer of the Chloride accumulator, has installed four of the eight sub-station batteries contracted for by the New York Central and Hudson River Railroad Company, for use in connection with the electrification of the New York terminal. The batteries now in operation are located, respectively, at Bronx Park, Kings Bridge, Mott Haven and Fiftieth Street. The total capacity of the eight sub-stations will be 60,000 horsepower. One of the two exciter batteries contracted for by the same company has also been installed at Port Morris.

The increase in the volume of business which the Western Electric is turning out is well shown by a comparison, says the Wall Street Journal, of the number of its employes at the end of 1905 and at present. December 31st last the company was employing 19,704 men. On November 1st the company had on its payrolls a total of 24,608 hands, an increase of approximately 5,000, or 25 per cent., during the 10 months. The Western Electric has been making additions to its plant almost every month during the year. In addition to the immense shops at Chicago and New York, the company has factories at several other points in the country, such as San Francisco; also works in London and Antwerp.

The American Hide and Leather Company has contracted with Allis-Chalmers Company to furnish one of the latter's horizontal Corliss engines of the heavy-duty type, which will be belted to line shafting and capable of supplying 500 horsepower in the Hide and Leather Company's Milwaukee plant. The Midvale Steel Company of Philadelphia has also ordered from the Allis-Chalmers Company a heavy-duty cross-compound engine, with cylinder 30 and 48 by 48 inches, for direct-connection to an electric generator, to be installed in its plant at Nicetown, Pa.

The Union Switch and Signal Company of Swissvale, Pa., has just been awarded the entire contract for the interlocking and signaling of the great terminal station now being constructed in Washington, D. C., by the Pennsylvania and the Baltimore and Ohio railroad companies. The Washington installation will be electropneumatic and the largest and most complicated signaling and interlocking installation that has ever been constructed in the world. The largest one previous to this was put in service at St. Louis at the beginning of the World's Fair, and before that the most important was the electropneumatic interlocking system at the terminals of the Boston South Station. Both of these plants were also installed by the Union Switch and Signal Company.

Frank B. Cook has received many orders for complete outside equipment, or pole cable terminals, for various telephone exchanges, as well as a large number of orders for distributing frames and switchboard protectors, including his types No. 8, No. 10 and No. 14. Mr. Cook has also been kept busy turning out his types B-4, B-5 and B-6 protectors for telephone instruments themselves. A few of the largest orders he has received for these various types of apparatus, the majority of them for the complete equipment, come from 17 different states and Canada. Mr. Cook has also received a great many large orders on his self-welding wire joints, Universal guy clamps and Cook clip. Prices and description of any or all of these types of apparatus will be cheerfully furnished on application to Mr. Cook.

ILLUSTRATED ELECTRICAL PATENT RECORD.

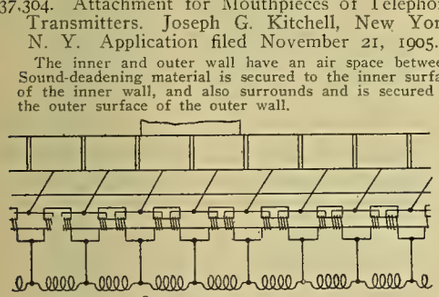
Issued (United States Patent Office) December 4, 1906.

837,296. Electric Welding Apparatus. Weston M. Fulton and John S. Brown, Knoxville, Tenn., assignors to the Fulton Company, Knoxville, Tenn.

A revoluble electrode is adapted to bear against the work and the welding current passes through the electrode to the work. Means are provided for removing the scale from the contact surface of the electrode during its operation.

837,304. Attachment for Mouthpieces of Telephone Transmitters. Joseph G. Kitchell, New York, N. Y. Application filed November 21, 1905.

The inner and outer wall have an air space between. Sound-deadening material is secured to the inner surface of the inner wall, and also surrounds and is secured to the outer surface of the outer wall.



NO. 837,425.—COMMUTATOR.

837,336. Signal. Thomas R. Nicholas, Carthage, Mo. Application filed May 10, 1906.

A detent normally holds a semaphore in safety position. Means are provided for moving the samaphore to danger position, and means, including an electromagnet for positively withdrawing the detent, cause the semaphore to move to danger position. A torpedo carrier is connected to move in unison with the semaphore.

837,349. Pendant or Like Support for Electric Lamps. Hubert C. Smith, Erdington, near Birmingham, England. Application filed May 12, 1906.

A sustaining block is provided with apertures through which looped cords can slide on the application of a pendant-adjustment movement.

837,369. Electropneumatic Brake. Edward A. Wright, Edgewood Park, and Walter V. Turner, Wilkinsburg, Pa., assignors to the Westinghouse Air Brake Company, Pittsburg, Pa. Application filed March 20, 1905.

An electrically operated valve controls the supply of air to the brake cylinder, and a double check-valve is placed between a triple valve and the electric-supply valve and the brake cylinder.

837,396. Electric Controlling System. Urias J. Fry, Milwaukee, Wis., assignor of one-half to George M. Basford, Mount Vernon, N. Y. Application filed April 9, 1906.

Working and cut-out circuits connect a number of substations with a main station, a polarized relay at each substation controlling the working circuit and having its magnet in the cut-out circuit. A pole-changing switch is placed in the cut-out circuit and means are provided for reversing the switch when the cut-out circuit is opened. A switch at each sub-station is arranged to open the cut-out circuit and to disconnect the associated polarized relay therefrom.

837,411. Regulating Device for Electric Meters. Robert C. Lanphier, Springfield, Ill., assignor to the Sangamo Electric Company, Springfield, Ill. Application filed December 13, 1905.

The armature of an alternating-current mercury meter is in series with the translating devices. A shunt-energizing coil is provided for energizing the polepieces and a condenser is placed in series with the energizing coil. A connecting yoke is adjustable toward and away from the polepieces.

837,413. Telegraph Transmitter. Charles W. Leiser, Salt Lake City, Utah. Application filed August 30, 1905.

An oscillating lever carries an armature on one end, and a soft-iron terminal at its other end. A magnet post is provided to contact with the iron terminal to minimize the vibration of the lever.

837,425. Commutator. Stanley S. Seyfert, South Bethlehem, Pa., assignor of one-half to William S. Franklin, South Bethlehem, Pa. Application filed February 20, 1905.

Leads connect the coils of the armature and segments of the commutator and there are oppositely acting inductances in each lead, the inductances of opposite signs in different leads being situated in the same magnetic circuit. (See cut.)

837,440. Receiving Device for Bond Detectors. Harris A. Watson, Sylvania, Ohio. Application filed April 13, 1905.

The device consists of a shell, a diaphragm mounted therein, a polarized magnet also mounted in the shell with the diaphragm on one side thereof and an induction coil located on the opposite side of the magnet from the diaphragm, in axial alinement with the shell and to the exterior thereof. Circuit connection is provided between the secondary coil of the induction coil and the coil of the polarized magnet, and between the primary coil and the line wires. (See cut.)

837,457. Telephone Transmitter. Fred W. Fahrenfeld, Rochester, N. Y., assignor to the Simplex Telephone Equipment Company, Rochester, N. Y. Application filed August 31, 1905.

The casing has an annular side wall, a ring of insulating material is fitted therein having an annular shoulder and a bridge piece supported thereon. A vibratory diaphragm rests on the edges of the walls of the casing, a cap fitting over it and engaging the outer side of the wall. Co-operating electrode plates are placed on the diaphragm and bridge.

837,469. Telephone Receiver. Stephen C. Houghton, Syracuse, N. Y., assignor to the Wire and Telephone Company of America. Application filed February 18, 1905.

The permanent magnet for the receiver is connected to a fixed support. Electromagnets, located back of the receiver diaphragm, have their cores pivotally connected to the permanent magnet.

837,470. Hand Telephone. Stephen C. Houghton and Frank M. Potter, Jr., Syracuse, N. Y., assignors to the Wire and Telephone Company of America. Application filed October 5, 1905.

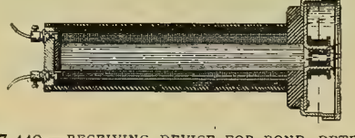
A horseshoe magnet is disposed with its arms extended upward and having a circularly formed heel, and is made long enough to provide a hand-engaging portion between its poles and heel. A telephone receiver contains a pair of electromagnets, the cores of which are attached to the poles of the magnet, and a telephone transmitter is conveniently located with respect to the receiver, having a circularly formed case substantially fitting the circularly formed heel of the magnet.

837,498. Indicating Electric Switch Cover. Charles G. Perkins, Hartford, Conn., assignor to the Perkins Corporation, Hartford, Conn. Application filed January 26, 1906.

Circuit-indicating characters on the outside of the case or shell are covered by a movable shutter having a central opening to expose the characters according to the condition of the circuit inside the case.

837,503. Telephone. Samuel J. Port, Birmingham, England. Application filed August 14, 1905.

A pair of receivers are each provided with an ear-suspension appliance made adjustable upon a tubular stem attached to the receiver. The receivers are connected to each other by means of a U-shaped holder adjustably connected to the stem, such tubular stem forming a passage through which to pass the conducting wires to make connection with the receiver.



NO. 837,440.—RECEIVING DEVICE FOR BOND DETECTORS.

837,512. Electric Hose-signaling Apparatus. William G. Seeley, Brookline, Mass. Application filed November 27, 1905.

A pair of sinuous electrical conductors or line wires are interposed between two of the jackets of a length of hose, and there is a multiplicity of attaching strips, each extending across one or both of the wires and serving to secure the latter in a predetermined position.

837,522. Automatic Apparatus for Controlling and Operating the Points of Electric Railways and Tramways. William H. Turner, Rowland E. Dixon and Thomas B. Stewart, Leeds, England. Application filed July 27, 1906.

The trolley wire is provided with an insulated contact plate and a frog, and the rails are provided with a switch. A solenoid is arranged in circuit with the trolley wire and contact plate. Intermediate operating devices connect the core of the solenoid with the frog and with the switch. A pivoted locking lever normally prevents the core from sliding, and means are provided for moving the lever on its pivot to release the core.

837,534. Telephone Apparatus. Garrison Barcock, Rochester, N. Y., assignor to the Simplex Telephone Equipment Company, Rochester, N. Y. Application filed August 31, 1905.

A switch controlling the telephone circuit is located in the receiver. Arms, projecting at one side of the transmitter comprise a handle by means of which it may be supported when in use, the arms being also adapted to secure the transmitter to the receiver. A switch-operating member is located between the arms and adapted to be operated when the transmitter is inserted between them.

837,567. Secondary-battery Plate. Frank C. Hood, Philadelphia, Pa., assignor to John D. Allen, Philadelphia, Pa. Application filed February 20, 1906.

There is a continuous series of parallel loops of finely corrugated lead tape. Separate strips of more deeply corrugated lead tape are interposed between the arms of each of the loops. Cross bars are located at the top and bottom of the plate, and longitudinal bars connect the cross bars between the ends and are secured to the loops and strips.

837,594. Telephone Mouthpiece Safety Guard. Edward Stempel, San Francisco, Cal. Application filed October 20, 1905.

A perforated disk is held over the mouthpiece by supports which are connected to the transmitter body.

837,616. Wireless-telegraph System. Henry H. C. Dunwoody, Washington, D. C. Application filed March 23, 1906.

The wave responsive device is a concrete mass of crystalline silicide of carbon.

837,634. Electric Switch. George P. McDonnell, St. Louis, Mo., assignor to the American Electric Company, East Orange, N. J. Application filed November 9, 1905.

A rotary disk is provided on one of its side faces with a circular slot. A controlling member consisting of a segmental-shaped block is mounted in the slot and adjustably held in position. A brush co-operates with the block. (See cut.)

837,635. Bell-ringing Circuit. George P. McDonnell, St. Louis, Mo., assignor to the American Electric Company, East Orange, N. J. Application filed November 20, 1905.

A resistance bar containing fuses is placed across a high-voltage main-line circuit and acts to shunt a portion of the current into a bell-ringing circuit.

837,636. Bell-ringing Circuit. George P. McDonnell, St. Louis, Mo., assignor to the American Electric Company, East Orange, N. J. Application filed December 28, 1905.

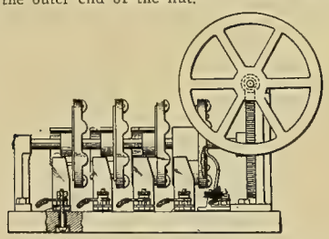
A magnetically controlled element is placed in shunt with the line circuit and controls the resistance of the shunt. An electric-bell circuit is in multiple with the element.

837,638. Lamp Socket. William H. Nichols, Bennington, Vt., assignor of one-half to Elmer Ellsworth Larrabee, Bennington, Vt. Application filed September 23, 1905.

The operating shaft is insulated from and controls the circuit connections. A toothed wheel is on the shaft, an open-linked chain engaging the wheel. A retracting spring is connected directly to one end of the chain.

837,654. Finishing or Guard Ring for Electric Conduits. Albert I. Appleton, Chicago, Ill. Application filed June 26, 1905.

A nut is threaded to have a screw-thread engagement with the end of the conduit. There is a brass ring, one edge of which engages the screw-threads within the central aperture of the nut and the other edge is bent over upon the outer end of the nut.



NO. 837,634.—ELECTRIC SWITCH.

837,670. Electric Signal. Harold W. Eden, Detroit, Mich., assignor to the P. R. Manufacturing Company, Detroit, Mich. Application filed February 5, 1906.

Non-magnetic bearing contacts have cone bearings and are connected to the armature. A spring attached to the armature engages the abutments when the armature has oscillated a predetermined distance.

837,671. Frame for Electric Bells. Harold W. Eden, Detroit, Mich., assignor to the P. R. Manufacturing Company, Detroit, Mich. Application filed February 5, 1906.

A plurality of laminations of insulating material are attached to the magnet-coil-supporting post by means extending through them.

837,672. Electric Bell. Harold W. Eden, Detroit, Mich., assignor to the P. R. Manufacturing Company, Detroit, Mich. Application filed December 26, 1905.

The vibrator is connected in electric circuit with the energizing circuit, and is held in insulated bearings. An armature carrying a bell hammer is connected to the vibrator, the armature being insulated therefrom.

837,673. Electric Signal Bell. Harold W. Eden, Detroit, Mich., assignor to the P. R. Manufacturing Company, Detroit, Mich. Application filed December 26, 1905.

A sounding member is adapted to strike against a bell. A circuit is divided between the resistance and the sounding member, one part of the current being short-circuited through the sounding member.

837,674. Electric Signal. Harold W. Eden, Detroit, Mich., assignor to the P. R. Manufacturing Company, Detroit, Mich. Application filed December 26, 1905.

There is a pair of magneizing coils, a separable connector between the wiring thereof, an armature carrying a means to engage the separable connector and to break the electric connection therebetween.

837,675. Electrically Actuated Signal Bell. Harold W. Eden, Detroit, Mich. Application filed July 18, 1906.

This patent applies to a method of connecting a sheet-metal post to a metal plate to form a part of an electric bell.

837,682. Process of Improving the Magnetic Qualities of Iron-silicon-manganese Alloys. Robert A. Hadfield, Sheffield, England. Application filed August 21, 1906.

The process of increasing the magnetic permeability and electric resistance and reducing the hysteresis action of an iron-silicon-manganese allow low in carbon, which consists in heating the alloy to a temperature above its critical point, and then cooling.

837,693. Ground Connection for Telephone Wires. Charles Lanz, Knoxville, Tenn. Application filed October 10, 1905.

A wire is coiled around a rod. A disk is placed on the rod adjacent to the coil. The apparatus is then galvanized.

837,701. Electric Motor. David Mendelson, Brooklyn, N. Y. Application filed March 24, 1906.

This is evidently a toy. The base stand has two upright standards which have between them at the bottom a stationary armature. An electromagnet is pivoted between the standards, and a circuit-closing switch is operated by the swing of the electromagnet.

837,749. Insulator. Louis Steinberger, New York, N. Y. Application filed December 11, 1905.

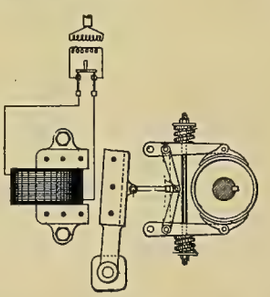
The body portion is of insulating material and is provided with a stem. A metallic member is embedded within the stem and projects therefrom. A clamping plate engages the member thus extending.

837,770. Annunciator Attachment for Mail Boxes. Wayne B. Allen, Columbia, Mo. Application filed October 24, 1905.

A frame is arranged in the bottom of the box, rods supported on each side of the frame, a series of contact fingers being pivotally mounted on each rod and overlying the opposite rod. Counterbalancing weights are adjustably mounted on the rear ends of each rod. The contact fingers and rods are arranged in an electrical circuit and a signal is actuated when the circuit is closed.

837,771. Self-restoring Trolley. James T. Andrew, Montgomery, Ala. Application filed September 7, 1905.

There is a revoluble cone-shaped eccentric cam independent of the trolley wheel and having a smooth peripheral surface inclined toward the trolley wheel and a revoluble cylinder independent of the cam and having a peripheral spiral groove.



NO. 837,853.—ALTERNATING-CURRENT MAGNETIC APPARATUS.

837,836. Trolley Head for Electrical Tramway Systems. Garnet B. Holmes and Arthur D. Allen, Wellington, New Zealand. Application filed March 26, 1906.

A head is secured to the trolley pole and a bracket is pivotally secured to the head in such manner that it tends to fall out of its vertical position. A jaw is swiveled in the bracket, the trolley wheel being journaled in the jaw. A pin is secured in cheeks projecting from the bracket and slots in the head are adapted to receive the pin and spring. Means are provided tending to raise the bracket so that the pin leaves the slots.

837,853. Alternating-current Magnetic Apparatus. David Larson, Yonkers, N. Y. Application filed November 15, 1905.

An armature is arranged to be moved by an alternating-current magnet. A load is connected to and carried by the armature and means are provided for reducing the load from a maximum to a minimum as the armature is moved by the magnet. (See cut.)

837,854. Alternating-current Magnetic Apparatus. David Larson, Yonkers, N. Y. Application filed November 22, 1905.

A winding is energized by an alternating current. There is a movable body of laminated inductive material, a load upon the movable body. Means are provided, dependent upon the current in the winding for magnetically attracting and balancing the body, and means for reducing the load upon the body as the body is moved.

837,857. Railroad Signal. Ernest C. Lombard, Peoria, Ill. Application filed September 22, 1906.

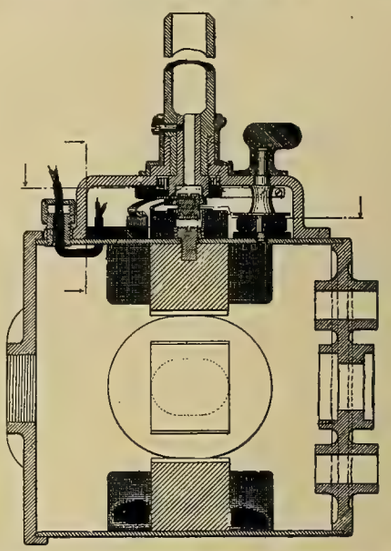
Means are provided adapted to be operated by a train at one point on the track. Similar means are provided adapted to be operated by a train at another point on the track, and means controlled by the co-operation of both of the first-mentioned means are provided for placing and automatically firing a torpedo.

837,889. Means for Commutating Motor and Other Electric Currents. Stanley S. Seyfert, South Bethlehem, Pa., assignor of one-half to William H. Jacobs, South Bethlehem, Pa. Application filed February 6, 1904.

The armature has a multiple winding. A plurality of insulated brushes of the same electric sign are adapted to successfully contact with the same commutator bars, the brushes being spaced apart so that they are always in contact with two commutator bars. Branch leads are provided for the brushes, and a resistance interposed between the branch leads.

837,894. Telephone System. Johan A. Avén, Stockholm, Sweden, assignor to Deutsche Telephonwerke R. Stock & Co. G. M. B. H., Berlin, Germany. Application filed August 22, 1905.

The system includes an order wire connection between the inquiring board and multiple board so that several operators have access to the same trunk lines to equitably distribute the inquiries to the inquiring operators.



NO. 12,571.—PORTABLE ELECTRICALLY OPERATED DRILL.

837,897. Connector for Storage Batteries. Absolam F. Clark, Philadelphia, Pa., assignor to William J. McGonigle, Philadelphia, Pa. Application filed May 12, 1903. Renewed September 11, 1905.

The plates of one pole of a cell are cast to a lead terminal plate. A pin is cast in the plate and extends into a terminal conductor. Both the pin and terminal conductor are incased in a lead structure.

837,901. Wireless Telegraphy. Lee De Forest, New York, N. Y. Application filed February 14, 1906.

The oscillation detector comprising two electrodes separated by a heated gaseous medium, one of the electrodes consisting of mercury.

REISSUE.

12,571. Portable Electrically Operated Drill. Adolph Pedersen, Cleveland, Ohio, assignor to the Van Dorn-Elliott Electric Company, Cleveland, Ohio. Application filed June 25, 1906. Original No. 809,460, dated January 9, 1906.

The inventor describes the combination of an electric motor provided with a suitable casing, a lateral enclosing portion connected to this casing, a drill handle connected to the casing, and a controller for the motor located within the lateral-enclosing portion. (See cut.)

PATENTS THAT HAVE EXPIRED.

Following is a list of the electrical patents (issued by the United States Patent Office) that expired December 10, 1906:

416,712. Electrical Annunciator. F. S. Carter, Burlington, N. J.
416,713. Method of Protecting Ralway Trains. J. I. Conklin, Brooklyn, N. Y.
416,732. Telegraph Transmitter. O. D. LaDow, Mechanicsville, N. Y.
416,746. Coupling Electric Motors. E. W. Rice, Jr., Lynn, Mass.
416,754. Telephone Switch. J. Sack, Dusseldorf, Germany.
416,762. Induction Coil, Transformer, Etc. E. Thomson, Lynn, Mass.
416,808. Testing Apparatus for Multiple Switchboards. C. E. Scribner, Chicago, Ill.
416,809. Test Circuit for Multiple Switchboards. C. E. Scribner, Chicago, Ill.
416,847. Hanging Device for Electric-arc Lamps. J. McLaughlin, Chicago, Ill.
416,862. Electric-light Support. B. Schardt and Wm. Lutzenberger, Dayton, Ohio.
416,873. Cutting Metal by Electricity. B. C. Tilghman, Philadelphia, Pa.
416,971. Electric Door Alarm. E. W. Taylor, Charlottetown, Prince Edward Island, Canada.
417,009. Telephone Transmitter. J. C. Eichmeyer, Utica, N. Y.
417,013. Electrical Pipe or Metal Welding Machine. H. E. Fowler, New Haven, Conn.
417,018. House Telephone Exchange. Wm. M. Goodeidge, Highland Park, Ill.
417,051. Passenger Recorder for Sleeping-car Berths. F. E. Leibnitz, Birmingham, Ala.
417,052. Electric Berth Recorder for Sleeping Cars. F. E. Liebnitz, Birmingham, Ala.
417,055. Secondary Battery. C. H. Logan, Toronto, Ontario, Canada.
417,075. Electric Gas Lighter. N. Newman, Springfield, Ill.
417,088. Method of Preparing Electrodes for Secondary Batteries. J. K. Pumpelly, Chicago, Ill.
417,089. Compound Dynamo-electric Machine. F. B. Rae, Detroit, Mich.
417,095. Electric Conductor. J. J. Saville and J. H. Winspear, Omaha, Neb.
417,120. Drop Switch for Electric Conductors. C. J. Van Depoele, Chicago, Ill.
417,122. System of Supplying Currents to Electric Railway Systems. C. J. Van Depoele, Lynn, Mass.
417,188. Electric Danger-alarm for Railway Block Signals. J. H. Hunter, New York, N. Y.

WESTERN ELECTRICIAN

EVERY SATURDAY

Vol. XXXIX. CHICAGO, DECEMBER 22, 1906 No. 25

Hydro-Electric Power in Mexican Mine Operation.

The Necaxa hydro-electric power station in Mexico supplies current at 60,000 volts pressure to a sub-station in the City of Mexico, a distance of nearly 100 miles. The sub-station is over 200 feet in length and 65 feet wide, and is equipped with 12 step-down transformers, each having a capacity of 1,800 kilowatts. There are two additional transmission lines from the Necaxa power house, passing through the City of Mexico, to the El Oro sub-station, a total distance of over 170 miles. At the El Oro sub-station, which is 115 feet long and 60 feet wide, there are seven step-down transformers which supply current to the El Oro gold mine at a pressure of 3,000 volts.

Current is also transmitted to the Tlapujuhua gold-mining district at a pressure of 6,000 volts. Some of the principal mining companies in this section of Mexico using current from the Necaxa plant are the Dos Estrelas company, the Esperanza company and the El Oro Mining and Railway Company, these mines utilizing from 8,000 to 10,000 kilowatts.

At the El Oro Mine the hoisting outfit at the Somers Shaft, shown in Fig. 1, is operated by a 200-horsepower electric motor, the armature shaft of the motor gearing with two large winding drums. Another large hoisting equipment is that located at the North Shaft, and shown in Fig. 2. It is operated by a variable-speed induction motor, directly coupled to the pinion shaft of the electric hoist and operating at a speed of 194 revolutions a minute. The induction motor driving this hoist has a capacity of 150 horsepower. This hoist was originally operated by steam, an interesting feature being the use of the steam cylinders as a braking system in addition to the mechanical brake provided. The steam cylinders act as compressors, and the speed can be regulated to a nicety by manipulating the air valves, while in case of trouble with the electric hoist, steam can be utilized as formerly without difficulty.

The Incline Shaft hoist at the El Oro Mine is directly coupled to a 400-horsepower motor. A large proportion of the ore is hoisted at this inclined shaft and dumped into hoppers automatically, the ore being fed to motor-driven gyratory crushers, each operated by belt transmission with a 100-horsepower electric motor. Motor-driven jaw crushers are also utilized. Fig. 3 shows the method of conveying the ore from the crushers by belts.

Current from the El Oro sub-station is distributed to various other step-down transformer stations, one of which, shown in Fig. 4, is located at Mill No. 2.

A large motor is used in the El Oro Mine machine shop operating on the three-phase alternating-current circuit at 50 cycles and 400 volts pressure. There is a 12-drill air compressor in operation, driven by a 120-horsepower synchronous motor. The induction motors of 200 horsepower and less are operated on the 400-volt circuit, while the motors of 200 and 400 horsepower, driving the large hoists and main shafting, are of the synchronous type, supplied with current from the 3,000-volt circuit directly.

The El Oro Mining and Railway Company has provided a special distributing sub-station which supplies current to the mine shafts and different mills. Fig. 5 is a view of this sub-station. The main Incline Shaft hoist is operated by a direct-current motor (Fig. 6) of 400 horsepower and is capable of hoisting 600 pounds of ore at a speed of 900 feet per minute. The weight of the rope is about one ton and that of the slip about two tons. A motor-generator set is supplied for providing the necessary current to this electric motor. This motor-generator set has a very heavy flywheel mounted on the countershaft of the direct-current dynamo and alternating-current motor.

The regulation of speed is said to be perfect, the steam cylinders on this hoist as formerly utilized being still in working condition, so that the hoist may be operated by steam power in 30 minutes time if found necessary.

There are seven six-inch slime pumps installed at the El Oro Mine, all of which are motor-driven, and it is stated that the cost of operation by electricity of the slime treatment complete is only 50 cents a ton, while formerly, by steam power, the cost was nearly double this amount. For handling water there are a number of heavy centrifugal pumps utilized, one of which operates against a head of 800 feet and delivers 500 gallons of water per minute. This is a Gould mine pump and is located in the Incline Shaft, driven by a motor of 130 horsepower.

When the ore has left the crusher it is distributed to the ore bins above the stamps of Mill No. 1, after having been carried entire. The ore is also carried by belt conveyors, like the one shown in Fig. 3, to the ore bins of Mill No. 2, the distribution being automatic by means of three belt

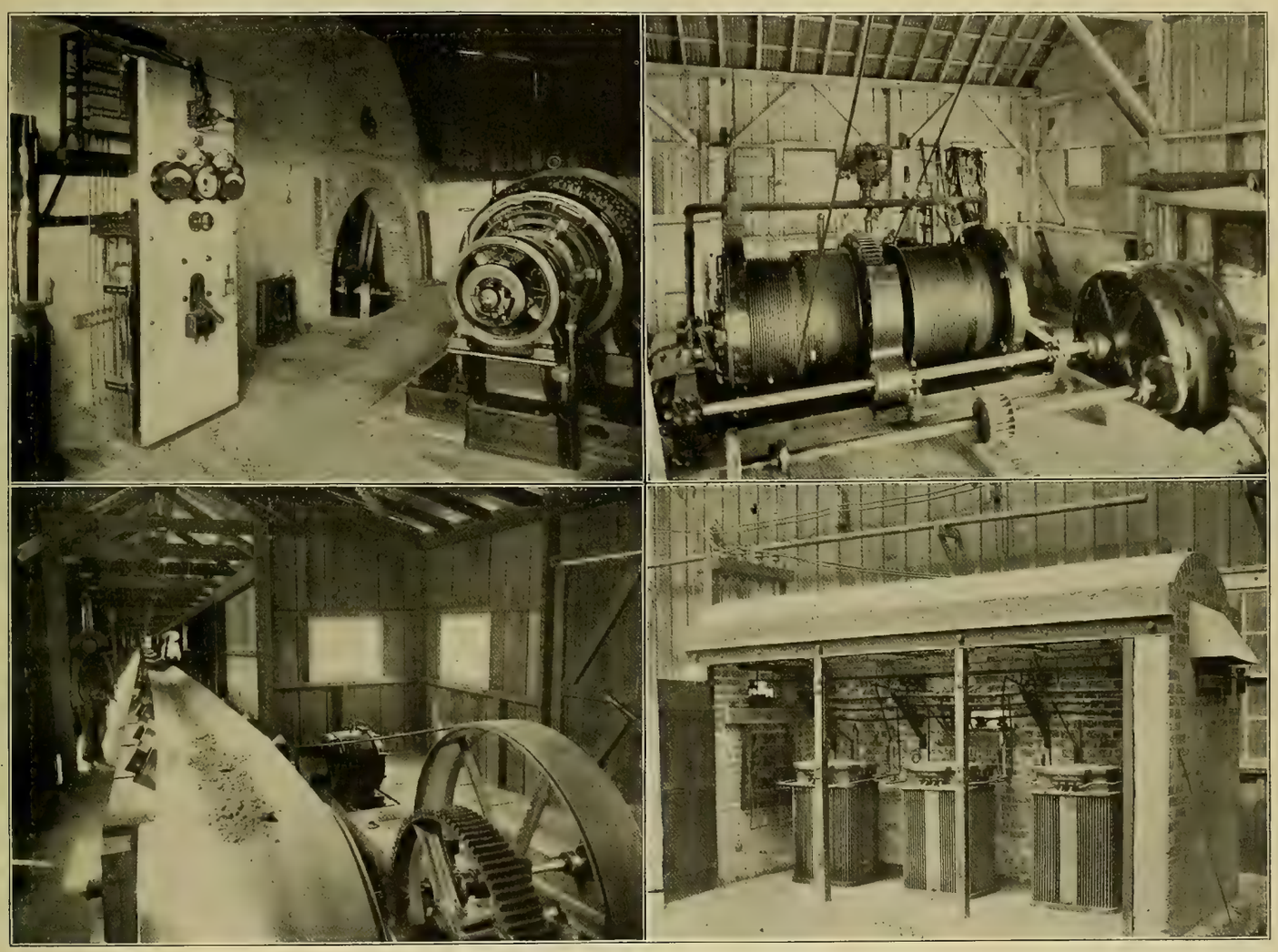


Fig. 1. 200-horsepower Motor-generator Set at Somers Shaft.
Fig. 2. 150-horsepower Motor-driven Hoist at North Shaft.
Fig. 3. Electrically Driven Belt Ore Conveyor at Incline Shaft.
Fig. 4. One of the Transformer Houses.

ELECTRIC POWER EQUIPMENT AT EL ORO MINE IN MEXICO.

conveyors, all motor driven, taking about 12 horsepower each.

Ore is hoisted from the Sanrafiel Shaft by electric hoists, and after being crushed in the same manner as at the other shaft is conducted to Mill No. 2 by the system of electric-driven conveyors, the arrangement being such that the ore may be sent to any mill desired. Rope driving is utilized at the older mill, No. 1, as the main stamp shaft here was formerly operated by a steam engine with rope transmission. It was only found necessary to install a synchronous motor of 350 horsepower capacity, the same system of belt drive being utilized to transmit the power to the cam shafts of the batteries. These are arranged in groups of 10 stamps, and the synchronous motor drives the main shaft by a rope transmission at a speed of 180 revolutions a minute. All of the cam shafts operate at about 50 revolutions a minute, the cams raising the stamps being arranged in pairs and giving about 100 drops to the stamps per minute. The stamps are dropped by the cams twice every revolution, as the latter are placed diametrically opposite in their position on the shaft. There is a lift of half a foot, and the stamps weigh about one-half ton each, with a duty of 4.7 tons of ore in a run of one day and one night.

In order to start the large synchronous motors a small induction motor of the variable-speed type is provided with single-reduction gear, the starting-motor shaft having a pinion held in place by a feather key. As soon as the large motor is up to speed and operating by its own power the small motor can be cut out by means of a hand lift.

The new mill is operated by a 550-horsepower motor running at a speed of about 90 revolutions

FIG. 5. DISTRIBUTING SUB-STATION AT EL ORO MINE.

a minute. This synchronous motor drives three tube mills and 100 stamps. There is also a similar motor provided, operating at the same speed, for supplying power to the cyanide plant. This motor has a capacity of 260 horsepower. The 260 and 550-horsepower motors are shown in Fig. 7, while Fig. 8 is a view in Tube Mill No. 2.

An interesting feature of the power distribution in connection with Mill No. 2 is the fact that the shafts of both of the motors mentioned are extended and have couplings to steam engines which can be started within a few minutes should the power be shut down for any length of time through accident. It is stated that these engines were designed and installed for this service before it was known that electric power would be available. The 550-horsepower steam engine can supply power direct, through the regular transmission, the same as the large motors, but on account of existing conditions in the cyanide plant the 260-horsepower engine can be utilized to drive the synchronous motor as a dynamo which will distribute current to the main distributing switchboard, and thus run the motors in any part of the mill where electric motors must be utilized, as well as in other parts of the mine where steam cannot be employed.

In the cyanide plant there are two solution pumps for handling the cyanide solution and seven pumps for the circulation of the slime, all electrically driven. A number of motors are also employed for driving the agitators, which consist of wooden arms for stirring the cyanide and slime solutions together, three of these agitators being driven by one motor.

A motor is used for running the mechanical excavators, which consist of a series of disks connected to radial arms and held above by a platform moving on rails above the tank. The motor is geared to the vertical shaft, and the mechanical excavators rotate like a disk plow, turning the sand toward a hole in the center of the tank. The sand is caught by the conveyor and is carried to the other tanks. It is distributed in these tanks and is treated by cyanide once more, or carried by the stacker and put on the tailings pile. A steam engine was originally supplied for driving the same belt conveyor, but a 40-horsepower motor has now been installed for doing this work.

For lighting the mines and mills three motor-generator sets, Fig. 9, and a steam-driven unit are employed. The first motor-generator set con-

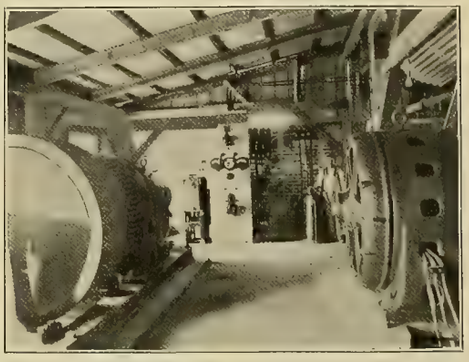


FIG. 6. MOTOR-GENERATOR HOISTING SET AT INCLINE SHAFT.

sists of a compound-wound direct-current machine supplying a continuous current of 125 volts and having a capacity of 150 kilowatts. The dynamo is driven at a speed of 580 revolutions a minute by an alternating-current motor having a capacity of 200 horsepower. There are also two 75-horsepower motor-generator sets operating at 720 revolutions a minute and supplying direct current at 125 volts, the dynamo having an output of 50 kilowatts. A steam-driven unit has been installed of 150 kilowatts capacity, supplying direct current at 125 volts. The generator is driven by an Ideal steam engine, to be utilized in case of emergency, should the power from the Necaxa hydro-electric plant fail for any reason.

It is stated that coal sells for $11 a ton at the El Oro camp, while wood costs about $4 a cord. It will therefore readily be seen that the supplying of hydro-electric current to this mining section is of the utmost importance in the economical operation of the El Oro gold mine.

It may be of interest to note some of the details of construction of the power-transmission plant in Mexico supplying current to the El Oro Mine. The Necaxa power plant of the Mexican Light and Power Company is equipped with six waterwheels of 8,200 horsepower each, constructed at Zurich, Switzerland, by Escher, Wyss & Co., each directly coupled to a 5,000-kilowatt alternator operating at a speed of 300 revolutions a minute.

This hydro-electric station is located in the Necaxa Cañon and has a capacity of about 50,000 horsepower. The water is received from the Necaxa and Tenango rivers, the latter flowing into the former a few miles below the city of Necaxa. These two rivers drain a territory of 227 square miles, and, owing to the extraordinary geological nature of the region, encounter a wonderful succession of waterfalls or precipitous plunges, with

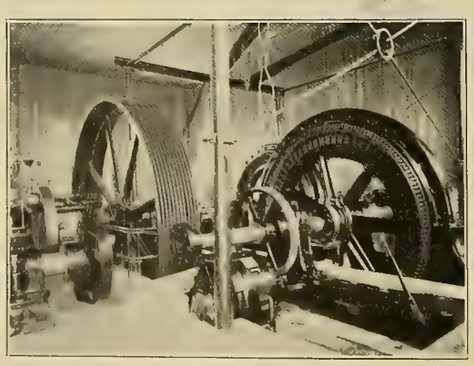


FIG. 7. 260 AND 550-HORSEPOWER SYNCHRONOUS MOTORS IN NEW ENGINE ROOM.

a total fall of 3,000 feet in a distance of about three miles. The joint flow of the Necaxa and Tenango rivers has been dammed, forming a reservoir or artificial lake. There are two waterfalls just below the reservoir, one 750 feet in height, and the other 320 feet high, giving a total fall with the rapids of 1,470 feet within a mile before the water rushes into the first power plant. Just below this plant another hydro-electric station will be constructed, which will have a fall of 1,100 feet, the two plants having a total output of from 75,000 to 80,000 electrical horsepower.

The earth dam required at Necaxa on account of the physical conditions is 600 feet long and 177 feet high, with a base width of nearly 1,000 feet. The area of the artificial lake formed by this dam is about three square miles.

At the south of the dam a tunnel is provided as an outlet for the reservoir having a total length of over 1,500 feet. Two vertical penstocks, eight feet in diameter, are installed in the tunnel, the diameter being reduced to seven feet as it leaves the tunnel. The water is conducted downstream a distance of half a mile, about one-third of the distance being through tunnels.

A receiver has been constructed seven feet in diameter and 22 feet long to receive the water from the penstocks at a head of nearly 200 feet. A pipe is connected with this receiver to each of the six waterwheels, the half dozen pipes connecting the receiver with the power house being somewhat less than half a mile in length. With the reservoir full the static head is over 1,400 feet at the lower end of the 30-inch pipe, the friction loss reducing this to 1,300 feet at the waterwheels.

These impulse waterwheels, of the Escher-Wyss type, are 100 inches in diameter and each wheel is provided with two regulating nozzles 4½ inches square arranged on the opposite side of the wheel, but having a common connection which allows them to be worked together. There is a vertical relief pipe provided one foot eight inches in diameter and about 250 feet high, and a by-pass valve is provided at the end of the pipe line feeding each unit which is mechanically connected

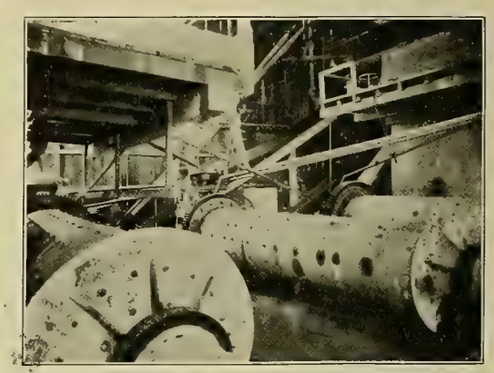


FIG. 8. TUBE MILL NO. 2 AT EL ORO MINE, ELECTRICALLY OPERATED.

to the nozzles. It is stated that these are so mechanically arranged that one opens when the other closes, keeping the flow of the water in the pipe constant and thus avoiding dangerous rams.

A feature of the 8,200-horsepower units is that vertical shafts are employed, 14 inches in diameter, carrying the field of the alternator and the 100-inch waterwheels, the weight being supported by 30-inch thrust bearings under an oil pressure of 150 pounds per square inch.

The alternators were constructed at Berlin by the Siemens-Schuckert Company. They are revolving three-phase machines, having a capacity of 500 kilowatts each at 300 revolutions a minute. The power house is 60 feet high and about 90 by 235 feet in dimensions. The six alternators ultimately to be installed in this building will generate 30,000 kilowatts. The present alternators generate a current having a frequency of 50 periods a second and a pressure of 4,000 volts. The exciting current is supplied from two motor-generator sets.

The high-tension long-distance transmission line is supplied with current at 60,000 volts from five banks of oil transformers. The current is raised in pressure from 4,000 volts as received from the generator by each of the five banks of step-up transformers, each group consisting of three units of 2,000 kilowatts each. The transformers and high-tension switching equipment was installed by the General Electric Company. The electrical equipment at the mines was installed by the Westinghouse company.

For operating mining machinery at El Oro, two transmission circuits are provided, carried on steel towers and mounted on insulators 14 inches in diameter. Two power-transmission circuits are utilized for the City of Mexico, making four circuits in all. The towers are about 500 feet apart, but in some cases double this distance is required,

necessitating special construction. The total length of the transmission line from the Necaxa power plant to the El Oro sub-station, as previously stated, is over 170 miles, the distance from El Oro to Mexico being about 75 miles and from Mexico to the Necaxa station about 95 miles.

It is interesting to note that in this very long transmission line the total loss in the transmission from Necaxa to the El Oro Mine is only about 13 per cent., five per cent. being the loss between the mines and Mexico and eight per cent. between the latter place and the power plant. These losses are, however, at full load and at 60,000 volts with 100 per cent. power pressure. It is maintained that the entire power can be carried over two of the four circuits and still have a loss of only 15 or 16 per cent. The copper cable used is of 168,000 circular mils. Six-strand copper cables are employed, with hemp centers, and having a diameter of one-half inch, the strength of the conductors being 60,000 pounds per square inch, while 40,000 pounds represent the elastic limit. P.

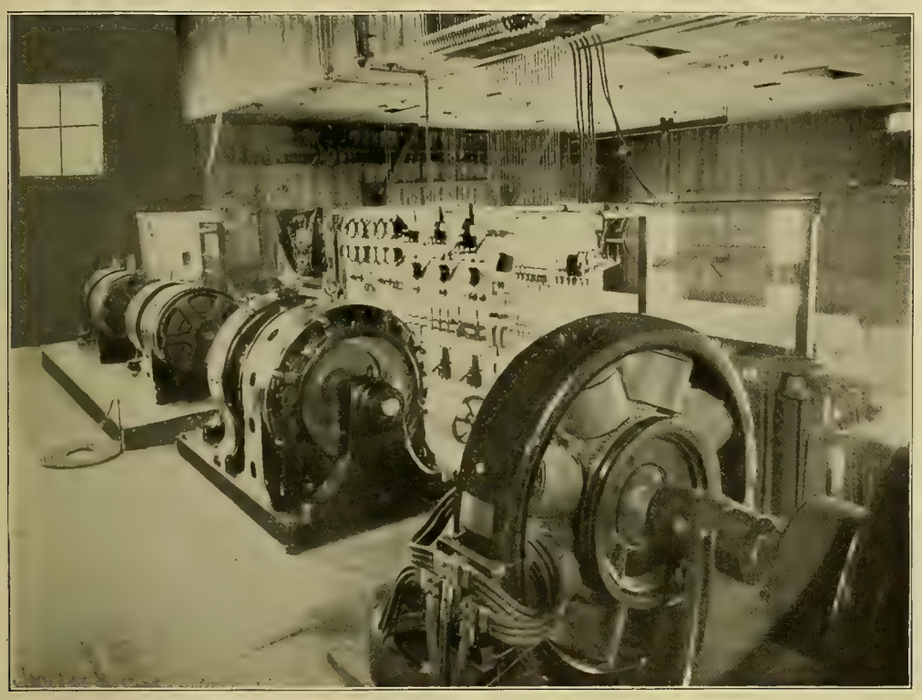


FIG. 9. LIGHTING SETS IN NEW ENGINE ROOM, EL ORO MINE, MEXICO.

Electrical Inspection in Western Cities.

At Toledo, Ohio, an electrical inspection ordinance, modeled in accordance with suggestions from the Underwriters' Electrical Bureau, has been adopted by the City Council. Inside wiring is to be regulated by a supervisor of wires, under the direction of the Board of Public Safety, and outside wiring is to be controlled by the superintendent of fire alarm.

The Oklahoma and Indian Territory Inspection Bureau of the Underwriters' Association will insist upon the appointment of an expert electrical inspector at Muskogee, I. T., to inspect all wiring installed in that city. The main difficulty at the present time lies in the fact that the lighting wires are overloaded.

A meeting of the Business Men's Club, in conjunction with the local fire-insurance men and several members of the Texas Fire Prevention Association, was held at Waco, Texas, recently, to induce the City Council to pass an ordinance to adopt the National Electrical Code. The committee from the Texas Fire Prevention Association was headed by Robert Price of Dallas, and after the conference committees from the Business Men's Association were appointed to go before the City Council with a petition to have such an ordinance passed.

At Louisville, Ky., the National Electrical Code has been adopted by ordinance for inside wiring only.

Discipline over electric wiring has been increased in Joliet, Ill., by the city electrician through the establishment of a system of blanks and the demand for formal applications and permits to do wiring. No work is connected to the lighting system except with permission from the inspector. The standard for wiring is reported as improved. The bulletins issued by the Western Association of Electrical Inspectors, recently organized, are said to have had a perceptible effect upon the character of the wiring. The fire-alarm system has been provided with a new set of storage batteries, and the purchase of an up-to-date switchboard is being urged.

The electrical inspection ordinance at Muncie, Ind., is being rigidly enforced, and the standard for inside wiring is being rapidly brought into conformity with the National Electrical Code. The old unapproved stock of devices and materials has practically disappeared from the shelves of the electrical contractors, and new up-to-date fittings have been substituted. Many old, defective equipments have been overhauled.

Possible Transfer of Chicago Edison Properties to Subway Interests.

Samuel Insull, president of the Chicago Edison Company, is quoted in the Chicago Record-Herald of December 13th as saying that no formal proposition for the purchase of the Chicago Edison property has yet been made. "We are expecting one, however," said President Insull. "I do not know when formal negotiations will be opened, although I would be very much surprised if anything along that line was done until after the holidays, at least."

This statement was brought out in answer to inquiries concerning the following New York dispatch, dated December 12th:

"It can be authoritatively stated that the deal by which the Chicago Subway interests acquire the Chicago Edison property has been finally closed. The idea of a guaranty and option has been abandoned, and a new company, with probably a nominal capital, will issue its 4½ per cent. collateral trust bonds for Chicago Edison stock at $200 for $100. The Chicago Edison shares will support the bonds. The new company's stock will be held by Chicago Subway.

"In addition the Chicago Subway interests will agree to spend $5,000,000 on the Chicago Edison property within a year, and $15,000,000 within four years. This expenditure is the inducement to Chicago Edison stockholders, as it places their shares ahead of the securities which must be floated to get the funds, whereas if they attempted the development of the property themselves they would have to raise the money on securities which would take priority over their shares."

Proposed Montreal-New York Waterway and Power Scheme.

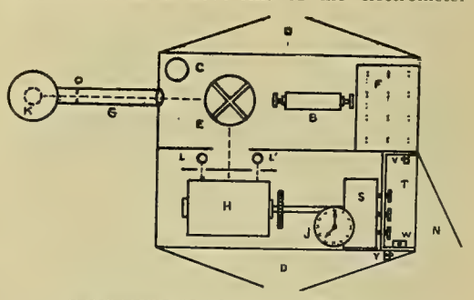
A Canadian correspondent of the Western Electrician writes: "Important developments are expected soon in connection with the project for the production of electrical energy by the Lake Champlain and St. Lawrence Ship Canal Company. This company has been incorporated by Dominion Parliament with an authorized capital of $8,000,000. It aims at the establishment of a waterway to give direct connection between Montreal and New York. The power scheme, however, is an interesting feature. The idea is to set up a large electric plant near Montreal, at Longueuil, where there is a fall on the little Montreal River of 72 feet in a longitudinal distance of 1,500 feet. In connection with the Ship Canal Company is an American organization, the International Development Company, incorporated under the laws of New Jersey, and this concern will take control of operations and will undertake the working out of the entire scheme. It is estimated that 100,000 horsepower can be developed."

Portable Quadrant Electrometer with Photographic Registering Device.

Messrs. Elster and Geitel, the German physicists, have lately brought out a simple and effective apparatus in the shape of a registering electrometer, which can be used to take curves of variations in potential wherever required. It is of special use in recording the electric disturbances in the atmosphere and keeping a regular set of curves of the same. By employing the photographic method, they succeed in forming the curves without any trouble. The apparatus is portable and easy to handle.

For the measuring instrument a special form of quadrant electrometer of their own design is used. It is insulated throughout with amber. To obtain the difference of potential, such as is needed in atmospheric work, a method of connecting the electrometer is employed which avoids the use of a large number of battery cells for charging the needle. The needle of the electrometer is connected with the body whose potential is to be measured, and the quadrants are connected to a dry battery consisting of from two to a dozen cells. The middle part of the battery connection is grounded in this case. By this method a more sensitive arrangement is obtained.

As will be noticed in the diagram, the apparatus is mounted in compact form in a cubical box measuring not over two feet in the largest dimension. The box is mounted on screw legs and divided into three compartments by partitions. In the first part is placed the quadrant electrometer (E), a set of dry-battery cells (F) and a water level (B). The base of the electrometer is movable and slides in a groove, so that it can be shifted or taken off entirely from the case. In the second compartment is mounted the photographic registering device, which operates by means of a spot of light reflected from the mirror of the electrometer. Sensitive paper is rolled upon the drum (H), which is worked by means of the clockwork device (J) (S). The drum makes one revolution in 24 hours. Light is sent into the eletrometer from the incandescent lamp placed in the side tube at (K), and the beam is cut down by the slot (O) and concentrated by the lens at the end of the tube. At one side of the box is a third compartment which contains the keys (T) for adjusting the movement of the clockwork, and the drum can be made to rotate from 24 hours down to two hours, as desired. Thus the variable movement of the electrometer



REGISTERING ELECTROMETER APPARATUS.

is recorded on the photographic paper in a curve which is longer or shorter for a given time.

A small battery (W) in the third compartment is used to light up the incandescent lamps (L) (L'), which lie in front of the drum. This is done automatically at one-hour intervals or less, so that a number of check points are recorded upon the drum alongside the curve. A screen placed in front of the lamps serves to shield the drum and form the points of light. A set of switches connected with the battery at (V) allows of varying the number of cells connected with the electrometer quadrants, thus varying the sensitiveness of the instrument. Most of the regulation can thus be carried out from this point by opening the cover (N) without letting in the light to the rest of the apparatus. At (C) is mounted an Exner electroscope, which is standardized along with the electrometer (E). It is of the gold-leaf type and contains a sodium dryer, being insulated with amber. The gold leaves are always in connection with the electrometer, so that a glance at the electroscope shows at once whether the potential of the needle is in the region of the desired sensitiveness. Fixed in the top of the case is a chronometer, which can be read from the outside, and it is in synchronism with the main clockwork of the drum. The apparatus is of value for taking the curves of potential in atmospheric disturbances, such as storms, snow, hail or the aurora borealis.

The Electrical Plant of the Ontario Power Company.[1]

By V. G. Converse.

Briefly outlined, this company's development comprises the taking of water from the upper Niagara River, leading it through pipes and penstocks to turbines in a station below the falls and there utilizing its energy for the generation of electricity which is transmitted to a second station on the bluff above and thence distributed.

Starting at the headworks, the water is diverted under curtain walls into two forebays in series, which are so proportioned as to provide the proper velocity through screens and gates, and so constructed as to exclude ice. From the inner or second forebay the water is conveyed in large conduits underneath the ground, along the outskirts of Queen Victoria Park, for a distance of approximately 1¼ miles, to a point adjacent to the Horseshoe Falls.

At the terminus of the 18-foot conduit now completed, nine-foot steel penstocks equipped with gate valves extend, first vertically and then horizontally, each to a turbine unit in the generating station. This building (shown in Fig. 1) is nearly on a level with the river below the falls, and is as close to the cataract as conditions allow. It is to be noted that the full head of the water between the upper and lower rivers has been acquired so far as was feasible from an economic standpoint.

Each generating unit consists of a horizontal double turbine direct-connected to a generator. (See Fig. 2.) The units are alike in appearance, but the fourth, or last, generator installed, possesses an advantage over the others in 20 per cent. increase of capacity. The completion of the station and its equipment will be but an extension of the present form until, according to existing plans, there is an installation under the one roof sufficient for the continuous delivery of 200,000 horsepower of electrical energy.

From the generating station the electric current is carried by underground cables to the distributing station on the bluff, 260 feet above and 600 feet back from the generating station. In the distributing station are the switching and transforming apparatus and the metering and controlling devices for the operation of the plant. From the distributing station go the overhead circuits of various voltages for the transmission of the power to the consumer.

The hydraulic portion of the plant and a part of the generating equipment having been in service for nearly a year, it is befitting to remark that in general the plan of the headworks to exclude ice, the operation of the first main conduit with its spillway, the location and action of gates, valves and reliefs for the water, together with the results obtained from turbines and generators, have proven most satisfactory. That all of these features have been put into use without a single

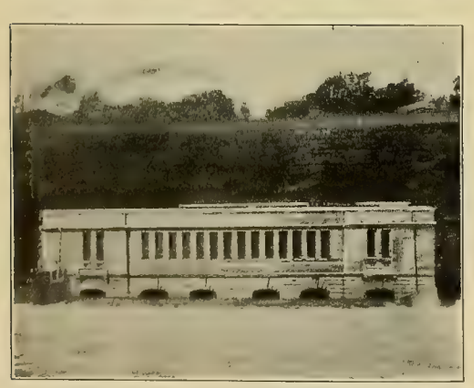


FIG. 1. GENERATING STATION.

difficulty, and have perfectly performed their various functions, is but the logical outcome of the careful study, painstaking attention to detail, and thorough execution of this portion of the work.

The coming month will witness the putting into service of the transformers, switches and other high voltage equipment of the distributing station, and the delivery of power to the enormous transmission system of the distributing company for use throughout Western New York, and somewhat later will come the electrification of the circuits now building for the delivery of power to the Niagara district of Canada.

Much has been said of the disfigurement of the park by the power-plant construction, and this with considerable justice, but to one who now sees the construction nearing completion, and notes the new channels and islands at the Dufferin Inlet, the provisions for the observation of the rapids and falls, the harmonious character of the buildings, and the general air of fitness and refinement, it cannot but appear that the retention of Niagara's beauty has been in mind as well as its exploitation for power. At present the only exceptions are the entrance and overflow buildings at the terminus of the main conduit. Their erection, which of necessity has been delayed to the last, is in progress, and very pleasing buildings will shortly hide the present unsightly constructions.

It is the essential purpose of this paper to describe the electrical features of the Ontario Power Company's plant. Three generators of 10,000-horsepower capacity each, and a fourth of 12,000 horsepower, are now in service. These machines are wound for three-phase current at 12,000 volts, and 25 cycles, and have revolving fields, the speed of rotation being 187.5 revolutions per minute. The total weight of a generator is 231 tons. Assembly, including the building up of the laminated iron of the rotor, and the winding and insulating of the armature, has been done entirely upon the ground. Two exciters have been provided, each of 500-horsepower capacity at 250 volts, and driven by their own turbines. A single exciter is of sufficient capacity for the fields of six generators.

FIG. 2. INTERIOR OF GENERATING STATION OF ONTARIO POWER COMPANY, NIAGARA FALLS.

The leads from the generators are single conductors, insulated with treated cambric. These leads, each in a separate compartment, are mounted on porcelain insulators, ample clearances to ground being allowed on all sides. The compartments are built up of thin shelves of reinforced concrete, secured to the concrete substructure of the building, and are closed by doors of asbestos which may be readily removed for inspection. At no place are the leads of more than three generators brought into proximity, and the leads of each set of three generators where they approach their respective oil switches on the gallery in the generating station are so protected and isolated from each other that grounds or short circuits would seem to be impossible.

The electrical equipment of the generating station, aside from the machines, consists of a switchboard, having a panel for each generator upon which are mounted an electrically controlled field circuit breaker, an ammeter and a control switch for tripping the first generator oil switch; also a panel for each exciter, containing the customary switches, and a voltmeter and ammeter. Secondary to this board is another panel board for the distribution of alternating and direct current for the light and power service in the station, and also for the distant control of the valves in each turbine penstock. Back of the exciter switchboard are small panels, one for each pair of generators, on which are mounted the terminals of the control wires and the relays for the automatic operation of the oil switches. There are also the generator oil switches, field rheostats and small motors on the turbine governors, all of which are controlled from the distributing station.

The outgoing generator leads from the oil switches go to cable heads supported and isolated in a substantial manner, directly under the floor supporting the switches. Here change is made to three-conductor cables, two being required for each generator. They are paper insulated and lead covered, having outside of the lead a spiraled steel-ribbon armor imbedded in and covered with jute.

The necessity for the location underground of the three-conductor generator cables and the various low-voltage control circuits leading to the distributing station presented new problems which were met in the following manner: A tunnel approximately nine feet square with arched roof was cut through the rock. This tunnel starts on a level with the main floor of the generating station, extends through the rear wall and rises at an angle of 30 degrees until it has passed under the main water conduits. For this portion of the distance it accommodates the two 30-inch penstocks for the exciter turbines. After passing under the main conduits it rises at an angle of 60 degrees and opens into a manhole halfway up the bluff to the distributing station. The difficulties were to support the three-conductor power cables and yet to isolate them and to provide for their easy drawing both in and out of the ducts. A generator cable weighs 13 pounds per foot, and for the length of the tunnel exerts a downward force of over a ton.

After leaving the manhole at the terminus of the cable tunnel, the cables are carried in three groups of tile ducts buried in the ground, the two outside ones being for power cables, and the inner one for control cables. From the duct courses the cables are taken into a distributing manhole at the front of the distributing station.

From the distributing manhole any generator cable may be drawn through a manhole and duct system along the front wall of the distributing station, and connected to any unit in the station.

The distributing station arrangement cannot but be regarded as both novel and unique, and a few of the considerations which have led to its design, may be of interest. In the first place it was impossible to comprehend all of the conditions which might arise in the distribution and utilization of 200,000 horsepower. Unlike the generating station with its similar units, the distributing station would undoubtedly be required to provide for the delivery of power both at generator voltage for use in the immediate vicinity, and also at voltages higher than that of the generator for long-distance transmissions. The delivery of power at generator voltage, however, would require but a comparatively small amount of space for the necessary busses, switches and lightning arresters, while the delivery of power at higher voltages would require, besides switches and busses for the generator voltage, a considerable amount of space for transformers and high-voltage equipment. In fact, the required ground space for a high-voltage unit is over ten times that for a unit of the same capacity at generator voltage.

It was thus evidently impracticable to commence the construction of this building at one end, as was possible with the generating station, since the combination of low and high-voltage unit spaces as they might be required would probably lead to either a very irregular building, or else one with considerable waste space. The assumption was therefore made that the output of six generators was the maximum amount that would be required for delivery at generator voltage. This capacity required such a length of bus for switch connections as might very properly be devoted in the length of the building to the switchboard and control equipment. Likewise the width of building required for the switchboard equipment in addition to that required for the low-voltage units corresponded very closely to the width required for high-voltage units. Consequently the switchboard section is located in the center of the building with switches and busses of low-voltage units in front of it, and their lightning arrester and selective switch equipment in the rear, the outgoing low-voltage feeders passing underground beneath the switchboard section. The low-voltage switches and busses of the high-voltage units occupy the same position relative to their respective transformer sections as do those of the low-voltage units

1. Condensation of a paper presented to the Canadian Electrical Association at Niagara Falls, June 19, 1906. Mr. Converse is electrical engineer of the Ontario Power Company. This may be considered as supplementing several articles of a general character on the subject which have appeared in the Western Electrician, the latest one being the paper of Mr. P. N. Nunn, engineer of the company, read before the Asheville, N. C., meeting of the American Institute of Electrical Engineers, on June 22, 1905, and printed in the Western Electrician on July 1, 1905.

to the switchboard section. This arrangement allows a continuous low-voltage bus and switch room, also a continuous high-voltage bus and switch room, and subdivides only the high-voltage transformer equipment, which division possesses some considerable advantage.

The distributing station is then the locus of the control and distribution of all power from the generating station. With its present dimensions it will accommodate besides the switchboard and control apparatus for the complete development, the equipment for handling the output of 14 generators, provided that six deliver power directly to the transmission lines. The extensions to the building will be on each end and entirely for high-voltage units.

That arrangement of the power circuits which would be best adapted to the character and future requirements of the plant was open to equally as much doubt as was the design of the building itself. The arrangement which has been adopted is shown in the accompanying diagram of power circuits, Fig. 3. It is believed that it possesses a flexibility sufficient to meet any requirement that may arise.

It will be noted that there are two busses for low voltage and one for high voltage. All have links or tie switches to break their continuity on each side of their junction with a unit. Generators may be paralleled on either of the low-voltage busses, and when so operated may supply the high-voltage bus through the transformers. When operation in this manner has been effected the generators may be disconnected from the low-voltage busses. The cross-connection of generators to either low-voltage feeders or transformer units, is also possible with the arrangement adopted. By opening either the tie switches in the bus-bars or the selector switches connecting to them, the station may be operated as a number of individual power plants.

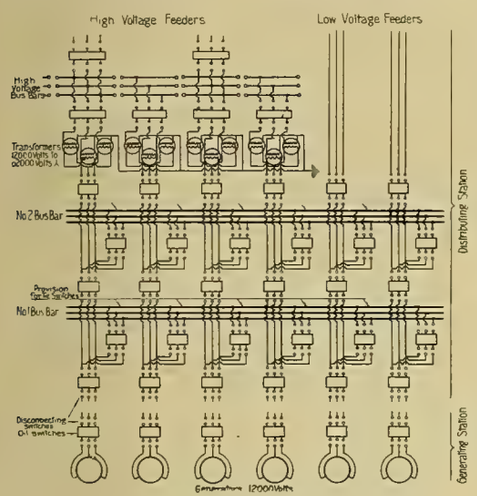


FIG. 3. DIAGRAM OF POWER CIRCUITS IN GENERATING PLANT OF ONTARIO POWER COMPANY.

The generator circuits entering the low-voltage bus room and the feeder circuits leaving it are single-conductor cables, the change having been made from three-conductor cables, in a manhole for each unit without the station wall.

The strap copper busses are mounted in a horizontal position on the outer sides of two concrete division walls extending from the floor to the ceiling of the room. They are supported in and isolated by a structure quite similar to that described for the generator leads in the generating station. All connections to and from the busses pass through porcelain bushings into the space between the two main division walls, and thence extend vertically to the switches in the room above. They also are separated by concrete barriers, there being no two cables in any one compartment. Potential transformers for use with instruments are placed within the same central space, and are isolated with barriers of alberene stone, the front of their compartments being closed by asbestos doors.

The use of concrete for the almost entire construction of a bus structure is somewhat of an innovation, and the success obtained with it assures the continuation of its use. It is not only strong, easily erected and economical of space, but furnishes one of the best fire-resisting mediums, and is comparatively inexpensive.

In the low-voltage switch room the oil switches are arranged in two parallel rows and separated into their unit groups. They are of the plunger type, actuated by direct-current magnets. Knife switches in both incoming and outgoing leads permit of their complete and assured disconnection from all circuits for necessary manipulation or adjustment.

In the transformer rooms (Fig. 4), only one of which is at present completed, are located both the transformers and the oil-insulated choke coils for their protection. The three transformers of a unit are of the oil-insulated, water-cooled type, connected in delta on the low-voltage and in star, with center grounded, on the high-voltage side. The secondary potential of each transformer is 36,000 volts, and as connected the resultant line voltage is approximately 62,000. Each transformer has a normal capacity of 3,000 kilovolt-amperes, and weighs, complete with oil and case, approximately 50 tons.

A traveling crane spans the room, and will handle any choke coil or transformer without interference with the operation of other units.

In the high-voltage room the switches and series transformers are on the floor and the bus-bars overhead. The latter are composed of copper pipe wrapped with treated cambric and asbestos braid, and are supported mainly by their tie switches, which are mounted on the tops of high masonry walls which separate the units.

The construction and action of the high-voltage switch is like that of the low-voltage one, but it is considerably larger because of the longer break and greater insulating distances required for the higher voltage. The oil is contained in large steel tanks, approximately 500 gallons being required for a switch. Oil piping for the switches and control wiring for their actuation are carried underneath the floor.

Horn gap lightning arresters of generous proportions and with graded gaps and resistances are located at the rear of the station for the protection of high-voltage feeders.

Low-voltage circuits are at present carried on wood poles, the details of the construction embracing no particularly new features.

The high-voltage circuits are in duplicate, and are carried on steel towers placed usually along a private right-of-way. The towers have a triangular base, tubular legs, and carry but the three wires of a circuit. A clearance of 30 feet is everywhere preserved between circuits. The construction is made especially strong with concrete anchorages, and by the liberal use of guys at angles and crossings. The insulators are massive, weighing 40 pounds, and are mounted on steel pins. The transmission cables are of aluminum 1⅛ inches in diameter, secured by ties or clamps as conditions require, and protected at the insulators against arcs by a serving of aluminum wire.

The control room (Fig. 5) is located on the top floor of the switchboard section, at the most advantageous position for the observation of the apparatus in the distributing station. Control pedestals, corresponding in number to generator units, containing operating switches and pilot lamps, with indicating instrument stands directly back of them, are arranged in an approximate semi-circle around the room. The line is broken only at the center to permit of the feeder-control panels, located at the back of the room, being visible to the operator. The semi-circular arrangement allows ample clearance between units for their distinguishment, and also enables the operator to see every instrument from any position within the control area.

Each instrument stand has mounted upon it a voltmeter, ammeter, wattmeter, power-factor indicator, frequency indicator and synchroscope; also three ammeters connected in the leads to the transformers.

A control pedestal contains, besides the small switches for the control of oil circuit-breakers, push buttons for opening and closing the generator field switch, a controller for the rheostat face plate and a controller for varying the speed of the turbine through the medium of the governor. A diagram of circuits on the face of each pedestal, in which are placed pilot lamps from oil switches, enables the operator to comprehend at a glance his circuit connections.

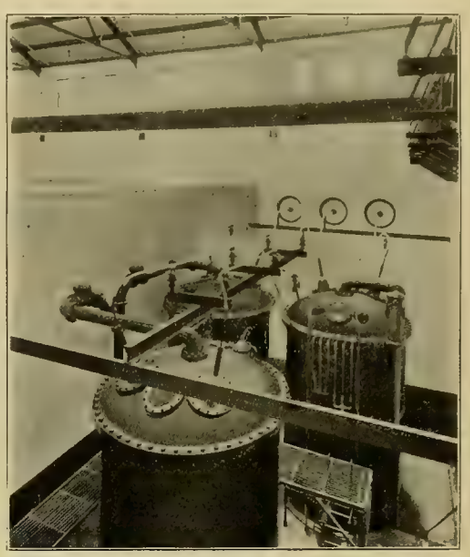


FIG. 4. VIEW IN TRANSFORMER ROOM OF ONTARIO POWER COMPANY.

Opposite the semi-circle of generator and feeder controls are two service boards, one on each side of the entrance to the room. One of the boards contains the switches and instruments required for the distribution of alternating current at 220 volts for light and power purposes in the building; also the control for the oil circuit-breakers located in the low-voltage service bus. The other board contains the switches and instruments requisite for the distribution of 250-volt direct current (derived at present from one of the exciters) for lighting and control purposes. There is also a panel on this board for the control of a storage battery which serves as a relay for the 250-volt exciter control current.

On the three floors beneath the control room, arranged in the same semi-circular manner, there are in order the recording-instrument boards, terminal and relay panels (Fig. 6), and assembly racks for control and instrument wires. The room containing the latter is in the basement, and besides accommodating the wires, contains a cell for a 240-ampere-hour storage battery, and also serves as a distributing point for all oil, water and steam piping.

The graphic recording instruments are of a new type and comprise voltmeters, ammeters, wattmeters and frequency and power-factor indicators. They are so connected in the low-voltage circuits that there is a continuous record of each generator as well as of the demands of any set of feeders.

[*Continued on page 502.*]

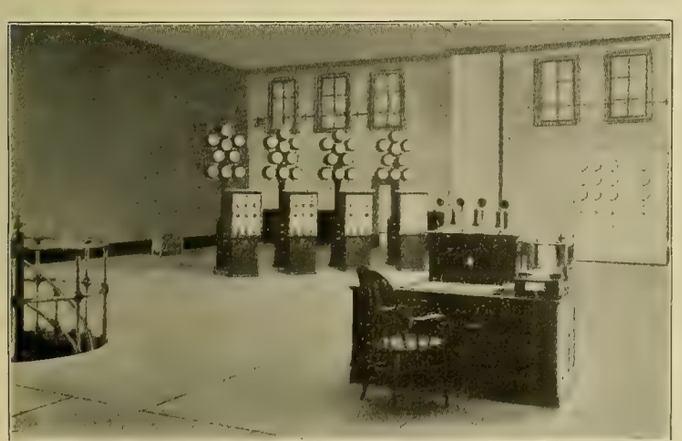


Fig. 5. Control Room.

Fig. 6. Terminal, Relay and Recording Instrument Boards.

ELECTRICAL POWER STATION EQUIPMENT OF THE ONTARIO POWER COMPANY.

WESTERN ELECTRICIAN

EVERY SATURDAY.

PUBLICATION OFFICES:

507 Marquette Building, - CHICAGO.

TELEPHONE, MAIN 1746.

Eastern Office, 150 Nassau Street, New York.

Telephone, 5220 Beekman.

Trade Supplied by Western News Co.

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DATES AHEAD.

Chicago Electrical Show (second annual exhibition), Coliseum, Chicago, January 14 to 26, 1907.

Northwestern Electrical Association (annual meeting), Coliseum, Chicago, January 16th, 17th and 18th.

Central Electric Railway Association (annual meeting), Indianapolis, January 17th.

WATTMETERS play such an important part in the electrical economy that all persons engaged in electric-light and power work should be familiar with the workings of the various types of these useful instruments. Hence the paper on "Meters," by Mr. Robert C. Lanphier, now running in the Western Electrician, is one of much practical value and ever-timely interest. Mr. Lanphier takes up the various types of meters and describes them in a judicial spirit, and he has prepared a paper which is really a valuable contribution to technical literature. In presenting it the Western Electrician has, with the permission of the author, illustrated several of the instruments to which reference is made, with the idea of adding to the attractiveness of the article. The paper is published in three installments, and the concluding portion will appear next week.

ONE OF THE MOST INTERESTING of the hydro-electric plants of the country is that of the Ontario Power Company at Niagara Falls. Several descriptive references to this installation have already appeared in the Western Electrician, but no apology is necessary for the publication of another article on this subject in this issue, inasmuch as the plant is a large one with many features of unusual interest which could hardly be exhausted in a number of articles. The present description is from the pen of Mr. V. G. Converse, electrical engineer of the company, who confines himself to the electrical part of the plant. The paper of which this article is an abstract was originally prepared for the Canadian Electrical Association, and it has been republished in pamphlet form by the company. It gives an excellent idea of the manner in which the conditions at Niagara Falls were met in this particular high-class example of modern power development.

PUBLIC OWNERSHIP has formed the subject of an important investigation carried on both in this country and in Europe by a committee of the National Civic Federation. It is now reported that this committee, which includes representatives of organized labor, public-service companies and the general business interests, has come to the unanimous conclusion that public ownership is to be opposed on the ground that it is unscientific, wasteful and morally undesirable. The committee is now at work on its report, which, it is said, will be made public some time next month. It is understood that even the representatives of the trades unions on the committee, who two years ago were enthusiastic advocates of the public-ownership idea, are now resolutely opposed to it.

If this report is true, it will be good news for the advocates of private ownership, for if the labor-union people are opposed to the idea there can be little hope of the adoption of the plan in American cities or American communities. The work of the committee has been very exhaustive and thorough, and the report presented will naturally carry great weight. It may well be hoped that the forecast of the nature of the report to which reference is made prove to be a correct one, for if it is a powerful influence will be thrown in the scale in the determination of this important question in the best interests both of the public and the companies which carry on the utilities that are affected.

DESPITE a great deal of talk, municipal ownership, to any great extent, is apparently a long way off as yet in Chicago. Nevertheless, the commission which is preparing a new charter for the city considers that the possibility of owning public utilities is a valuable asset for the municipality to possess. At a recent meeting of this body the provisions of the Mueller law for municipal ownership and operation were extended to all public utilities with but little opposition. Among the utilities mentioned are "all intermural railways, subways, telephone, telegraph, gas, electric lighting and power plants." Docks also are listed. Besides these, the provision specifically applies to all other "local public-utility works operated in, over, under or upon the streets and public places of the city."

Of course, this charter has not been adopted, but it is very likely that this provision will be. The sentiment appears to be that municipal ownership is not necessarily, or perhaps even probably, to be adopted, but that the city should retain this formidable weapon in its possession, so that if the quasi-public service is badly administered by a private corporation a remedy is at hand. Thoughtful students of the situation, however strenuously they contend that private operation of industrial enterprises is best, concede that the municipality granting the franchises does possess this ultimate right. In this situation it behooves the private corporations affected so to conduct the enterprises in which they are engaged that the general public and its representatives in city governments shall recognize, in fairness, that private ownership, under suitable municipal regulation, is the best for all concerned.

DR. STEINMETZ has made another notable contribution to the literature relating to the fundamental principles which underlie the art of artificial illumination. This is his address on "Light and Illumination" delivered before the Illuminating Engineering Society last week, an abstract of which appears elsewhere in this issue. The author shows that the apparent efficiency of a light-giving body depends on the number of vibrations which can be set up by that body that happen to come within the range of vision. The difficult point for the engineer is that light is a physiological manifestation and cannot be measured as a physical manifestation. It is measured by comparison, and when lights of different colors are considered it is impossible to place their values exactly as is the case with physical measurements of other forms of energy. But what is needed is illumination, not light. As the effect of light in a room depends on how much is admitted through the pupil of the eye, and as the pupil of the eye contracts to protect that organ against an undue amount of light, it follows that if the light is in the direct range of vision less of it is admitted to the eye, and, therefore, the value of the illumination is less. Again, some forms or colors of light possess more "intense" vibrations and more heat vibrations than others, and the physiological effect is less because the eye guards itself against these vibrations and less light is admitted. Thus the question of color and kind of light is of great importance, and should be carefully studied for different classes of illumination.

These are merely approximations of some of the scholarly author's ideas and are here given to indicate roughly the value of this paper and to direct the attention of the reader to it.

STREET-RAILWAY prospects in Chicago are much brighter. There seems to be a decided tendency on the part of the representatives of both the city government and the operating companies to agree on a workable compromise by which the street-railway service of the city may be rehabilitated. At this writing ordinances are being drafted by which the companies will be granted licenses to operate the lines, provided the service is placed in first-class condition. By this arrangement the city will receive a certain percentage of the net profits, perhaps 55 per cent. Thus the city and the companies will enter into a virtual partnership, the former giving the use of the streets and the latter operating the systems.

It will be observed that this is not municipal ownership, although it is true that in the franchises which will probably be adopted provision will be made for the sale of the properties to the city on six months' notice. But it is likely that if the plan proves to be as satisfactory as is hoped the actual purchase of the properties will not take place for many years, and perhaps will never be consummated. This is the more likely to be the case, as the city would perhaps have trouble in financing the proposition, inasmuch as the valuation of the properties of the two companies is now placed at $50,000,000, and perhaps $40,000,000 or $50,000,000 more will be added by the betterments —amounting to practically rebuilding the systems— which are contemplated.

Mayor Dunne shows some disposition to insist that the proposed ordinances be submitted to a referendum vote at the coming spring election. Were it not for this possibility of delay, it is likely that the arrangement now practically agreed upon would be executed at or very soon after January 1st. In any event, the situation has taken a most hopeful turn, and it is reasonably certain that the tiresome and discreditable wrangling in the traction situation is all but a thing of the past.

Light and Illumination.[1]

By Charles Proteus Steinmetz.

Light is not a physical quantity, but is a physiological effect exerted on the human eye by certain radiations. There are different forms of energy convertible into each other, as magnetic energy, electric energy, heat energy, mechanical momentum, radiating energy, etc.

Now, radiating energy is derived from other forms of energy, for instance, from heat energy. By raising a body to a high temperature we find that this heat energy is converted into radiation which issues from the heated body. In an incandescent-lamp filament we get a mass of radiations of different wave lengths, i. e., different frequencies.

The frequencies of radiating energy, somewhat less than one octave, can be perceived by the human eye as light. Light, therefore, is the physiological effect exerted upon the human eye by a certain narrow range of frequencies of radiation. Frequencies lower than those visible to the eye, and frequencies higher than those visible to the eye, are again invisible. We frequently speak of those frequencies lower than the visible ones as radiating heat, and of those frequencies higher than the visible ones as chemical rays. We must, however, understand that there is no distinction between them. There are no heat rays differing from light rays or chemical rays. Any form of energy when destroyed must give rise to an exactly equivalent amount of some other form of energy; however, if we destroy radiating energy, by intercepting the beam of radiation, interposing an opaque body in its path, then that energy of radiation is converted into some other form of energy, usually into heat.

If we consider the infinite range of radiation issuing from heated bodies, we find those rays which are of lower frequency than the visible rays will be felt as heat, because they contain a very large amount of energy. The rays which are visible represent very little energy—it just happens so—and therefore they do not contain as much heat. There is no essential difference between heat waves or light waves, but any radiation that is converted into heat when destroyed, or converted into any other form of energy, the so-called chemical ray, ultra-violet light, the X-ray, when intercepted, also produces heat just as much as a red light, only very much less heat, not sensitive to the touch, because the total energy of the ray happens to be very much less. Our means of producing radiating energy are able to produce high intensities of radiation only for very low frequencies, invisible ultra-red rays, but we are not able to produce anywhere near the same intensities of radiation for higher frequencies.

It is obvious, if we intercept and destroy radiation to convert the energy into other forms of energy, if the energy is only high enough, we get high temperature, high chemical action, by the mere effect of temperature, and we also may get the chemical effect by what probably is some kind of resonance phenomena. The particles of a body, say the atoms of the molecules, naturally must have some rate of vibration of their own. If, then, a ray of radiation impinges upon them which is of a frequency of the same magnitude as the inherent rate of vibration of the atom, you see, by resonance, that vibration of the atom must rapidly increase in intensity until it breaks away from the molecule, until the chemical combination is split up. The inherent frequency of oscillation of the atom seems to be about of the same magnitude as the visible radiation, or rather a little higher frequency. If we assume that the wave entering a mass of the silver salt is such as to give a rate of vibration of about the range between the violet and ultra-violet, it is easy to understand that this frequency of light will split up the silver salt by increasing its vibration or resonance, and the shorter or longer waves will not have any effect, or an effect in much less degree, so that it may be a mere incident that these chemical compounds on which we observe the chemical action of radiation just happen to be sensitive to the violet end of the spectrum.

The distinction between heat waves, chemical waves, light waves, is not a physical distinction, but it is radiating energy of the same character, differing merely in wave lengths, and the visible range is somewhat less than one octave, rather at the upper end, at the higher frequencies, which are difficult to produce. This makes the problem of investigating and dealing with light difficult for the engineer, because it is not a physical quantity which can be measured accurately, as in the case of power or velocity, but it is a physiological effect. We can, indeed, measure very accurately the total energy of radiation from a heated body, but the total energy of radiation is not light, only a very small part of it is visible.

Energy radiating at low frequency represents no light whatever, has no physiological equivalent, is invisible. When you come into the visible range it represents physiological effect, and is the equivalent of light. Therefore, when you pass from the visible into the invisible range, you see that physiological equivalent must pass from zero into a finite value and must necessarily pass continuously, that is, at the other end of the visible range. The light equivalent of energy must be extremely low, and the further you go into the visible range, you reach the maximum in the middle, in the green and yellow, and it decreases again down to zero at the violet end of the visible rays. Beyond that are still higher frequencies, and then the physiological equivalent of energy is zero again. Inversely, if we take the mechanical equivalent of light as a minimum in the middle of the visible range, where one candlepower of light represents the lowest amount of energy and increases toward the end of the spectrum, to the visible range, to infinity at the end, because at the end of the visible range there is no more light, then the infinite amount of energy would not produce any more scintillation than one candlepower in light.

Now, that means, in plain language, that the efficiency in light production is the function of the wave lengths, that is, of the color, and that is at its maximum in the middle of the spectrum. The same amount of energy gives the largest amount of light, and the same amount of power, measured in watts, gives the largest amount of light measured in candlepower, if the power is in the form of the radiation of the frequency corresponding to the middle of the visible ray. Therefore, we get the efficiency of light production as the function of the wave lengths. Unfortunately, the physiological equivalent of power, or the physiological effect of light varies not only with the wave lengths, but also with the absolute intensity. Suppose we undertake to compare red, yellow and green lights, or any lights of different colors. We meet the great difficulty as to how to compare them. We want one candlepower in light, as red, yellow or green. You cannot compare them directly, for we have no physical measure of light. We cannot measure it physically, because it is not a physical quantity, but a physiological effect. We compare different lights by comparing them with a standard candle, but a standard candle has a certain color, yellowish or white, and we cannot compare it exactly with any other illuminant which has a different color.

Light in the middle of the spectrum and the short-wave end of the spectrum is very much more prominent and gives better illumination where the total intensity of illumination is low, while the long wave or low frequency of the red and orange and yellow light gives a much more brilliant effect at high intensity.

This is of importance for the illuminating engineer, because you see, where you desire to get very high effects, as in decorative lighting or in advertising, you get much better results from the low-frequency end of the spectrum, from the orange and yellow light, whereas, when you desire to get low intensity of illumination, as in street lighting, you get a much better result from the short-wave end of the spectrum, or the middle of the spectrum. Until the development of the Welsbach gas mantle, practically all methods of producing light were based on incandescents, i. e., by impressing energy on a solid body, either chemical energy of combustion, or electric energy in the incandescent or carbon-arc lamp.

We have increased the temperature of the gas flame by using a gas of higher chemical energy, as acetylene. The acetylene flame is white; the ordinary gas flame is yellow. We have increased the temperature of the carbon filament by replacing the carbon with some more refractory material, such as tantalum, osmium, tungsten, etc., and so get a higher efficiency.

We could increase the efficiency of the gas flame by mixing the gas with air, as in the Bunsen flame, but we have to insert a luminous body of some other material, not carbon produced by the gas by its dissociation, because the carbon is instantly consumed. We can do it by a skeleton of platinum wire, which can be set glowing.

If we could find a body giving abnormally high radiation of short-wave lengths, in the visible range, and abnormally low radiation of long waves at low frequency, it would give an abnormally efficient incandescent body. Such bodies exist, and the enormous progress in gas lighting made by the introduction of the Welsbach mantle is based on selective radiation, that is, the oxides do not radiate the same range and same order as the black body; incandescent carbon would do, but gives an abnormally large amount of visible rays compared with invisible rays; that is to say, it gives a larger percentage of high-frequency light rays compared with the low-frequency invisible rays. Now, possibly some of these highly efficient metal filaments, like the tungsten filament, also owe their high efficiency to selective radiation.

When you come to selective radiation, we must understand what is meant by the term. If you define as selective radiation any radiation in which the intensity is distributed from the spectrum differently from that of the theoretical black body, then the Welsbach mantle has selective radiation. If, however, you define selective radiation as the radiation of a body which gives spectrum lines, sharply defined lines, i. e., which gives abnormally low intensities within narrow ranges, which give absorption bands, bright bands in the spectrum, then the Welsbach mantle is not selective radiation, because it does not show absorption bands, black bands or bright spectrum lines.

In an incandescent lamp filament you do not get a definite pitch, or a definite frequency of vibration, that is, definite wave lengths of light, but we get an indefinite number. The reason is, we have a solid or liquid body in which the vibrating atoms are sufficiently close together to interfere with each other.

Since the spectrum light is based on the interference of vibrating molecules, it is easy to understand, when you bring the atoms or molecules closely together, as in atmospheric pressure, interference begins, and you find the line spectrum largely, the lines getting more confused and blurring into each other. Where we set gas or vapor into vibration, it vibrates at its own frequency, independent of the temperature. It gives a certain vibration, and it is merely a question of the character of the material whether a very large percentage of the total energy of radiation will happen to be within the visible range or outside the visible range. Temperature does not come in, because frequency of radiation is no longer a function of the temperature, but independent of the temperature; in general, it is the same.

The possibility exists of finding materials which, when energized, as vapor or gas, will give a spectrum having a large amount of energy in the visible range, thus giving an efficiency of light production far in excess of that available by incandescent lamps. So far the only metals which have been found which give these characteristics are mercury, calcium and titanium. These three metals give spectra which contain such a large percentage of the total radiation that the amount of light, measured physiologically in candlepower, is far in excess of that which possibly could be produced by incandescence, even with the assistance of selective radiation.

However, after all, it is not light we want, but illumination. The demands of illumination are mainly of two classes, general illumination and local, or concentrated, illumination. Many cases require general illumination, where the desire to see equally well, to get the same intensity of illumination throughout the whole illuminated area, is considered. The drafting-room, the schoolroom, the hall of a house and the streets of a city require general illumination, uniformity, fairly high intensity; very high intensity in drafting-room, to be able to do careful work everywhere; relatively low intensity in the streets of a city.

In other cases we require concentrated lighting; in domestic lighting, in the dining-room, in the living-room, we desire light mainly on the table where we work, eat, read, etc.

In producing illumination we can use either direct lighting or indirect lighting; the rays issuing from the source of light may either pass directly to the illuminated objects, or they may pass to a reflecting surface, and reflect it from that surface to the object, or they may be passed through a refracting body, as the frosted incandescent-lamp globe, or opal globe of the arc lamp, and so reach the illuminated object. In general, it is obvious that any method of indirect lighting by refraction or reflection wastes a considerable amount of light.

We can have indirect lighting, either by reflecting or refracting, by some attachment to the lamp, a reflector or holophane globe, or a frosted globe, or by deflecting the light from the ceilings and walls of the rooms on the objects to be illuminated. It is not always feasible to have light walls, especially when you come to machine shops or foundries, and in other places where the walls do not remain white. The walls always change to some darker color. The question is, what color do these walls assume? The color of everything which is changed by age is due to either iron or carbon. If you look around you will find in most cases it is the result of iron, reddish-brown, but it sometimes is due to carbon, and then the shade is a brownish-yellow. The color which all materials assume are either the one or the other. Both are in the long-wave or low-frequency end of the spectrum. Where you have to count on reflected light, and desire to get the benefit of reflected light from walls which cannot be kept perfectly white, then the sources of light originally in the long waves and low-frequency radiation on the yellowish tinge will be more efficient than any other waves.

Again, it is not the amount of light which reaches the object illuminated which is of importance, that is, not the physical intensity of illumination, but the amount of light which from these illuminated objects reach the human eye. With the same intensity of illumination, the same amount of light reaching the illuminated object, of the same color, the amount of light entering the eye may vary widely with the opening or contraction of the pupil of the eye. By eliminating the source of light from the field of vision and eliminating the contraction of the pupils resulting from the high intrinsic brilliancy of the illuminating body, we get actually a very much larger amount of light into the eye with the same amount of light

1. From an address presented before the Illuminating Engineering Society at a meeting held in New York on December 14, 1906.

striking the illuminated object; that is, we get a higher physiological efficiency. Even with a much less amount of light reaching the illuminated objects, we still get more light in the eye. It appears, however, that this automatic protective faculty of the eye developed through the ages is a protection, not against light, but against energy; apparently the eye is protecting itself against the energy of radiation, not the physiological intensity, and since the energy of radiation is mainly in the ultra red, in the long waves, the frequency which causes its reaction is the frequency on the long-wave end of the spectrum, the red end, yellow waves; these make the pupils contract and cause the self-protective action. This action is much less if the green and blue rays are in evidence.

That is of importance in places where you cannot take the light out of the field of vision, as in street illumination, where you must have all the sources of light along the street and must see them. By cutting off the red end of the spectrum you eliminate that contraction of the pupil, and you get the full benefit of the light between the illuminants, while, with the low source of light, as with the incandescent or arc lamp of old, you do not get the benefit, i. e., the physiological effect of the illumination by a green illuminant in such cases is superior to that by a yellow illuminant.

It is quite important for the illuminating engineer also to select the shade or color of the light and study the requirements of each case which comes into his charge. It would be just as wrong in one case to use an incandescent lamp, where the mercury arc lamp would be better, as to do the reverse. We have to consider them between general illumination and local illumination, between direct illumination and indirect illumination, and between directed illumination and diffused illumination. These three different classes or distinctions to a certain extent overlap.

In the case of general illumination vs. diffused illumination, the problem may be to get uniform intensity all over. You can get that by distributing a large number of small units all around the cornices and reflect the light from white walls and ceilings, and get a very diffused illumination, or you could get general illumination, where the intensity of illumination all over is the same in a moderate-sized room, from one source of light by using one of these sources of light with a holophane reflector. The problem in domestic lighting is to get sufficient directed and sufficiently low diffused lighting so as to get the best vision, to get sufficient shadows to see by, but not too dark shadows to become tiresome. During the daytime we get directed light from the windows, diffused light reflected upon the walls. To get the proper proportion between directed and diffused light, we have to employ shades, and we have to use walls of somewhat darker color. When you come to lighting in the evening, with a source of light like the incandescent lamp or gas lamp, concentrating light in all directions, then the diffused light, compared with the concentrated or directed light, will be a much higher percentage than in the daytime for the same color of wall, partly due to the color of the light, which is yellow, and more reflected from the walls, largely, however, because with the daylight through the window the directed light is a much larger percentage of the total light than in the lamp, where only a small part is concentrated light. It is not comfortable to have this strong light, and we put shades on which absorb three-quarters of the light, but which gives us a more comfortable illumination in the room. That means waste, however, and you pay twice for what light you get. The proper illuminating engineering is to secure the correct distribution curve of the source of light, so as to give the desired amount of concentrated lighting on the dining-room and reading table, and give only as much diffused lighting as is compatible with the amount of direct light used, to see by the shadows. The problem of domestic lighting, from the illuminating-engineering point, is to determine the illumination over the entire area, and also the character of illumination, whether directed or diffused; how large an amount of light should be concentrated, and how large an amount should be directed; then also comes in as an important factor the question of colors and shades of light, as was discussed before.

Discussion (in part).

A. E. Forstall, New York: As a result of my study, I have come to the conclusion that the Bunsen flame is non-luminous, not because the combustion of the carbon particles take place so rapidly that they cannot give off any light, so that there is no particle in the flame to be raised to incandescence, but because the chemical action in the flame is naturally different from that in the ordinary luminous flame. This difference results in the hydrocarbons, which in the luminous flame are decomposed before they are consumed, setting free carbon particles, which can be heated, and in the Bunsen flame these hydrocarbon particles are entirely consumed and destroyed as hydrocarbon before the combustion is complete, in the sense of having the carbon turned into the carbon dioxide, before they can be decomposed and set free in carbon particles.

P. S. Millar, New York: I was much interested in the reference to improper lighting, as exemplified everywhere. I have been particularly impressed recently with examples of this on the part of those interested in illuminating enterprises. If we look at the illumination in the offices of our gas and electric-light companies, we shall find examples which certainly court criticism; if we go into the offices of our lamp factories, we will also find the same state of affairs. I think the cause of illuminating engineering will be greatly advanced if we stop scolding the public for the little attention it gives to the subject and devote a little more time and attention to the matter of our own light installations.

Guy V. Williams, New York: In the matter of illumination, I think it is not always so much the efficiency we are after. Illumination has two effects—psychological, which shows us the light is present, and also the physiological. The illumination we want depends on what we want it for. In a ballroom we want a bright, soft light, which will contribute to raising our spirits and enthusiasm. In art museums we want a strong light to bring out the beauty of the objects of art, if the object is perfect, but if it is not perfect, we want a softer light which will shield the blemish and make it appear as though it really were perfect. I have often noticed in some of the hotel lobbies, where the illumination was brilliant, that it was probably some moments before I could see clearly. In the home, bright illumination is never desirable. Very often we want a cozy place, and in such a place we want a soft and very dim illumination. When we go to a restaurant, sometimes we are in the mood to sit in a brilliantly illuminated room and listen to the music, and hear the people coming and going, and at other times we are in the mood when we want to go into a nook and have a very dim light, so that we are almost in a shadow. I think these two points are often the deciding factors for what is good illumination for each purpose respectively.

Paul McJunkin, V. R. Lansingh, New York; W. H. Gardner, Jr., Boston, and Dr. Steinmetz also took part in the discussion.

Chicago Street-railway Problem Nearing a Solution.

It is possible that before the close of the present year franchise ordinances will have been passed by the Chicago City Council, and accepted by the Chicago City Railway Company and the Union Traction Company, which will bring to an end the years of litigation and controversy and provide the means for giving Chicago a first-class street-railway system adequate for the needs of the people.

At the time of writing the finishing touches are being put upon the ordinance drawn by the local transportation committee of the council, all the terms of which are understood to have been agreed to by the committee and the traction representatives.

The last thing which stood in the way of a possible agreement between the council committee and the traction companies was the matter of the value to be placed upon the properties should the city decide to buy, which power it is given in the new ordinance. This obstacle has been removed. As stated in the Western Electrician last week, the value given the properties by the city's commission of experts was about $51,000,000. With these figures as a basis the negotiations resulted in an agreement on $50,000,000 as the amount to be placed in the ordinance—$29,000,000 for the Union Traction Company and $21,000,000 for the Chicago City Railway Company. To these figures, of course, will be added the amounts expended by the companies in improvements up to the time when the city decides to take over the properties, should it ever find itself in a position to do so.

The new ordinance will require the companies to spend $40,000,000 to $50,000,000 in rehabilitating the lines. On this amount they will be allowed five per cent. brokerage, 10 per cent. as contractors' profits and five per cent. interest on the investment. What is left of the income from the lines after meeting the above items and paying operating expenses is to be divided between the companies and the city, the city to receive 55 per cent. of the net profits and the companies 45 per cent.

Rebuilding and improving the two systems is to be under the control of three engineers, one selected by the city, one by the companies and one to be chosen by the two. It is understood that the third member of this board will be Mr. Bion J. Arnold, if his services can be secured, both sides having expressed their confidence in his unquestioned engineering skill and undoubted fairness. Rebuilding of the systems and details of the improved operation, including a probable subway in the downtown district, is to follow closely the ideas laid down by Mr. Arnold, who has been an important factor in the matter of engineering problems incident to the present prospective settlement.

It has been rumored that Mayor Dunne, while pleased with the terms of the proposed ordinance, may insist on submitting the matter to a vote of the people before the council takes action. But it is believed that this course will be abandoned by the mayor if the transportation committee reports practically unanimously on the ordinance.

The life of the franchise for each company is to be 20 years. Upon giving six months' notice the city may at any time purchase the property of each company for municipal operation. The price to be paid is to be made up of the value of the present properties ($50,000,000) and the cost of the rehabilitation and subsequent construction. This is estimated at $50,000,000. If unable to purchase directly the city may acquire the ownership of the lines through a licensee company, which will operate until the city can take full title. If after 20 years the city does not acquire ownership of the lines it may grant the right to operate to any other company that shall purchase on the same terms as the city.

A complete rehabilitation of its equipment is to be carried out within three years by each company. Cable tracks will be replaced by tracks equipped for the best electric service; at least 60 miles of electric track will be rebuilt; new power houses will be constructed and equipped and car barns will be reconstructed. The number of double-truck up-to-date cars is to be increased as rapidly as possible until in the case of the City Railway 800 such cars are in operation and 1,200 by the Union Traction Company.

The two companies are to contribute not to exceed $5,000,000 toward the cost of building a subway for street cars and other traffic in the central business section of the city. The City Railway is to pay two-fifths of the amount advanced and the Union Traction Company three-fifths. This is exclusive of the reconstruction of the river tunnels as part of the Union Traction system. The elevated railways may be required by the city to use the subway.

Twenty-one through routes, as shown in the Western Electrician some time ago, permitting a passenger to travel from one extreme part of the city to another on the same car for one fare, are to be established. Universal transfers are to be exchanged and honored by the two companies at all places where their lines cross or connect, except in the downtown district bounded by Twelfth Street and the river.

The Electrical Plant of the Ontario Power Company.

[*Continued from page 499.*]

In the control room the chief operator's position is in the center, where, at his desk, he may observe, by means of his instruments, every electrical occurrence and direct his assistants as required. He has his own private telephone system running to all the rooms in the building, and also has direct connection with the telephones along the transmission lines. He may communicate with the generating station either by telephone or telautograph, the latter being almost exclusively used because of its unmistakable records.

While unusual for the control operator to be away from the sound and sight of his moving machinery, it is believed that the design which necessitated it has been carried out in such a manner that the separation may prove of distinct advantage.

Of the principal electrical equipment of the plant, the wires and cables have been furnished by the Standard Underground Cable Company, Pirelli & Co. of Italy, and the Northern Aluminum Company, and the apparatus by the Westinghouse Electric and Manufacturing Company.

The electrical design of the plant has been in the charge of the writer under the direction of the engineers, Messrs. L. L. and P. N. Nunn, and with the aid of an able corps of assistants, among which stand out most prominently the names of Mr. Paul Cheever and Mr. J. A. Brundige.

Mineral Products of the United States.

The mineral products of the United States for the calendar year 1905 amounted to a total value of $1,623,877,127, according to the report of the United States Geological Survey, issued in November, 1906. In 1904 the value was $1,360,883,554. The production of pig iron in 1904 was 16,497,033 tons, with a value of $233,025,000. In 1905 this production amounted to 22,992,380 tons with a value of $382,450,000. The production of copper was 812,537,267 pounds in 1904, with a value of $105,629,845, and in 1905, 901,907,843 pounds, valued at $139,795,716. Of aluminum, the production in 1904 was 8,600,000 pounds, with a value of $2,477,000; in 1905, 11,347,000 pounds were produced, valued at $3,246,300. The production of platinum for 1904 was 200 ounces, value $4,160; in 1905, 318 ounces were produced, with a value of $5,320. Of the non-metallic minerals, 668,358 pounds of sheet mica, with a value of $109,462, were produced in 1904, and 851,800 pounds were produced in 1905, having a value of $185,900. Of the metal tungsten, which is grouped with unspecified mineral products, the value of $268,676 is given to the production for 1905.

WIRELESS OR RADIO-TELEGRAPHY.

By D. McNicol, A. M., A. I. E. E.

CHAPTER III. (*Concluded.*)

Waves and Wave Motion.—Hertz Waves

The tapping-back process is accomplished automatically in the manner illustrated in Fig. 13, in which (C) is the coherer, (B) and (B′) the batteries, (R) the telegraph relay, and (T) a dismantled electric bell. The action is as follows:

When a train of waves falls upon the coherer the resistance of the filings falls from an almost infinite value down to a few hundred ohms. Current from the battery is enabled to flow through the relay coils, attracting the armature, which in turn closes the local circuit in which the electric bell or tapper is located. The tapper, striking the coherer causes decoherence. So, unless the waves are continuous, the local circuit is opened, and ready for another wave.

It should be here stated that when a continuous train of unbroken waves is passing through the coherer, the tapping of the decoherer, while it shakes up the filings, does not result in increasing the resistance of the tube; decoherence is only possible after the waves have ceased. The fact that this is so permits of the short dots and long dashes of the Morse alphabet being faithfully reproduced by the relay.

As is the case in wire-line telegraphy, a Morse sounder is connected in the local circuit, either in series or in parallel with the decoherer, in order that the signals may be sufficiently audible. It is also common practice to connect an ordinary telephone receiver in the circuit in place of the Morse sounder, the signals being reproduced in the microphone receiver by the characteristic

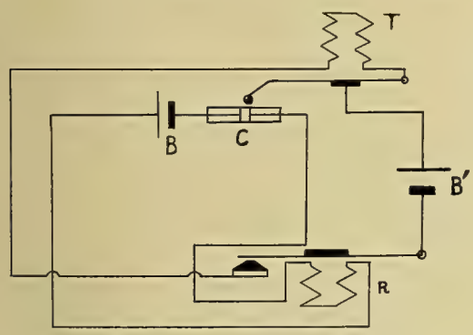


FIG. 13. DIAGRAM OF DECOHERING APPARATUS.

sounds of cohesion. In this arrangement the receiver is fitted to a headpiece, which allows the instrument to be held permanently to the ear of the receiving operator, as is customary in telephone exchanges.

In addition to the mechanical tapping device for restoring the high-resistance condition, there are several other methods which have been resorted to for securing the same results. One of these is by applying heat to that part of the tube containing the filings. Another method, which may be used where the particles are iron or nickel, is to employ an alternating or moving magnetic field, it being found that when the waves have ceased to affect the filings, charged electromagnets placed in close proximity to the tube attract the particles, thereby disarranging them, much in the same manner as is accomplished by means of the tapper. These latter two methods have not, however, been found to give as satisfactory results as the mechanical tapper.

It might be supposed that during the many and exhaustive researches conducted with different elements and compounds, in order to determine their specific electrovariable qualities, some substances would be found to exhibit different behavior when subjected to the effects of electric waves. Prof. J. Chunder Bose of Calcutta, India, found that the variation in resistance is not always a reduction, for, if pieces of clean potassium are placed in loose contact, the action of the waves is to increase the resistance. In the case of arsenic it has been shown that radiation from a certain distance increases the resistance and when placed farther away reduces its electrical resistance. With one notable exception, however (that of the De Forest responder, which will be mentioned later), the peculiar properties of these substances have not been availed of in the construction of wireless receivers; and, as a general thing, the various forms of imperfect contact detectors have been found to give the maximum degree of known sensitiveness.

Note.—This series of articles was begun in the issue of December 1, 1906. It will be complete in ten chapters. In reference to the repetition in the title it may be explained that wireless telegraphy is the popular name for the transmission of intelligible signals through space by Hertzian waves, while the term radio-telegraphy was officially adopted by the Berlin International Wireless Conference and promulgated November 3, 1906.

CHAPTER IV.

The Generation and Propagation of Electric Waves.

Fig. 14 shows a diagrammatic view of the transmitting apparatus originally employed by Guglielmo Marconi, the eminent Italian inventor. In the drawing (A) is a Righi wave exciter, (B) a Ruhmkorff induction coil, (K) a Morse key, and (C) a battery. The exciter consisted of two solid brass spheres 11 centimeters in diameter and one millimeter apart. The spheres were fixed in an

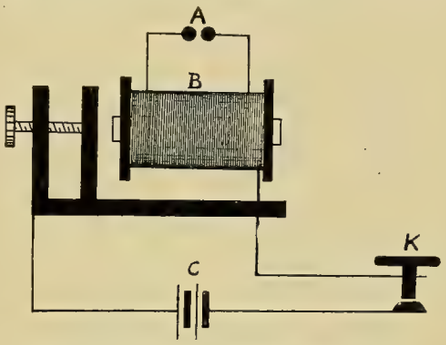


FIG. 14. ORIGINAL MARCONI TRANSMITTER.

oil-tight casing of parchment or ebonite, so that an outside hemisphere of each was exposed, the other hemisphere being immersed in vaseline oil thickened by the addition of a little vaseline. The advantage gained by using the vaseline oil was that the surfaces of the brass spheres between

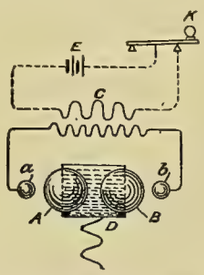


FIG. 15. ANOTHER DIAGRAM OF ORIGINAL MARCONI TRANSMITTER.

which the sparks passed were kept bright and clean.

Fig. 15 is another view of the same wave generator, showing the separate windings of the induction coil, in which (C) is the primary winding and (a) (b) the terminals of the secondary. (E) is the battery and (K) the key.

Mr. Marconi's later experiments led him to

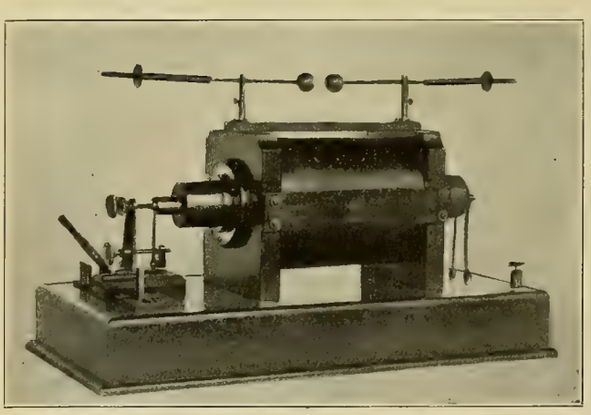


FIG. 16. USUAL TYPE OF HERTZ WAVE TRANSMITTER.

doubt the advantages of the oil immersion, and in his more recent work he has used a simple individual spark gap between the two brass balls. Long-range practice has, however, established the fact that the exciting energy of the oscillating system of the transmitter can be increased by increasing the discharge potential by enlarging the spark-gaps. The resistance of the spark-gap increases with its length up to four millimeters, beyond which the increase is no longer proportional, so that by arranging several separate spark-gaps, each within the allowable limit, the discharge energy is thereby increased.

Professor Reginald A. Fessenden of Washington, D. C., has made use of another method to secure greater voltages between the secondary terminals, with a given spark length, by allowing the spark to occur in a gas compressed to 20 atmospheres or

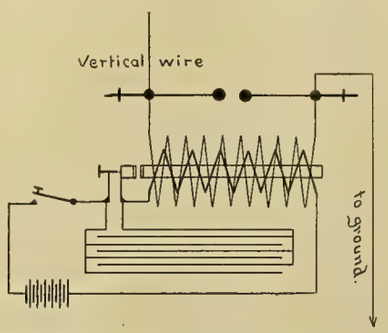


FIG. 17. WIRING DIAGRAM OF HERTZ WAVE TRANSMITTER.

more, and the consequent sharp breakdown of the air gives greater radiating power to the connected aerial wire.

Fig. 16 shows a view of the usual type of Hertz wave transmitter employed in wireless telegraphy. It consists of an induction coil with its accompanying primary circuit-breaker mounted on one end of the base, and the two brass-ball terminals of the secondary circuit mounted on top of the coil. In the base box there is placed a condenser of the tin-foil mica type. The wiring of the two coils and the condenser connections are shown in Fig. 17.

The transmitter used in the De Forest system of wireless telegraphy consists of an alternating-current generator, which energizes the primary of an oil transformer with a 500-volt current, which is stepped up to 20,000 volts. The transformer in turn charges a battery of Leyden-jar condensers to its maximum capacity, which, when discharged through an air gap, sets up electric oscillations of great intensity. In isolated stations the generator is driven by a gasoline engine, but where 110 or 220-volt current is available, the generator is driven by a motor from street mains.

It will, of course, be understood that the induction coil, or transformer, whichever is employed, forms only a part of the apparatus used in sending out electric-wave signals. In practical wireless telegraphy it is common practice to make use of what is known as the Thompson-Kirchoff electrical-oscillation circuit for generating electric waves.

Fig. 18 is a diagram of the wiring of a closed oscillation circuit, in which (C_1) and (C_2) are

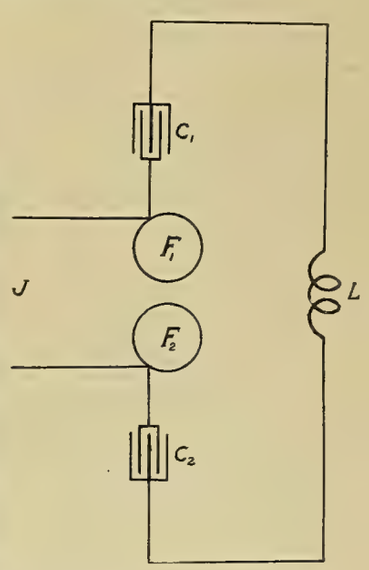


FIG. 18. CLOSED OSCILLATION CIRCUIT.

batteries of Leyden-jar condensers, the outer coatings of which are joined electrically by the self-induction coil (L) and the inner coatings connected with the spark balls (F_1) and (F_2) of the secondary circuit of an induction coil. The action is as follows:

At the moment that the primary circuit is interrupted an induced impulse occurs, charging the one inner coating positively and the other nega-

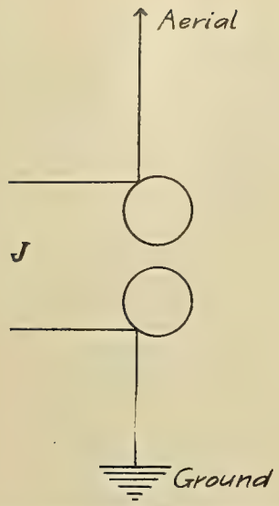


FIG. 19. SIMPLE OPEN OSCILLATION CIRCUIT.

tively. When the value of the discharge potential equals the length of the spark-gap the opposing charges are compensated, the inner coatings through the spark-gap and the outer coatings through the inductance (L). The compensating effect, being oscillatory, is possible only along the path indicated, as, owing to the high self-induction of the secondary of the induction coil, the generated charge could not traverse the latter. It is clear that an oscillation circuit so arranged is entirely closed during the discharge, the current on either side of the spark-gap being of corresponding amplitude and phase and of opposite sign. While it is true that this arrangement of transmitting circuits permits of the generation of powerful electric waves, it is also a fact that for the purposes of long-distance signaling the arrangement has little merit as an energy radiator.

On the other hand, where a simple open system is employed (see Fig. 19), while the energy is radiated satisfactorily, and to great distances, yet the requirements of a commercial system of wireless telegraphy are such that, more important than the bridging of great distances, is the matter of selectivity, by which we mean the possibility of a great number of stations working interchangeably without interfering with one another's operations.

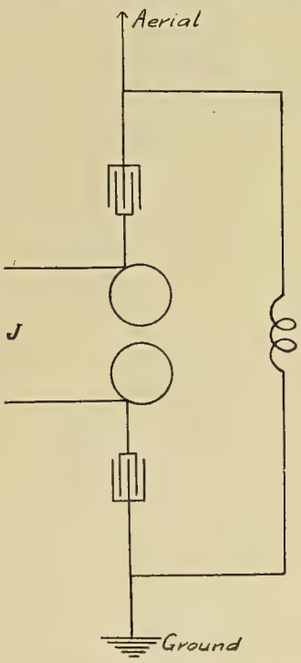


FIG. 20. BRAUN'S DIRECT COUPLING.

The chief advantage of the open system is in replacing one-half of the Kirchoff oscillating circuit by an earth connection, whereby the wave length is increased. Grounding the radiator system has the effect of doubling the wave length and making the radiated wave four times the length of the aerial conductor employed.

A vast amount of pioneer work has been done in Germany by Professor Braun and his associates, especially in relation to wave-transmission systems where the advantages of the open and the closed circuits have been combined in devising arrangements termed coupled systems.

Fig. 20 shows a wiring diagram of Braun's direct coupling, and Fig. 21 a diagram of indirect coupling as employed in the German "Telefunken" system (the commercial combination of the Braun-Slaby-Arco-Siemens-Halske inventions).

The employment of such coupling arrangements (which include in their circuits condensers of high-energy capacity in multiple with the spark-gap and inductance coil and directly connected to the earth plate and to the aerial wire) provides that the maximum amount of the energy generated is transmitted to the strongly damped aerial wire for the purposes of radiation.

The determination of the wave length concerns the frequency, damping and coupling. The last may be defined as: $T^2 L_1 L_2 = L_{12}^2$, where L_1 L_2 equal the coefficients of self-induction of both primary and secondary system, L_{12} the coefficients of mutual induction, and $T^2 = T_1 T_2$ or the coefficients of coupling. For the degree or coupling the limits may be ascertained by $0 \leqq T \leqq 1$ or for a rigid coupling, $T = 1$ or $L_1 L_2 = L_{12}$.

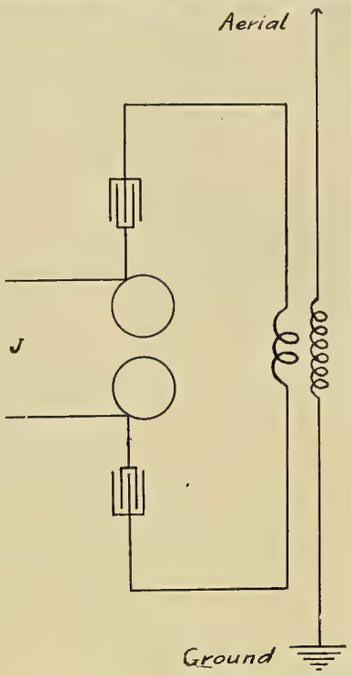


FIG. 21. BRAUN'S INDIRECT COUPLING.

In a later chapter dealing with aerial conductors and with directed wireless telegraphy we shall again refer to the effects of open, loose and closed coupling in practical operation.

[*To be continued.*]

OBITUARY.

Fitzhugh Townsend.

Fitzhugh Townsend, A. B., E. E., instructor in electrical engineering at Columbia University, died of typhoid fever on December 11th in the New York Hospital after an illness of three weeks. Mr. Townsend had been connected with the electrical engineering department of Columbia as assistant, tutor and instructor since 1897. For the last few years he has been interested in the development of a new railway signal device he had invented. This system will be installed on the New York Central. He was joint author with Prof. George F. Sever on a work on "Laboratory and Factory Tests in Electrical Engineering." He was an associate member of the American Institute of Electrical Engineers.

William A. Whittlesey.

William A. Whittlesey, one of the founders of the Stanley Electric Manufacturing Company, died at his home in Pittsfield, Mass., on December 5th. He was born in Danbury, Conn., February 21, 1849. In 1886 he went to Pittsfield in charge of the Pittsfield Illuminating Company, which he later consolidated with the Pittsfield Electric Light Company, under the name of the Pittsfield Electric Company. About 15 years ago he became interested in some of William Stanley's electrical devices and was treasurer and manager of the Stanley company until 1896, when he severed active connection with the company in order to devote his entire time to the Pittsfield Electric Company. He had served in both branches of the Massachusetts Legislature and was a prominent Mason. He left a wife and one daughter.

Wallace C. Johnson.

Wallace Clyde Johnson, the well-known hydro-electric engineer of Niagara Falls, N. Y., died at his home, 421 Cedar Avenue, on December 15th. Two weeks previous he was stricken down with an acute attack of dilation of the heart, superinduced largely by overwork. Mr. Johnson was born in Granville, Mass., May 21, 1859. He was educated in the public schools of that place, and in 1880 entered Williams College, graduating from that institution in 1882. In 1884 he graduated from the Worcester Polytechnic Institute. That year he accepted a position as assistant engineer of the Holyoke Waterpower Company, and in 1886 he became connected with the Niagara Falls Hydraulic Power and Manufacturing Company as chief engineer. He retained this connection until 1900, since which time he had been consulting engineer of that company, and had devoted considerable of his time to the development of water-power in various parts of the United States and Canada.

Mr. Johnson came to Niagara Falls at the time when a new era was dawning in power development, and the Niagara Falls Hydraulic Power and Manufacturing Company carried out his plans most faithfully. He designed the development at Shawinigan Falls, Que.; planned the development of the Albion Power Company at Waterport, N. Y.; the development of the Empire State Power Company on Schoharie Creek, near the Mohawk River; the development at Hannawa Falls, in St. Lawrence County, and the development of the Bodwell Water Power Company at Oldtown, Me. He was also connected with many other developments in various parts of this country and Canada. He was a member of the American Society of Civil Engineers, the American Society of Mechanical Engineers, the Engineers' Society of Western New York, of which he was at one time president, an associate member of the American Institute of Mechanical Engineers and an associate member of the Society of Arts, London, England.

Co-operative Movement in the Electrical Industry.

Last March, it may be remembered, a joint meeting of a number of leading men from all branches of the electrical trade was held in New York. At this meeting a very representative committee was appointed to co-operate in developing the plans and in perfecting the organization. Mr. W. M. McFarland, acting vice-president of the Westinghouse Electric and Manufacturing Company, chairman of this committee, called a meeting for December 13, 1906, at the Imperial Hotel, New York, to further consider the objects, plans, results and organization of the association.

At the morning session Mr. J. Robert Crouse presented a paper dealing with the work and results, which was fully discussed. This was followed by a further paper on the commercial plans formulated for the future, which was likewise discussed from various points of view.

At 1:30 p. m. the gentlemen present lunched together, and at 3 p. m. assembled for the afternoon session. The first part of this session was devoted to a reading of the proposed constitution and by-laws, after which a general and lively discussion of the entire proposition was indulged in. The sense of the meeting was crystallized in the following resolution introduced by Mr. Walter Cary of the Sawyer-Man Electric Company, which was unanimously passed:

"Resolved, That it is the sense of this meeting that the commercial programme outlined for the Co-operative Electrical Development Association for 1907 and the future is along sound lines, and gives good promise of highly profitable returns to all concerned.

"It is the further sense of this meeting that immediate steps be taken to perfect the organization of the association and to prosecute its commercial plans vigorously, pursuant to which the chair is requested to appoint three committees of five members each, as follows: Committee on constitution and by-laws, committee on membership assessments, committee on commercial programme."

The chair appointed the following committees:

Committee on Constitution and By-Laws.—E. E. Jackson, chairman; A. D. Page, General Electric Company; Walter Cary, Sawyer-Man Electric Company; F. J. Newbury, John A. Roebling's Sons Company; W. W. Freeman, Edison Electric Illuminating Company of Brooklyn.

Committee on Commercial Programme.—F. S. Terry, chairman; W. C. Bryant, Bryant Electric Company; R. S. Hale, Edison Electric Illuminating Company; A. L. Doremus, Crocker-Wheeler Company; E. W. Gillmer, Peerless Electric Company; F. Bissell, The F. Bissell Company.

Committee on Membership and Assessments.—J. S. Anthony, chairman; Walter Cary, Westinghouse Electric and Manufacturing Company; W. W. Freeman, Edison Electric Illuminating Company of Brooklyn; Charles B. Price, Pettingell-Andrews Company; James R. Strong, president National Electrical Contractors' Association.

These committees will, in the immediate future, formulate and submit their detailed reports to the chairman of the joint committee, so that at its next meeting the Co-operative Electrical Development Association may be formally and finally launched.

In the evening at eight o'clock the confreres sat down to a banquet, over which Mr. J. S. Anthony of the General Electric Company presided gracefully. The more serious business of the day hav-

ing been dispatched, the evening was given over to the cultivation of closer acquaintance and general good fellowship.

Following is a list of those in attendance: W. M. McFarland, Westinghouse Electric and Manufacturing Company, Pittsburg, Pa.; Walter Cary, Sawyer-Man Electric Company, New York; W. C. Bryant, Bryant Electric Company, Bridgeport, Conn.; J. S. Anthony, General Electric Company, New York, N. Y.; A. D. Page, General Electric Company, Harrison, N. J.; E. S. Keefer, Western Electric Company, New York, N. Y.; A. L. Doremus, Rodman Gilder, Crocker-Wheeler Company, Ampere, N. J.; E. W. Goldschmidt, Wagner Electric Manufacturing Company, St. Louis, Mo.; F. S. Terry, National Electric Lamp Company, Cleveland, Ohio; F. J. Newbury, John A. Roebling's Sons Company, Trenton, N. J.; E. E. Jackson, New York, N. Y.; W. H. Blood, Stone and Webster, Boston, Mass.; W. W. Freeman, Edison Electric Illuminating Company of Brooklyn, N. Y.; John F. Gilchrist, Chicago Edison Company, Chicago, Ill.; R. S. Hale, Edison Electric Illuminating Company, Boston, Mass.; J. E. Montague, Buffalo and Niagara Falls Electric Light and Power Company, Niagara Falls, N. Y.; F. M. Tait, Dayton Lighting Company, Dayton, Ohio; F. Bissell, The F. Bissell Company, Toledo, Ohio; Charles B. Price, Pettingell-Andrews Company, Boston, Mass.; James R. Strong, president National Electrical Contractors' Association, New York, N. Y.

The following-named gentlemen who were expected to be in attendance were unable to be present: Arthur Williams, president National Electric Light Association, New York, N. Y.; Henry L. Doherty, New York, N. Y.; Gerard Swope, Western Electric Company, Chicago, Ill.; O. A. Stranahan, Allis-Chalmers Company, Milwaukee, Wis.; A. T. Clarke, American Circular Loom Company, Chelsea, Mass.; E. W. Rockefellow, Western Electric Company, New York, N. Y.

Transformation of Electric Power into Light.—New Types of Incandescent Lamps.

Two notable papers were presented at the New York meeting of the American Institute of Electrical Engineers on November 23d last. Both related to the subject of high-efficiency electric-lighting units, now attracting so much attention, and both were valuable contributions to the literature of the art. The first was entitled "Transformation of Electric Power into Light," and was written by Dr. Charles Proteus Steinmetz. The author of the other was Dr. Clayton H. Sharp, who chose as his subject "New Types of Incandescent Lamps." Dr. Steinmetz's paper was given in the issues of the Western Electrician of December 1st and December 8th, while a comprehensive abstract of Dr. Sharp's paper appeared in this journal last week. The two papers were discussed together, and what follows is an abstract of the stenographic report of that discussion.

Discussion (in abstract).

Professor Herschel C. Parker, Columbia University: There are only two or three points in Mr. Steinmetz's beautiful paper on which I am capable of saying anything that will interest you. The first point is the fact that it is not the melting point of refractory substances that gives a high efficiency, but it is the other point of disintegration or vaporization, as is beautifully shown by the tungsten filament and tantalum filament, and which has been pointed out. These have a much lower melting point than carbon, and yet a much better vaporization, and hence show a great increase in efficiency. My associate, Mr. Walter G. Clark, and myself have been experimenting for a number of years on the subject of incandescent lighting, and we hope at no great length of time in the future to present some of these results, which we think are of interest, before the society. A certain filament with which we have been experimenting, the substance of which is supposed to have a melting point of 1,800°, has shown an efficiency in experimental lamps of about one watt per candle, with an average life of 700 to 1,200 hours. The vapor tension of this substance is remarkable; that is, it is almost impossible to vaporize the substance, and this fact bears out the statement of Mr. Steinmetz.

Another point about the filament is that we have substances which at low temperatures of 1,800° or 1,900° will give an efficiency of one watt per candle, and if at the same time we have carbon filaments which, running at 1,800° or 1,900°, give us an efficiency of 3.5 watts per candle, since we know the carbon filament at least approximates the black body, we certainly know we have substances which have an immense selective radiation in the solid form, notwithstanding what the experiments of Messrs. Waidner and Burgess have shown regarding the tungsten and tantalum filament. They show us practically nothing with regard to this field of selective radiation of solid substances. This, I think, is one of the most promising fields we have concerning the efficiency of incandescent filaments. The point that Mr. Steinmetz brought out beautifully about vapors, that we have the most intense selective radiation without respect to temperature, is shown wonderfully in the experiments in connection with the electrodeless discharge. My friend, Mr. C. C. Trowbridge, at Columbia University, has carried on some very elaborate experiments in this field, and has shown that when the receiver is surrounded by liquid air, a very considerable luminescence may be obtained and the luminescence may continue for a number of minutes after the electrical disturbance has been discontinued. He has calculated that if the number of molecules in the rare gases could be increased, the efficiency would be something enormous, aproximating 100 per cent.; that is, we can have luminescence in the gas, practically, that is absolutely independent of temperature.

J. W. Howell, Harrison, N. J.: One thing which impressed me very deeply this evening is the fact that practically all of the efficient illuminants mentioned tonight originated in either Austria or Germany. The tungsten filament, from the nature of the material, can be most easily made in rather large candlepowers. Dr. Sharp put 25 candlepower as the lower limit, but the really practicable lower limit is higher than that, and, speaking for the General Electric Company, I think 40 candlepower would be about the lower limit at 110 volts, but they will manufacture and have lower candlepowers for smaller units, and lower voltage lamps will have to be employed either in series or in other ways. But while that is the limit, it fits in exactly in the place where the carbon filament is weak. The carbon filament is weak above 40 candlepower, and the tungsten filament is strong. The tungsten filament from 40 to 200 candlepower is at its best, and at these candlepowers, 200 candlepower for the incandescent lamp, with its distribution and stability, is better than twice that candlepower or more from an arc lamp, and I look to the tungsten lamp as being the competitor of the small arc lamps, and the large ones, too, for that matter, and for other forms of light, the values of which lie between 50 and 200 candlepower.

As Professors Waidner and Burgess state, a polished platinum wire is the most efficient metallic light-giving body, and some of the tungsten filaments approach very closely in appearance to polished platinum wire. I think those forms will be more efficient than the others which do not approach that condition.

Percy H. Thomas, New York: As I understand Dr. Steinmetz, he attributes the extra high efficiency of the gas illuminant to the fact that the radiations are largely in the visible spectrum when they come from a free gas. That is undoubtedly true. The impression is created in the paper, at least I have obtained that impression—perhaps it is not correct—that these radiations are exactly of the same nature as the heat radiations which appear first as the filament is being heated. This may be so, but they may possibly be of a different character. The heat radiations are generally conceded to be due to the vibration of molecules or atoms in the gas; that is, there is a translation, the vibrations moving backward and forward. It is held by a good many that the waves of light are due to vibrations, not of translation of atoms, but of vibrations within the atoms, deformations, like a bell, you might say. This would draw a distinct line between heat radiations and light radiations. In this case the light radiations would, of course, include ultra-violet, the longer red and the infra-red—any vibration which comes from the vibration within the molecule. The atom can be looked at as a bell, would give a sound like a bell. This explains very nicely how the atoms of a gas give a definite color, and how the light from an incandescent gas is of a particularly definite spectrum, has definite spectrum lines.

When we come to gas, and consider electric excitation, we get a beautiful explanation of the efficiency of these gas illuminants by considering the corpuscular view of the passage of current through the gas. If we assume that the current passing through is due to a shower of projectiles of small corpuscles attracted by the positive electrode, and there are a certain number of these atoms in the space, we can consider an atom being struck by one of the corpuscles as being set into a vibration such as drawn here. In view of the small size of the corpuscles relative to the size of the atom and their extremely high velocity, their effect on collision would be to produce a local deformation rather than a translation of the whole atom. The result would be a large percentage of energy which is turned into radiation would be due to the formation of the atom itself, which is light, and the actual translation given to the atom which would represent heat, is comparatively small. If we consider the atomic weight of the atom, we will see that the heavier atom will have a larger percentage of the light waves and a lesser percentage of the heat waves, because it is relatively heavier than the small corpuscle. As a matter of fact, this is to my mind a rather more probable explanation of the higher light efficiency of certain material, such as mercury, than other materials, such as carbon. There may be a close interlinking of the temperature explanation with the atomic-weight explanation, but I believe that the atomic weight is the more fundamental condition.

Another point of a very much more practical nature is worth while raising. For instance, there are other things besides the ultimate efficiency which determine the usefulness of a type of lamp; such matters as the conduction or convection of heat due to the presence of air. The figures given by Dr. Steinmetz for the maximum possible efficiency of bodies are calculated, as I understand, on the basis only of the rated energy. If these sources are in the presence of air or other gases, there will be a conduction or convection, mostly convection, of heat, producing the light in addition. As between an incandescent filament and an arc lamp, you see this consideration is of great importance, the filament, being in a vacuum, does not lose energy by convection or conduction. This gives it a great advantage. The arc light does lose a great deal in that manner, so that its intrinsically high efficiency, due to its higher temperature, is not so great as might be supposed.

John W. Lieb, Jr., New York: The question of mere efficiency by itself does not represent necessarily an advance, if it is obtained at too great a cost or the sacrifice of the life of the filaments, or if the development is obtained at too high an initial cost in the production of the filaments themselves. If in the new developments which we have before us the efficiencies which have been indicated of 1¼ watts per candlepower for the tungsten filament were to be obtained at an important sacrifice of life, then, though the cost of production of the lamps was very low indeed, we would at once stumble on a very serious commercial handicap for such lamps, for it is a fact that if we should have lamps, even though they cost but little, and the cost of renewal thereof would be low, which had a short life of 100 or 150 hours, they would be commercially impracticable because of the fact that the continued renewal and burning out of the lamps would be a matter of very serious inconvenience. With the lamps which have been developed with the high efficiency, we have very fortunately coupled therewith a very satisfactory light. As to the cost of production of these illuminates, it is well at this time, when they have not reached completely a commercial stage of development, to say a little. Unquestionably, as appears from a superficial inspection of the lamps, it is necessary to look forward for a time at least to a considerably increased cost, but with such enormous saving in the amount of energy, the initial cost of the lamp becomes a factor which can well be borne.

Dr. Sharp refers to the performance of a high-efficiency tungsten lamp on 25 cycles. With the carbon-filament lamps which we have now of the 3.1-watt per candlepower efficiency, it is unquestionably true that for the very highest standard of illumination the performance of these lamps of 16 candlepower at 25 cycles is not completely satisfactory. Some might say it is not at all satisfactory. It is undoubtedly true as an engineering proposition that if it were practicable to have our most efficient illuminants so that they could be used on 25 cycles with entire satisfaction, we will have a condition of affairs which would lead to some rapid and important changes in our methods of distribution. Our central power stations are very largely at present producing 25-cycle current, and at least for the illumination of the very highest standard it is hardly available with our present type of incandescent lamps. The characteristics of the tungsten filament, its hanging on to the candlepower, even with large changes of voltage, presented some hope that the tungsten filament might be the long-desired filament which would fill these requirements. But it seems to be a race between this physical characteristic and the other one of the extreme tenuity of the filament, making the lamp, on the other hand, more sensitive to fluctuations of current. We, therefore, at least as far as the experiments to which Dr. Sharp has referred, still have to look forward to some further developments, some further modification, which may solve this problem.

The foreign municipalities, in granting privileges to the local companies, thought it wise and best to protect the public against possible abuse by avoiding a requirement that the company should supply incandescent lamps within and included in the cost of current supply. The result is that there the public goes out into the open market for the purchase of its incandescent lamps. What the result of that line of policy has been was made quite evident recently by the results of some tests made in England, particularly, of the incandescent lamps which were found on customers' circuits after a number of years of such operation. The lamps were found to be of all types and all efficiencies, particularly of the lower kind, so that the efficiencies of the lamps found on the system ranged all the way from six watts per candlepower to eight, nine and 10 watts. In the purchase of illuminants like incandescent lamps, it is not the same as buying a candle at the grocery store; it is a difficult article to purchase at best, and the public is too prone to look entirely on the question of their life, the result being an enormous sacrifice of their efficiency.

Walter G. Clark, Columbia University: I was quite interested in Mr. Thomas' discussion regarding the shape of the molecules, but there are some physicists who might not agree to the argument.

I pay my respects to Dr. Steinmetz. I have had a chance to pay some attention to some experiments which Professor Parker and myself have been carrying on, and with your permission I will refer to some of them.

In the matter of the evaporation of carbon at the temperature of the incandescent filament, my observations have led me to believe that the ordinary filament is not of even temperature, but is made up of very narrow zones or spots of high incandescence, and, possibly, in an unflashed filament, of actual arcing in some places, and that the temperature which we observe is the mean of a series of high-temperature and low-temperature spots. These would of necessity be very narrow, but from the fact that the filament is originally made up from a material which must pass off as a gas during the process of carbonizing, it must leave the filament somewhat porous, and as the surface is carbonized before the interior, the gases leaving the interior would break through any surface seal formed by the carbonizing of the surface and reduce the cross-section of the filament at that point, and, in an unflashed filament, there would be a tendency to form a small arc across the gap in shunt with the continuous portion of the filament back of it. In flashing, these spots would be the first to be covered with the dense low-resistance carbon deposited out of the hydro-carbon. As the temperature is excessively high at this point and the carbon deposited is of very low resistance, compared with the porous unflashed portion, the tendency is to over-deposit, for the carbon is not only deposited at the actual point of the greatest temperature, but for some distance on either side. Thus, while flashing improves the filament, it does not entirely eliminate the high and low-temperature conditions. But the temperature of a carbon filament probably represents the mean of a great number of extremes of temperature, and the carbon is vaporized from the high-temperature points where the greatest amount of vaporization has taken place. With the graphitized or metalized filament the conductivity is more nearly uniform on account of the greater per cent. of dense carbon, so it is possible to operate the filament at a higher temperature.

I am of the opinion the hot-point condition also holds where metallic filaments are made up of tungsten filament, for the current passing through the filament at the time the centering together takes place will follow the path of lowest resistance where the arcing between the particles welds them together, and particles not directly in the path of the current may not become an active part of the filament. The arcing between the particles would continue until the points of contact fuse together, when the temperature would immediately drop below the fusing point—but the points of contact would still represent the points of greatest temperature.

It has been noted that some metallic filaments which are white in color at low temperatures still radiate as black bodies. In this connection I have noted that a great many white metals turn black before they begin to radiate light. Steel, of a light gray or silvery color, confined in a vacuum freed of oxygen, passed through several changes of color to black before it began to radiate light at the red end of the spectrum; this was also true of platinum, iridium and copper, but did not appear to be true of aluminum.

I have also noted that it is possible to make a non-luminous gas flame luminous by charging it with a silicon vapor, which broke up and gave silicon dioxide upon coming in contact with the air, and I have found it difficult to prevent the oxidization of silicon when in contact with air at any high temperature. I do not understand the statement that the silicon arc is non-luminous, assuming that Mr. Steinmetz is referring to an open arc; the oxidization of carbon in the arc would, of course, produce a gas which would show little if any luminosity, but the oxidization of silicon dioxide, in my experience, becomes luminous at a comparatively low temperature, and an open arc from silicon should form the dioxide and become luminous.

William J. Hammer, New York: Speaking of the work of De Lodyguine, about 10 years ago he took out a couple of patents on tungsten and other materials in which a heated filament was placed in a receptacle and oxyhalogene compounds and other heavy gases were allowed to descend from the top, and hydrogen gas, which is very light, was allowed to ascend. Mr. De Lodyguine made a number of lamps, some of which he has told me lasted several hundred hours. But he also informed me he did not succeed in making a commercial incandescent lamp in this way.

It is interesting to call attention to the fact that the tungsten which was prepared for the Bureau of Standards in Washington, according to the statement in their report, showed the highest melting point of anything tested. The temperature was 3,200° C., they also state, without any discoloration of the work.

C. W. Hogan, Philadelphia: Some time ago my attention was called to a new form of carbon filament, for which was claimed an efficiency of 2.5 watts per candlepower, with an increased light over our present form. I was afterward told by another person that this was due to the cross-section of the filament, and I did a little calculating which I would like to present. It is the difference between the triangular cross-section and the circular section. With the triangular section of five mils, it compared with the carbon filament with a diameter of five mils. The section is in the triangular 10.825 and in the circular 9.66. With the same radiating surface it will give us a length of 9.8 for triangular and 9.33 for circular. The final efficiency figured out for 16 candlepower, using the same method of treatment for the same carbon for the triangular section, would be 1.74 watts per candlepower, against 3.31 for the circular section. I would like to hear from some of the physicists if there was anything in the nature of the carbon which would render these figures void; that is, if at that diameter the cross-section will carry for these figures. The amperes for that candlepower would be in the triangular cross-section 0.253 and for the circular section 0.482, so that the carbon would actually be carrying less current in the triangular section than in the circular section. Consequently, I think it would be at a lower temperature and would have a greater radiating surface. I think from these figures the life would be longer, owing to the lower temperatures at which the carbon would be operated, but the total illumination would be greater—that is, there would be more radiating surface for the light with the smaller cross-section.

Professor W. S. Franklin, Lehigh University, Bethlehem, Pa.: Most of you are familiar with the fact that there has long been a fundamental difficulty in the kinetic theory of gases, in that the different modes of motion which are possible in the gas do not each of them represent the amount of energy which should be represented according to the gas theory. According to the gas theory, each particular type of motion in the molecule which is possible, should represent the same amount of energy. Each separate type of oscillatory motion should represent the same amount of motion. According to that theory, a gas, if it is heated, should radiate long wave lengths and short wave lengths, in much more equal amount than we actually observe in the case of a hot gas. That fundamental difficulty has recently been largely explained by a young physicist now at Princeton University, by the name of James. He has shown if you heat a gas, that the energy given to it at the start is given out in the form of translational energy, and therefore the first effect of heating is to produce increased pressure, or if the flame is not constant, increased flame. As Dr. Steinmetz pointed out, and Mr. James has also shown, it takes a very long time for the bombardments of the molecules to hammer the energy into the molecule, and causes a large portion of it to result in molecular oscillations.

In the case of a gas, then, we have a substance in which, if you heat it by ordinary means, the most of the heat that is given out is represented in it by translational motion, and the amount of light radiated is very small, and the result of the James theory is, it takes a very long time for the translational energy to be hammered over into molecular energy. If you take a gas and give it energy primarily in the form of mercury energy, it distorts the molecules by electric stress, breaking them so that after the discharge is past you have luminescence, and it is known that the luminescence persists for a long time, even if the energy of translational motion is very small. Perhaps the substances which show that property to the most striking extent are the oxides of the two didymiums. They have the property of almost giving the long spectrum in the solid form, especially when excited by cathode bombardment. These substances give the possibility of being selectively excited, and therefore radiating short waves of enormous strength, even though they may be at a low temperature. If we are to employ selective excitation for the production of light efficiency from solid substances, we must make use of some peculiar property of didymium.

Dr. Steinmetz: In regard to the melting point of tungsten, 3,200° C., I would not count on that value, because it is a black-body temperature of tungsten. It is that temperature at which tungsten would melt if its radiation were that of the black body. If it is not the radiation of a black body it would not melt at that temperature, but some lower temperature. The paper expressly states that is the black-body temperature of tungsten, but it is probably not the actual temperature. The manufacture of tungsten would be simplified by making it ductile, but I must draw your attention to one feature: Of all the incandescent filaments the only one not suited for rapidly oscillating stress is the tungsten filament, which shows a feature of crystallization like sheet iron, while the osmium and carbon, which have no fibrous structure, show no disadvantage in the alternating current. It is quite possible, if we got ductile tungsten, that the tungsten filament would be inoperative on the alternating current. I do not say it is so, but there is some probability of it.

It is undoubtedly true that increased radiating surface of the triangular surface will radiate more light. Unfortunately, it will also radiate in the same proportion more heat rays and more total radiation. That means the efficiency would be no better than in the case of the round filament. The only difference would be that the total radiation from a triangular filament would be greater than the total radiation from a round filament of the same section, and therefore to maintain the same temperature of the triangular filament you would have to put in more energy. You could do the same thing by using a hollow filament, as has been done, but you do not gain anything in radiation.

There are some future developments possible in the increased efficiency of the arc lamp, because even an efficiency of one-fourth of a watt per candlepower is a ridiculously low efficiency from the point of view of the efficiency of the electric motor. You could possibly still get higher efficiency than this. However, you must see that what we want is not life, but illumination, and then the question of the distribution of light comes in, and that depends not only on the total volume of light you get, but also on the size of the units, and the smaller units give you an advantage. The advantage is in favor of the incandescent lamp. Again, high intrinsic brilliancy gives you a disadvantage and low intrinsic brilliancy, that is, larger light from a given source, gives you an advantage. In that respect the advantage is with the mercury arc and the vacuum tube and is against the ordinary arc and against the high-efficiency incandescent lamp, which two reduce the intrinsic brilliancy. Furthermore, the total illumination required also comes in as an essential factor, and that is a feature which has never had to be considered before, because until the last few years all artificial illuminants had the same color, varying in gradation from an orange red to yellow and yellowish white, but with a different luminescent material, arcs, you have then the bluish green of the mercury, the monochromatic yellow of the calcium spectrum, the white of the tantalum, and you get different colors, and in the question of illumination comes in the differences of the physiological effect of different colors.

I stated in my paper, for instance, that green is a much more efficient color than red, and that the same amount of energy put in a green light gives much more candlepower than a red light; that is, the light equivalent of energy is the function of a color, but is not only a function of the color, but also a function of the total intensity. This intensity varies as the ratio of sensitiveness of the light for different colors; it varies with the absolute value of the illumination, while for a very intense illumination the eye is more sensitive to green. The same amount of energy put into a green light is very many more times effective than the same amount of energy put into a red light, when seen at a considerable distance. The intensity increases much more than the inverse proportion of the square of the distance in the lack of visibility with the orange and yellow, and much less with the green; when you go away a quarter of a mile, the orange red has long ago sunk down in the darkness, while the green light still sends out a visible beam. Where you want to get a low intrinsic brilliancy is in suburban lighting; there the green, irrespective of the physical efficiency, has great advantage over the reddish yellow. The reverse applies when you go to very high intensity, to glaring light. When the light is used to draw attention for advertising purposes, the reddish yellow is always preferred and is also more pronounced, more glaring than the greenish light. When you have lights of different colors, the physiological effects will come in as an effect to be considered on the relative value of the lights dependent on the different intensity of illumination which you desire to get. Irrespective of the absolute efficiency, the electrical and mechanical efficiency, we may find for certain classes of work that the mercury lamp is more efficient physiologically than any other illuminant, while for other classes of work the flaming-carbon arc will hold its field, due to its yellow color. In another case the tungsten lamp will be superior, but you cannot speak of absolute relative efficiency of illuminants, because the physiological effect varies with the color and intensity of the illumination.

Central Electric Railway Association.

Elaborate preparations are being made for the annual meeting and banquet of the Central Electric Railway Association, to be held in the Claypool Hotel, Indianapolis, on January 17th. The governors of Ohio and Indiana will be asked to speak, and invitations have been sent to T. E. Mitten, president of the Chicago City Railway Company, H. H. Vreeland, president of the New York City Railway Company, and W. A. Bancroft, president of the Boston Elevated Railroad Company. A committee has been appointed by President C. E. Spring of Dayton to make nominations at the January meeting. This committee is composed of J. O. Wilson, Cleveland; Frank D. Norviel, Indianapolis; G. H. Kelsey, Anderson; C. M. Paxton, Dayton, and S. D. Hutchins, Columbus, Ohio. A number of special and private interurban cars will be run from various points to Indianapolis. The Indianapolis Traction and Terminal Company will take care of the cars on their arrival. W. F. Milholland of Indianapolis is secretary-treasurer of the association, and the arrangements for the meeting are being made at the association's headquarters in the Traction Terminal Building, Indianapolis.

Meters.

By Robert C. Lanphier.

Part II.

In all induction meters it is necessary to provide some form of compensating device for making the meter correct on inductive as well as non-inductive loads, this device being usually in the form of an additional adjustable low-resistance secondary, which can be introduced in the field of the shunt magnet so as to give such change in the phase of the shunt magnetization as is necessary. The way in which this device is applied differs in the various induction meters.

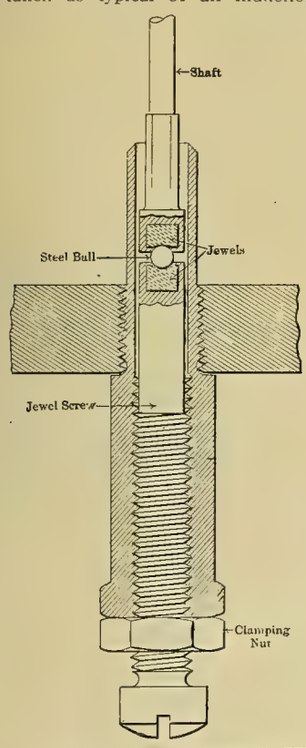
All induction meters also have some form of light-load adjustment for initial friction, which

TYPE B WESTINGHOUSE SINGLE-PHASE WATTMETER.

may be either in the form of a device for distorting the shunt field, giving a slight rotative effect by such distortion, or in the form of an auxiliary winding on the series coil which may give a slight starting field as required. The armature or rotating element of an induction meter would evidently run at very high speed, as was said of commutator meters, unless properly retarded, and the same device of a damping magnet acting upon a disk or cylinder is used in all induction meters, as in commutator meters. Usually the damping magnet acts upon the same disk which is used to produce the driving effect, the poles of the damping magnet being located with respect to the disk so as to be well away from the shunt and series fields, thereby avoiding any demagnetizing effect of the latter upon the permanent magnets.

The motion of the armature is transferred to the recording train by means of a worm or a pinion upon the armature shaft in the same manner as in commutator-type integrating meters.

The type "B" Westinghouse meter now in use may be taken as typical of all induction meters.



LOWER BEARING OF WESTINGHOUSE WATTMETER.

and is more simple in construction than the type "A" which preceded it.

Two of the most important and desirable features of the type "B" meter are the very light weight of the rotating element and the improved lower bearing. In all integrating meters it is desirable to have a high torque upon the armature, so as to overcome inaccuracy and variation on light load, but at the same time the weight of the rotating element should be kept as low as is consistent with proper construction, in order to prevent extreme wear upon the jewel bearing.

In an alternating integrating meter this wear upon the lower bearing is liable to be particularly severe, on account of the vibration or pounding of the armature produced by the alternating fields acting upon it, and particularly the shunt field. The additional extremely rapid vibration caused in this way tends, sooner or later, to injure the jewel bearing and the pivot of the armature shaft unless some means are taken to eliminate the same as far as possible.

In the type "B" meter the lower bearing is improved by having two cupped sapphire jewels, one held fixed in the lower bearing screw and

TYPE C WESTINGHOUSE POLYPHASE WATTMETER.

one mounted on the lower end of the armature shaft, embracing between them a highly polished steel ball of less radius than the radius of curvature of the jewels, so that there is very slight surface contact between the jewels and the ball.

It is said that the motion of the armature and the vibration of the spindle keeps the little steel ball constantly turning, so there is no opportunity, practically speaking, for severe wear to take place either upon the jewels or the ball.

The adjustment for inductive load or the "phase

TYPE I THOMSON HIGH-TORQUE WATTMETER.

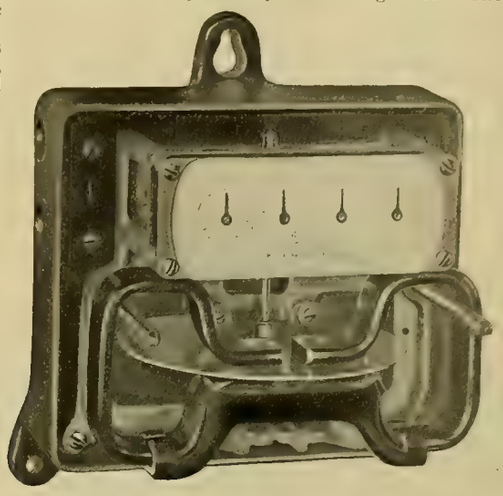
compensation," as it is sometimes called, is obtained in the type "B" meter by moving a piece of copper in the same gap of the shunt magnet in which the aluminum disk armature rotates, thereby varying the phase of the shunt magnetization as necessary. The adjustment on light load is easily obtained by shifting another copper loop in an auxiliary gap of the shunt magnet, so as to distort part of the shunt field and give a slight starting effect, as may be required.

The construction of the type "B" meter is very durable and the finish excellent. The type "C" Westinghouse has been recently brought out, similar to "B" in all general features, with mechanical changes principally, and the torque higher. The type "I" Thomson, high-torque meter is similar in principle to the Westinghouse meter, but the torque is very much higher, and the moving element is also considerably heavier. The ratio of torque to weight is therefore practically no higher than in the Westinghouse meter.

The adjustment for inductive load in the type "I" meter is obtained by varying the resistance of an auxiliary short-circuited secondary around the core of the shunt coil, instead of by moving a metallic piece in the gap of the magnet, as in the Westinghouse. The light-load adjustment is obtained by moving a small metal piece, somewhat in the same way as in the type "B" Westinghouse.

The type "I" meter is well arranged to prevent demagnetizing effect of the alternating fields upon the permanent magnets held at the front of the meter, and this is also true of the type "B" Westinghouse, the frame holding the laminated magnet being of cast iron, so as to get a good shield between the alternating field and the magnets.

The type "K" Fort Wayne meter has now been longer on the market, with practically no change, than any other induction meter, and has been very successful. The torque in this meter is high, but the armature is a little heavier than in some of the other induction meters. The armature is entirely different from that in other induction meters, being of cylindrical shape, instead of a flat disk. The series coils in the type "K" meter differ from those used in the Westinghouse and General Electric induction meters, having no iron cores, and practically no choking effect. The



INTERIOR VIEW OF TYPE I THOMSON WATTMETER.

shunt magnet is arranged relatively to the armature with its gap between the series coils, so that the latter act upon the induced currents circulating outwardly each way from the shunt field between the series coils.

The adjustment for inductive load and for different frequencies in the type "K" meter is obtained by varying resistances in windings arranged upon the core of the shunt magnet inside the armature, and also of windings upon the reactance coil which is in series with the small shunt winding of the core within the armature. This actual shunt coil is small and does not take over one-tenth of the total drop on a 100-volt circuit, the balance of the drop being absorbed in the ironclad reactance coil at the bottom of the meter. This was the practice in the type "A" Westinghouse meter, but in the type "B" Westinghouse the entire shunt drop is taken up in the shunt coil. This is also true of the type "I" General Electric.

The light-load adjustment in the type "K" Fort Wayne is obtained by shifting a small auxiliary iron piece or core in the path of the shunt magnet which distorts the shunt field slightly one way or the other, with respect to the fixed core going up back of the cylinder. The adjustment is very easily obtained for light load, and the piece can be firmly set in position after obtaining the desired adjustment.

In some forms of the type "K" meter one permanent magnet is used and in others two, the permanent magnets being specially shaped so as to embrace the cupped armature, the adjustment in both types being obtained by moving up or down, so as to embrace more or less of the armature, this differing from the arrangement in meters having a disk armature where the adjustment is obtained by moving the magnets in or out with

TYPE K FORT WAYNE INTEGRATING WATTMETER.

respect to the disk, so as to give a different radius and thereby a different damping effect.

The type "W" Fort Wayne meter has been recently brought out and is considerably different in construction from the type "K". The two shunt coils energize a small laminated magnet, the whole being held in a brass frame, which also supports the two series coils situated at an angle on the disk with respect to the shunt field poles, so as to give proper turning effect. The armature is a plain disk of aluminum, supported on the usual polished pivot and cupped sapphire bearing.

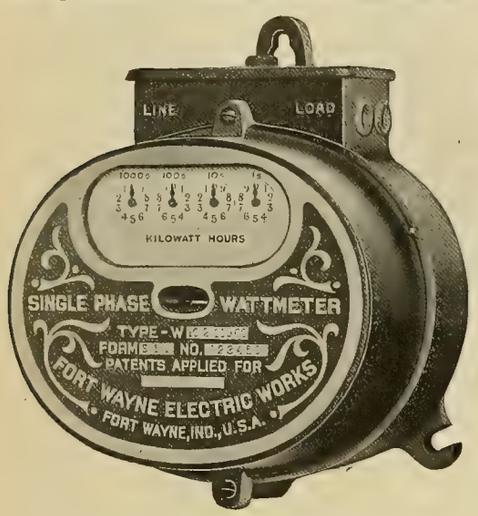
The adjustment for light load is obtained by

a micrometer screw, which acts upon a thin copper piece moving in the gap of the shunt magnet and distorting the field in the usual manner.

The adjustment for inductive load and frequency change is obtained in a manner similar to that in the type "K". Only one permanent damping magnet, which is similar in shape to that used in the type "A" Westinghouse, is employed in the type "W" Fort Wayne meter.

The Stanley meters had many features of interest, and a large number of these meters are still in use, although the meters are no longer manufactured.

The first Stanley meters were very large and very expensively constructed. The size was afterward greatly reduced, but the same important features were preserved as in the first meters. The most important part of these Stanley meters was the magnetic suspension, or flotation, for the moving element, to eliminate jewels and the de-



TYPE W FORT WAYNE SINGLE-PHASE WATTMETER.

terioration of accuracy on light load due to the latter. The armature was carried by a thin tubular steel shaft, held laterally by a very fine steel piano wire, the latter being stretched tight between top and bottom screws in the frame of the meter. The shaft was supported on the wire at proper height by the attraction of a powerful permanent magnet, having its poles at the top and bottom of the shaft, the latter being surrounded by bushings shaped so that the pull upon the top and bottom of the shaft would be about equal, thereby keeping the armature correctly located in the gaps of the driving and damping-magnet systems, but without any support to turn against either at the top or bottom.

This scheme worked out beautifully in practice in thousands of meters made by this company, the principal objection being that it was considerably more expensive than any form of jewel bearing and required great accuracy in manufacture.

The variation in effect of the damping magnet or magnets in Stanley meters was obtained without moving the magnets with respect to the disk, as their damping effect was varied by moving up or down an adjustable pole piece, which varied the gap between the pole piece in which the disk rotated, thereby varying the total strength of the damping-magnet field and giving a wide range in adjustment for the main speed.

The type "H" Stanley meter, brought out about two years ago, had a very ingenious jewel bearing instead of magnet flotation, designed to eliminate the trouble found with the ordinary cupped jewel. This was the meter called the "rotated-bearing" type. The jewel was set in the end of a small shaft at 45 degrees to the armature spindle or shaft, the jewel shaft being held in a support on the frame of the meter and having a small gear at its lower end driven from the last wheel of the recording train, which was placed below the damping disk, instead of above, as in other induction meters. The motion imparted to the jewel in this way was very slow, but was sufficient to present continuously new points on the jewel to the tip of the armature spindle. This tip was held against a spring placed within the hollow shaft of the armature, so as to act as a cushion and absorb vibration of the latter to a considerable extent.

It is said that meters with this rotated-jewel bearing have been run over 100,000,000 revolutions at a rate of 200 revolutions per minute, with the damping magnet removed from the meter, without showing any sign of injury to the jewel or pivot.

The other features of the Stanley meters as to arrangement of the alternating fields with respect to the armature, etc., were much the same as in other induction meters.

The Scheeffer meters which have been on the market in several types for many years operate on the same principle as the Westinghouse meter and have had features of construction in common with some of the other meters. These meters are no longer manufactured for the American market.

The Gutmann meter, which was manufactured until about three years ago, and of which a number are still in use, had some interesting features different from other induction meters.

The armature was slotted in spiral lines, instead of being blank, the presence of the slots and their shape being for the purpose of obtaining as high torque as possible with the fields as used in this meter, and also causing the mode of operation of the meter to be somewhat different from other induction meters.

The Gutmann meter had a single damping magnet acting upon the slotted disk on the opposite side of the meter from the shunt-driving magnet. The armature was quite light, and this shaft had the lower tip resting on an ordinary cupped jewel.

The meter was very simple in construction, easy to calibrate and easy to repair, but was not of as high torque with respect to the weight of the moving element as some of the later induction meters.

[*To be concluded.*]

The President on Corporation Control and Industrial Training.

In his message to Congress, dated December 3d, President Roosevelt has the following to say concerning corporation control and industrial training:

"The reactionary or ultraconservative apologists for the misuse of wealth assail the effort to secure such control as a step toward Socialism. As a matter of fact, it is these reactionaries and ultraconservatives who are themselves most potent in increasing socialistic feeling. One of the most efficient methods of averting the consequences of a dangerous agitation which is 80 per cent. wrong is to remedy the 20 per cent. of evil as to which the agitation is well founded. The best way to avert the very undesirable move for the governmental ownership of railways is to secure by the government on behalf of the people as a whole such adequate control and regulation of the great interstate common carriers as will do away with the evils which give rise to the agitation against them.

"So the proper antidote to the dangerous and wicked agitation against the men of wealth, as such, is to secure, by proper legislation and executive action, the abolition of the grave abuses which actually do obtain in connection with the business use of wealth under our present system—or, rather, no system—of failure to exercise any adequate control at all. Some persons speak of it as if the exercise of such governmental control would do away with the freedom of individual initiative and dwarf individual effort. This is not a fact. It would be a veritable calamity to fail to put a premium upon individual initiative, individual capacity and effort; upon the energy, character and foresight which it is so important to encourage in the individual. But as a matter of fact the deadening and degrading effect of pure Socialism, and especially of its extreme form, Communism, and the destruction of individual character which they would bring about, are in part achieved by the wholly unregulated competition which results in a single individual or corporation rising at the expense of all others until his or its rise effectually checks all competition and reduces former competitors to a position of utter inferiority and subordination.

"In enacting and enforcing such legislation as this Congress already has to its credit, we are working on a coherent plan, with the steady endeavor to secure the needed reform by the joint action of the moderate men, the plain men who do not wish anything hysterical or dangerous, but who do intend to deal in resolute common-sense fashion with the real and great evils of the present system. The reactionaries and the violent extremists show symptoms of joining hands against us. Both assert, for instance, that if logical, we should go to government ownership of railroads and the like; the reactionaries, because on such an issue they think the people would stand with them, while the extremists care rather to preach discontent and agitation than to achieve solid results. As a matter of fact, our position is as remote from that of the Bourbon reactionary as from that of the impracticable or sinister visionary. We hold that the government should not conduct the business of the nation, but that it should exercise such supervision as will insure its being conducted in the interest of the nation. Our aim is, so far as may be, to secure, for all decent, hard-working men, equality of opportunity and equality of burden.

"The actual working of our laws has shown that the effort to prohibit all combination, good or bad, is noxious where it is not effective. Combination of capital like combination of labor is a necessary element of our present industrial system. It is not possible completely to prevent it; and if it were possible, such complete prevention would do damage to the body politic. What we need is not vainly to try to prevent all combination, but to secure such rigorous and adequate control and supervision of the combinations as to prevent their injuring the public, or existing in such form as inevitably to threaten injury—for the mere fact that a combination has secured practically complete control of a necessary of life would under any circumstances show that such combination was to be presumed to be adverse to the public interest."

* * *

"It would be impossible to overstate (though it is, of course, difficult quantitatively to measure) the effect upon a nation's growth to greatness of what may be called organized patriotism, which necessarily includes the substitution of a national feeling for mere local pride; with as a resultant a high ambition for the whole country. No country can develop its full strength so long as the parts which make up the whole each put a feeling of loyalty to the part above the feeling of loyalty to the whole. This is true of sections and it is just as true of classes. The industrial and agricultural classes must work together, capitalists and wageworker must work together, if the best work of which the country is capable is to be done. It is probable that a thoroughly efficient system of education comes next to the influence of patriotism in bringing about national success of this kind. Our federal form of government, so fruitful of advantage to our people in certain ways, in other ways undoubtedly limits our national effectiveness. It is not possible, for instance, for the national government to take the lead in technical industrial education, to see that the public-school system of this country develops on all its technical, industrial, scientific and commercial sides. This must be left primarily to the several states. Nevertheless, the national government has control of the schools of the District of Columbia, and it should see that these schools promote and encourage the fullest development of the scholars in both commercial and industrial training. The commercial training should, in one of its branches, deal with foreign trade. The industrial training is even more important.

"It should be one of our prime objects as a nation, so far as feasible, constantly to work toward putting the mechanic, the wageworker who works with his hands, on a higher plane of efficiency and reward, so as to increase his effectiveness in the economic world, and the dignity, the remuneration and the power of his position in the social world. Unfortunately at present the effect of some of the work in the public schools is in the exactly opposite direction. If boys and girls are trained merely in literary accomplishments, to the total exclusion of industrial, manual and technical training, the tendency is to unfit them for industrial work and to make them reluctant to go into it, or unfitted to do well if they do go into it. This is a tendency which should be strenuously combated. Our industrial development depends largely upon technical education, including in this term all industrial education, from that which fits a man to be a good mechanic, a good carpenter or blacksmith to that which fits a man to do the greatest engineering feat. The skilled mechanic, the skilled workman, can best become such by technical industrial education. The far-reaching usefulness of institutes of technology and schools of mines or of engineering is now universally acknowledged, and no less far-reaching is the effect of a good building or mechanical trades school, a textile, or watchmaking, or engraving school. All such training must develop not only manual dexterity but industrial intelligence. In international rivalry this country does not have to fear the competition of pauper labor as much as it has to fear the educated labor of specially trained competitors; and we should have the education of the hand, eye and brain which will fit us to meet such competition.

"In every possible way we should help the wageworker who toils with his hands and who must (we hope in a constantly increasing measure) also toil with his brain. Under the Constitution the national legislature can do but little of direct importance for his welfare save where he is engaged in work which permits it to act under the interstate-commerce clause of the Constitution; and this is one reason why I so earnestly hope that both the legislative and judicial branches of the government will construe this clause of the Constitution in the broadest possible manner. We can, however, in such a matter as industrial training, in such a matter as child labor and factory laws, set an example to the states by enacting the most advanced legislation that can wisely be enacted for the District of Columbia."

Merger of Washington Electric Properties.

A report from Spokane, Wash., says that Isaac W. Anderson of Spokane has been elected chief executive officer of a company backed by Philadelphia men for the consolidation of 14 electric power, railway and light plants. The various plants mentioned are located at Eugene, Springfield, Albany, Cottage Grove, Corvallis, Seaside, Roseburg, Baker City and Walla Walla, Wash., and Pendleton, Dallas and Albany, Ore.; also gas plants at North Yakima, Wash., and Lewiston, Idaho. The plants are valued at $6,000,000. It is understood others are to be taken over. A. L. Welch of Portland, Ore., is manager of the consolidated properties.

Automatic Starting Compensator for Induction Motors.

Simple as is the construction of the squirrel-cage type of induction motor, the fact that the larger sizes require a suitable starting device has prevented the simplicity of the motor from being widely taken advantage of when automatic methods of control are essential. The automatic starting compensator recently perfected by the General Electric Company, for three-phase induction motors, will therefore greatly broaden the field for motors of this type, especially in pumping and similar work.

The automatic starter consists essentially of a

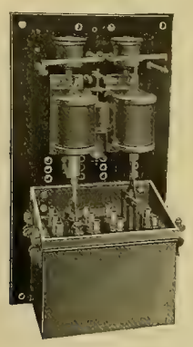


FIG. 1. AUTOMATIC STARTING COMPENSATOR.

compensator with two oil-immersed switches, the starting and running positions of which are controlled by two solenoid magnets interconnected by a time-limit relay device. One solenoid switch connects the motor to the compensator, while the second solenoid throws the motor directly on the line. The time allowed for letting the motor come up to speed between the two operations is provided for by an adjustable dashpot auxiliary switch. An interlocking device prevents both solenoid switches being closed at the same time. The motor is started by closing a small push-button switch.

The arrangement of these various parts is shown in the illustration, Fig. 1. At the left is the solenoid operating the compensator switch; at the right the solenoid which throws the motor directly on the line, while the relay switch is mounted in the center.

The feature which contributes most to the successful operation of the device is the arrangement of the main solenoid switches by which the operating circuits are broken when the solenoid core is drawn up into the closed position. The cores, as they rise, trip a switch in their energizing circuits, so that the solenoid coils do not remain in the circuit. Each core is held in the closed position by means of a detent controlled by a small auxiliary solenoid, which, when energized, merely serves to hold the core up, floating in its magnetic flux. When the motor is running, the only coil energized is this small auxiliary solenoid which controls the detent of the line-switch solenoid.

Thus, all operating circuits except the main-line switch and the one small solenoid are open,

FIG. 2. FLOAT SWITCH.

and there is no disagreeable humming or energy wasted in auxiliary circuits. The solenoids are all wound for single-phase, so that they can be operated from one leg in the circuit.

In starting up a motor a small push-button switch is closed, energizing the left-hand solenoid, which throws the compensator into circuit. At the same time the auxiliary relay switch is lifting its core against the retarding action of the dashpot, and after an adjustable interval of time this switch disconnects the starting solenoid, energizes the right-hand solenoid, and thus throws the motor directly on the line. When the motor is running, the compensator is cut entirely out of the circuit.

To stop the motor, the push-button switch is opened, the small auxiliary solenoid core falls on the detent, thus disconnecting the line switch and leaving all spool circuits opened until the push-button switch is again closed. Failure of current acts in the same way as opening the push-button switch.

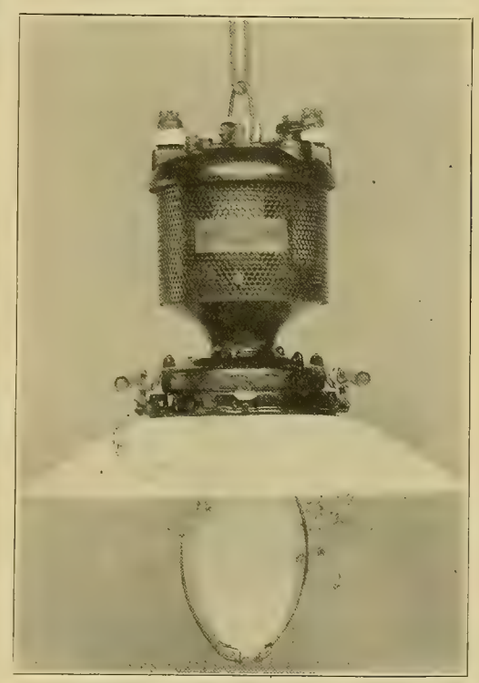
This automatic compensator can be supplied where the remote starting and stopping of three-phase induction motors is necessary. In pumping, the push-button switch may be replaced by a float or pressure switch (Fig. 2). A single-pole float switch can be used, and when the water is to be controlled by pressure, the type M. C. governor, similar to that employed in air-brake work, can be substituted for the push-button switch. These are but two of the many ways of applying the automatic compensator which will suggest themselves.

The automatic compensators described are built for circuits employing a potential up to 550 volts. For circuits operating at higher potentials the General Electric Company provides a series transformer to step down the voltage for the energizing coils. The compensator coils are provided with the usual taps for adjustment to various starting conditions. External enclosed switches are used in the circuit when the motor is across the running side of the compensator switch.

New Special-design Short Arc Lamp.

The accompanying illustration is a view of a new-design short lamp, adapted for 110 or 220 volts direct current, possessing many features of excellence in design and numerous commendable points in material and workmanship. Efforts to produce a lamp adapted for low ceilings have hitherto resulted in the production of more or less unsightly forms of lamps, all lacking in symmetry of design and compactness.

In the Western Electric Company's new lamp the over-all length has been reduced to what is



IMPROVED SHORT ARC LAMP.

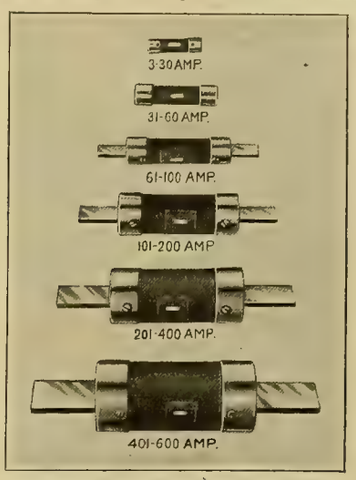
said to be the lowest practical minimum, being but 20 inches from the top of the lamp to the lower end of the enclosing globe, this, too, without reducing the length of the carbons so greatly as to materially cut down the life under that given by an ordinary five-ampere lamp. A life of 100 hours with each trimming is guaranteed. Instead of the large bulky case which is ordinarily found in short lamps, this lamp, by reason of the use of indestructible windings and specially designed resistance units, is of very small dimensions and quite as symmetrical in design as the regular well-known types of lamps manufactured by this company.

Special attention has been paid in the construction of this lamp to secure adequate ventilation while at the same time protecting the regulating mechanism from harmful accumulations of dust. These lamps are often placed in basements and low rooms, where the heat accumulating is often very great, such as boiler rooms and engine rooms, and their design has been with special reference to such service. In the choice of material for the different parts, only such as has been found best adapted for the purpose has been made use of, and this, combined with excellence of workmanship and care as to the accuracy of detail parts, has produced a lamp which, it is asserted, can be relied upon for years of service with but little expense for maintenance.

In the new lamp, provision is made to preserve the lamp absolutely from injury, even where fuses are entirely omitted, and the lamp may stand with the arc absolutely short-circuited for hours, it is said, without material injury, and will be found ready for normal operation the moment proper conditions are restored.

Enclosed Fuses.

For 18 years the Chicago Fuse Wire and Manufacturing Company has been making fuse wire and fuse links, and has earned for its product an enviable reputation for accuracy and reliability. When the electrical interests and insurance associations demanded that fusible protectors be of enclosed pattern, this company decided to equip its factory with facilities to supply this demand, and it has enlarged these facilities several times. The accompanying picture is of a sample board being prepared for distribution among jobbing houses. This collection covers not only the 250-volt National Electrical Code line, but samples of old Code material for 250 and 500 volts. These fuses, constructed in accordance with the standard dimensions as specified by the National Electrical



SAMPLE BOARD OF ENCLOSED FUSES.

Code for 3-600 amperes, 250 volts, have been approved by the Underwriters' Laboratory of Chicago and the Factory Mutual Laboratory of Boston, and are included in the lists of approved fittings promulgated by them.

The Chicago Fuse Wire and Manufacturing Company has spent much time and money in carefully investigating the enclosed-fuse problem, which has resulted in the development of a product that is in consistency with its well-known fuse wire and fuse links. Over 1,200 tests have been conducted in compiling the tables of elements that would insure the highest degree of accuracy desired.

An important feature of any enclosed fuse is the powder filler which surrounds the fusible element, its functions being twofold, first, to secure greater degree of uniformity of conditions and consequently higher accuracy in rating; second, the filler, in smothering down the arc at time of break in circuit, assists in securing safety operation. Yet to meet these two purposes the requirements of a filler are exacting.

Besides the National Electrical Code enclosed fuse, the Chicago Fuse Wire and Manufacturing Company is prepared to furnish all old Code fuses of any desired type or dimension, as well as special fuses, to meet the requirements of any particular class of work. The object of the company is to cover completely and thoroughly the entire field of electrical fuses, and supply the wants of its customers, whether they desire rated fuse wire on the spool, open fuse links or enclosed tubular fuses, promptly and satisfactorily. The fuse department is under the direction of Mr. C. T. McDonald, its electrical engineer, who, prior to his association with this company, was under W. H. Merrill as an engineer in the electrical department of the Underwriters' Laboratories. In this position he was called upon to make repeated tests and note the good and bad points of not only every enclosed and open fuse but also most every type of circuit-breakers and protectors on the market. In this connection Mr. McDonald has drawn his own conclusions as to what constitutes a safe and reliable protector, and has embodied them in the Union fuse.

Pacific Gas and Electric Company May Change Hands.

Writing under date of December 13th the San Francisco correspondent of the Western Electrician says: "There is understood to be a foundation in fact for the reports that the Pacific Gas and Electric Company, which is the holding company for the California Gas and Electric Corporation and the San Francisco Gas and Electric Company, has arranged to sell out to the Western Power Company. The Gould interests, which are building the Western Pacific Railroad from Salt Lake City to San Francisco, in order to complete an additional transcontinental railroad system, are also prominent in the Western Power organization. It is known that negotiations

are pending for the purchase of the Pacific Gas and Electric system.

"The Western Pacific Railway, which is to be completed in about two years, will be a large user of electric power in time. The Southern Pacific company, in the meantime, is not idle regarding the securing of sources of electric power, in case a supply of cheap electric power from the Pacific Gas and Electric system is not available. It is understood that the Southern Pacific interests control important water rights in Northern California and in Oregon that can be utilized for the production of electric power for operating main-line trains over many miles of its mountain divisions, and have engineers at work on plans."

New Application of Multiple-voltage System.

Applications of the well-known Ward Leonard multiple-voltage system of variable-speed control, the American manufacturing and selling rights for which are controlled by the Allis-Chalmers Company of Milwaukee, have been made in numerous industries throughout this country and in Europe, including cloth-printing establishments, railroad shops, machine shops, and wherever variable speeds are required from motor-driven machine tools. An interesting description was recently read before the British Institution of Electrical Engineers of the hoisting installation at the Zollern II. Colliery in Germany, where use is made of electrical equipment involving the Ward Leonard system of voltage control.

The armatures of the hoisting motors are connected directly without switches to the armature of a generator, the voltage of which can be varied at will, the field strength of the hoisting motors being maintained at a constant value. The winding drum is driven by two direct-current motors, each of which is rated at 750 horsepower at 500 volts. These motors receive their power from a motor-generator, a description of which is given below. The whole of the starting, stopping, speed regulation and reversing is done by one switch, which operates a resistance placed in the shunt-field circuit of the generator of the motor-generator set. By this means only currents of small magnitude are dealt with, the burning of contacts is avoided, and heavy and expensive resistances are not necessary. Practically no power is wasted in resistance when the winding drum is run at reduced speeds. A small amount of energy is returned to the motor-generator from the winding motors during retardation, and this is usefully applied in accelerating the enormous flywheel used with the motor-generator instead of being consumed by friction in braking.

Main generating equipment consists of two engine-driven 525-volt 1,100-kilowatt direct-current generators, which supply power to the whole of the machinery at the colliery. A single generator is sufficient to supply power to the electric hoisting equipment, the washery, fans, air compressors, workshops and pumps.

The most interesting part of the electrical installation is the motor-generator referred to above. This machine is used to prevent abnormal fluctuations in the demand for power from the main generators. The starting of the winding drum would have necessitated a tremendous rush of current from the generators if the usual type of equipment had been employed. The motor-generator consists of a shunt-wound generator direct-connected to a 15-ton flywheel and a special variable-voltage generator. The flywheel is of steel and runs at a peripheral speed of 14,000 feet a minute. It is placed between the two bearings of the set, the armature of the motor being mounted outside of the bearing, and that of the other outside of the other bearing. Although the motor is rated at only 300 effective horsepower, the generator has an output of 1,000 kilowatts when excited to full electromotive force of 550 volts. The latter machine is especially designed. It is provided with a double commutator and a special field magnet, having auxiliary poles with series windings to prevent sparking. The main field coils are shunt wound and are supplied with current from the main generators. By this means any desired electromotive force is obtained for operating the hoisting motors.

Although the current taken by the hoisting motors during starting was 1,500 amperes, decreased to 1,000 amperes as the hoisting motors reached full speed, and became 500 amperes when the drum was brought to rest, the current taken from the main generators by the motor of the motor-generator set varied from 100 while the drum was being started, to 450 when the drum reached full speed, and decreased to zero when the drum was being brought to rest.

The Village Council of Coopersville, Mich., has closed a contract with the Grand Rapids-Muskegon Water Power Company to light the streets of the village. The contract calls for 40 100-candlepower lamps. The company will also furnish commercial lighting and power

Insulator Clamps for Long-span Transmission.

The accompanying illustrations show some useful devices which are now being generally adopted to take the place of tie-wires on long-span electrical transmission systems. The clamp shown in Fig. 1 is designed to securely hold the cable or transmission conductor in the groove of the insulator. The insulator, shown in Fig. 2, is constructed with an undercut recess on either side of the groove in the center of the insulator top, so that when the clamp is in position it is interlocked

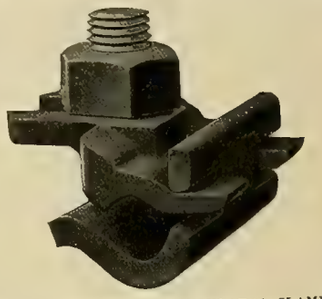


FIG. 1. INTERLOCKING INSULATOR CLAMP.

under the projecting portion in such a manner that the wire cannot be removed or the clamp separated from the insulator without unlocking the clamp.

Construction is such that the end strain on the clamp is distributed so that excessive pressure can at no time be concentrated on a small area of porcelain, and at the same time sufficient clearance is allowed so that the cable and clamp together may move freely when the cable or conductor is in place in the insulator, avoiding the hinge action which takes place when the wire is rigidly held in the insulator.

The heavy construction now adopted for long-span transmission requires that the fastening between the conductor and supports should be strong enough to stand the normal maximum strain calculated for the line under differing weather conditions. To increase the efficiency of the transmission line, steel towers, steel pins and heavy insulators are now being generally used, and experience has proved that, to be consistent with this

FIG. 2. POSITION OF CLAMP IN INSULATOR.

construction, stronger and more reliable fastenings than are provided by the tie-wire should be used.

These insulator clamps are manufactured by the Clark Electric and Manufacturing Company, 135 Broadway, New York city, which is putting on the market many different designs of clamps to suit every requirement, both for the regular standard shape of insulator and special insulators of its own design.

Minnesota Company Refused Permission to Divert Canadian Water.

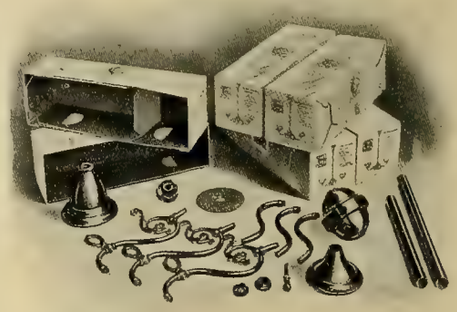
A recent dispatch from Ottawa, Ont., says: "The International Deep Waterways Commission has reported against the application of the Minnesota Canal Power Company of Duluth for authority to divert certain waters from the Birch Lake drainage basin in Lake and St. Louis counties, Minnesota. If granted, it would materially affect the water level in Rainy River, New Ontario. The city of Winnipeg, the town of Fort Francis, the Ontario and Minnesota Power Company, E. W. Backus, holder of certain power concessions from the Ontario government, the Koochiching Company and the Rainy River Improvement and Navigation Company all resisted the application.

"The commission suggested the adoption of a treaty between the United States and Canada, to settle rules and principles to govern the diversion of international waterways, but recommended that such waters be used freely by both sides for navigation purposes and for locks used for purposes of navigation. The people in the Rainy Lake country are well satisfied with the result, because the granting of the concession would have meant the loss of practically all waterpower on the Canadian side of the line."

New "Box Line" Fixtures.

The Cleveland Gas and Electric Fixture Company of Cleveland, Ohio, manufacturer of a general line of lighting fixtures, with sales departments in Cleveland and Pittsburg, is completing the erection of a new factory in Conneaut, Ohio, with about 75,000 square feet of floor space and a full equipment of improved machinery. The company intends to greatly increase its output of gas and electric-lighting appliances, particularly with reference to serving the requirements of electrical dealers in the United States and Canada. It will manufacture a staple line of what it calls the "C" line of "box" fixtures, illustrated herewith, which will comprehend all requirements in low and medium-priced fixtures, and to manufacture which the new factory, with its furnishings, is provided. Already a portion of the factory is in operation, and the company is considerably oversold on these goods. It fully expects to meet all demands with prompt shipments by January 1st and thereafter.

The parts of each fixture of the "box line" are contained in a pasteboard box measuring 14½ by 4½ by 4½ inches, which assures that there will be



NEW "BOX LINE" FIXTURES.

no lost parts when the fixture is ready to assemble, and also that the fixture will be kept clean and untarnished until ready for installation.

The "box line" fixture is a unique idea and an innovation in the fixture trade, and is so thoroughly practicable and valuable that this company has applied for a patent on the idea. Fixtures packed in this manner are especially valuable for those who carry goods in stock, as they take but little space, and a great variety of the goods can be carried in a small space. A neat and attractive pamphlet is issued by the company, which covers fully the various points on the fixture and will be mailed on application to the general offices, Cleveland.

A New Interurban Road for Texas.

Contracts have been let by the Texas Traction Company for the equipment of a 65-mile electric road between Dallas and Sherman, Texas. The new line will parallel the existing steam road between the two cities and will be one of the longest electric roads in the state. While the apparatus is standard direct-current throughout, the equipment, in some respects, presents several features of interest.

The country through which the new line is laid out is flat and rolling, there being no grades exceeding one per cent., and a maximum curvature of but three degrees. In order to have a clear headway for operating cars, a private right-of-way has been established by the company, so that the run between Dallas and Sherman will be made in two hours and 30 minutes. This schedule includes a 15-minute run within the city limits of Dallas, where the cars must necessarily be operated at lower speeds. While the main traffic will be of an express nature, stops have been provided about every two miles to take care of the local travel.

Fifteen car equipments will be provided to maintain the initiative schedule. These will be of the standard interurban type, each 50 feet long and equipped with four GE-73 (75-horsepower) standard direct-current motors equipped with the Sprague-General Electric type M system of multiple-unit control. Each car will be further provided with General Electric air brakes and compressors.

Power for the new road will be generated by steam at McKinney, a town located about midway between Dallas and Sherman. The main power-station equipment will include two 1,000-kilowatt Curtis steam turbo-generators, working under a steam pressure of 150 pounds at the throttle with 125 degrees superheat. The turbines will operate condensing. Current will be generated at 2,200

volts and 25 cycles and stepped up for transmission to 19,100 volts. For exciting the fields, two 35-kilowatt generator sets will be provided. The compactness and low-maintenance charges of these machines adapt them particularly for exciting units.

The three-phase current from each of the turbo-generators will be transformed in a set of three 330-kilowatt air-blast transformers. One transformer of the same capacity will be installed as a reserve. To supply air for cooling, duplicate blower sets will be furnished, one set being driven by an induction motor, the other by a direct-current motor. Each blower will have a capacity of 10,000 cubic feet.

One of the special features of interest in the new road lies in the rotary-converter equipment. Six sub-stations will be provided, including one at the main station and a portable equipment. This last-mentioned sub-station comprises a special car containing a 300-kilowatt rotary converter, air-blast transformers and suitable switching apparatus for cutting into the transmission system wherever necessary. The portable sub-station renders unnecessary the duplication of rotary converters at the fixed sub-stations, for the portable equipment can be shifted to various parts of the line and used as an emergency station or auxiliary in case of need.

Regular sub-station equipments are to be provided at the main station and at four points distributed along the railroad. Each of these sub-stations will be equipped with a 300-kilowatt 600-volt rotary converter, with the necessary switchboards, oil-cooled transformers and lightning arresters.

The sub-stations will be interconnected by high-tension transmission lines, operated initially at 19,100 volts. Eventually, however, a transmission potential of 33,000 volts will probably be used, and for this purpose taps will be provided for Y connection of the transformers. With the few exceptions noted, the new line follows, in general, the standard direct-current practice of the General Electric Company.

Michigan Telephone Managers Organize.

The Independent Telephone Managers' Association of Michigan was organized at a meeting of some 60 representatives of Independent interests held in Jackson last week. There were 35 companies represented. The object of the association, as set forth in the constitution, is to discuss papers and subjects pertaining to the operation, maintenance, accounting service, interchange of toll service, etc., of the Independent telephone companies. There is in the state an organization of Independent telephone companies where the broad problems of telephony are discussed, but the new association will consider only the practical problems of the business, none of its politics.

The officers elected are as follows: President, F. B. Newman, manager of the Citizens' Telephone Company, Grand Rapids; vice-president, William J. Robinson, manager of the Citizens' Telephone Company, Muskegon; secretary-treasurer, H. T. Clough, manager of the Union Telephone Company, Owosso.

Any employe of an Independent telephone company operating in the state of Michigan, who holds a position as manager, wire chief, chief troubleman or head of any department or who is engaged in the routine work of telephony, is eligible to active membership. Presidents, vice-presidents, etc., are eligible to associate membership, but have no right to vote on any subject connected with the management of the association. The annual dues are fixed at $2.

The Jackson meeting opened on Tuesday and closed Wednesday morning. A. F. Burch, manager of the Citizens' Telephone Company of Battle Creek, in a paper on "Conduct and Personal Appearance of Employes," urged the necessity for courtesy in the treatment of patrons as essential to the building up of a successful business. Thoughtfulness of others and neatness of appearance were declared prime factors of good employes. Mr. Burch got the points for his paper by asking three of his inspectors each to write a paper on what constitutes a good inspector. "Switchboard Troubles" were discussed by C. R. Kehoe, manager of the Citizens' Telephone Company of Jackson, who urged the education of inspectors by manager or wire chief as the best method of eliminating these troubles.

Other papers were: "How Check Errors can be Avoided," W. B. Vivian, manager of the clearing house; "How to Improve Interchange Toll Business," H. T. Clough, manager Union Telephone Company, Owosso; "Rural Lines," C. R. Smith, manager Homer Telephone Company, Homer; "How to Encourage the Use of Long-distance Lines," F. M. Howard, manager Valley Telephone Company, Flint; "The Good this Association May Do," W. J. Robinson, manager Citizens' Telephone Company, Muskegon; "The Value of Discipline," C. B. King, manager Washtenaw Home Telephone Company, Ann Arbor; "The Value of Independent Telephone Service to a Business Community," F. V. Newman, Citizens' Telephone Company, Grand Rapids.

The next meeting is to be held in six months. The place was left to the executive committee, but Lansing is favored by the membership. At the next meeting of the association the chief operators will be in attendance to give them an opportunity to get acquainted and to establish a bond of helpfulness.

Southeastern Telephone Developments.

A very important decision has been reached by the corporation commission of the state of North Carolina, involving the question of establishing a new and lower telephone tariff by the Bell company. The secretary of state of North Carolina filed a complaint with the commission last April and asked for a reduction of rates, and that charges be made according to the time the telephones were used in long-distance service. The commission in its decision holds that a rate based on distance is the only fair method to pursue, and the complaint of the secretary of state is thereby without results.

A new $17,000 telephone exchange building has been contracted for by the Bell Telephone Company of Missouri, to be located at Belleville, the contract for the construction work having been let to the Southern Illinois Construction Company.

The Southern Bell Telephone Company is extensively engaged in the work of placing its wires underground in Richmond, Va., and it is now understood that most of the work has been completed.

The Carolina Telephone and Telegraph Company proposes to install a system in the town of La Grange, N. C.

The Tristate Telephone Company of Osceola, Ark., has filed a certificate with the secretary of state showing an increase of $120,000 in its capital stock, and a change of name to the Tristate Telephone and Telegraph Company.

The new underground telephone system of the Bell company at Asheville, N. C., has been completed and is working in excellent order.

Telephone News from the Northwest.

The Zenith Telephone Company will install a new exchange for West Duluth. The company has secured what is regarded as a perfect party-line system, which will be installed.

Edward Barron has succeeded S. D. Hastings, Jr., as manager of the Wisconsin Telephone Company's exchange at Green Bay, Wis.

W. J. Whistler of Hayward, Wis., has sold the Spooner telephone exchange to G. H. Ross of Chetek.

The Winona (Minn.) Telephone Company proposes to rebuild its plant and to put in an automatic system.

The Mesaba Telephone Company will erect a new building at Chisholm, Minn., for its central office and will make other changes.

George W. Price has decided to move his factory for the manufacture of telephone and telegraph cross-arms from Wonewoc to Crandon, Wis. R.

GENERAL TELEPHONE NEWS.

The Galena Mutual Telephone Company has made application for a franchise to operate a telephone system in Galena, Kan.

Members of the state traffic committee of the Independent Telephone Association of Michigan were in Grand Rapids on December 14th to discuss the extensions necessary to connect Grand Rapids and Detroit with Chicago. This was the regular quarterly conference of the traffic committee of the Clearing House Association. Those present were: W. B. Woodbury, Home Telephone Company, Detroit; H. A. Price, Saginaw Valley Telephone Company; F. M. Howard, Saginaw Valley company, Flint; C. L. Norton, United States Telephone Company, Cleveland, Ohio; W. J. Melchers, Union Telephone Company, Alma; C. E. Tarte, Citizens' Telephone Company, Grand Rapids.

The Merchants' Association of Joliet, Ill., has petitioned the Chicago Council urging that no telephone franchise be granted unless communications were made with out-of-town telephones. The petition was referred to the gas, oil and electric-light committee. Alderman Young, chairman of the gas, oil and electric-light committee, introduced an order in the council this week, which was passed, that the finance committee appropriate a sufficient sum to employ telephone experts and engineers and for stenographic work in the preparation of the report of the committee on rates. The committee wants the advice of experts before granting a franchise to any telephone company.

CORRESPONDENCE.

Continental Europe.

Paris, December 6.—The French Thomson-Houston Company has been making experiments with single-phase traction on a short section of tramway line in the suburbs of Paris, using a car fitted with the Latour motor. Current for the experimental line is furnished by a sub-station erected nearby containing a 500-volt direct-current motor coupled to a single-phase alternator. The latter machine supplies single-phase current at 500 volts and 25 cycles. On the car are mounted two Latour ironclad four-pole motors, each of which will give 50 horsepower. A low voltage had to be used on the trolley wire, as the regulations will not allow of going higher than 500 volts. A transformer mounted on the car lowers the voltage to 300 for the motors.

In the annual Automobile Show, which is to be held in the Grand Palace during the greater part of December, the electric lighting is to be made one of the special features. Mercury-vapor lamps will be grouped in the center of the cupola, forming a centerpiece, from which will radiate bands of incandescent lamps, so as to give a very handsome effect, owing to the combination of the two colors. It is said that over 80,000 lamps are to be used.

Tests upon the new metallic-filament incandescent lamps continue to be carried out in Germany. Not long ago four of the Wolfram lamps of the 110-volt type were tested and were found to run on 57 watts for 57.2 candlepower, which is very close to one watt per candle. Osmium and tantalum lamps tried at the same time were found to have a much lower efficiency, this being 1.76 and 1.61 watts per candle, respectively.

Revolving electric cranes of the tower pattern are brought out in Germany by different firms. One of the most successful of these is the type of crane built by the Carl Flohr firm, and two of these are now operating at the port of Bremen, where they are used for unloading coal. What is noteworthy about this crane is that efforts are made to reduce the weight of the fixed as well as the moving parts, so that there is less pressure upon the rails of the track. Such a crane will handle 45 tons an hour, and takes about 300 watt-hours for 1.7 tons of coal.

A new train-lighting system is in use on the Kathiawar narrow-gauge railroad in India. The generator, of the Vicarino-Crawford type, is mounted on the car axle, and it charges two sets of storage batteries, which are alternately placed upon the circuit. However, the dynamo is not placed under the end car, but is in the middle of the train and mounted on the axle of a first-class carriage. This is done in order to reduce the fire risk to the inflammable material which is often carried in the end car, and it also gives a shorter wiring for the train. Designed for one kilowatt, the generator charges the batteries at 32 volts in two groups, having a total of 180 ampere-hours. The batteries are sufficient for lighting a train of 16 cars, and the cost of the system is about $1,700.

In order to provide for the extension of the telephone system at Hamburg, a number of cables were laid under the water of the Aussenalster, which connect with the underground cables. The new cables are about 1,100 feet in length and are lead-covered, measuring four inches over all, and containing 250 double wires each. They are laid at a depth of seven feet in the water.

It is proposed to utilize Lake Constance for storing up a large quantity of water from the Rhine, so as to secure a supply of power, and in this way it is estimated that some 90,000 horsepower can be obtained. A large hydro-electric plant would be built not far from the lake, and would send current over a wide area. The estimated cost of the undertaking, as far as the hydraulic work upon the lake is concerned, is somewhere near $1,200,000.

The electrochemical industry in Italy is in a prosperous condition at present. Quite a number of hydro-electric plants are now operating for this purpose. These are in the hands of eight different companies, representing a total capital of $5,000,000. Carbide of calcium and soda are the principal products from these plants.

One of the most recent Swiss projects is that of using electric traction on a part at least of the St. Gothard railroad. Current would be furnished from a hydraulic plant located in the upper part of the Lessin basin. Should the project for securing current from the Rhone at Monthoux be carried out, Paris would receive hydraulic power for the first time over a 240-mile pole line. Using a 220-foot head of water, it is estimated that 100,000 horsepower could be obtained. The project calls for no less than 48 generating groups, using the high-voltage direct-current system, working the line at 130,000 volts. A. DE C.

Great Britain.

London, December 5.—Once again the Electricity Supply Bill has been introduced into Parliament, but seeing that we are now within a few weeks of the close of the autumn session—itself

an unusual occurrence—surely the bill might very well have been postponed until next year. Its introduction now serves no possible useful purpose. The history of this bill is a remarkable one, and it seems to fare the same, no matter which political party is in power. It first made its appearance four years ago, presumably in response to a deputation from the Institution of Electrical Engineers to the Board of Trade. The complaints of this deputation covered the whole field of the electrical industry, whereas the bill above referred to deals only with the electric-supply portion. It was pointed out that electrically we are governed by parochial legislation and not national, and that no amendment whatever had taken place in the law relating to electric lighting since 1888, while the electric tramway industry was still in the hands of legislation originally drafted to deal with horse traction as far back as 1872. To this day no serious attempt has been made to remedy these defects, although for four years the farce has been gone through of introducing the electricity supply bill. This is the more astonishing when the fact is recalled that in 1904 a House of Lords committee considered this measure, and reconciled conflicting interests to such an extent that, taken as a whole, the bill is commended by all sections of the industry. It allows intercommunication, so to speak, between neighboring supply authorities (for which at present special powers have to be obtained) and, in fact, authorizes the Board of Trade to use common sense in regard to a host of small points of detail, every one of which now have to be specially taken before Parliament.

By one of those curious ironies of fate, the meeting-house of the Landemanians in London, of which body Michael Faraday was an elder, and where he worshiped from 1862 to 1869, has been acquired by the National Telephone Company for the purpose of an exchange. It is pleasing to note, however, that the officials of the Telephone company are not devoid of a little sentiment, for they have caused to be erected upon the wall a tablet recording the fact that Faraday worshiped there, and they have also marked the spot occupied by his pew. Lord Kelvin unveiled the tablet, and there were also present two of Faraday's nieces, and a host of electrical people.

The long-promised decision of a special committee of the London County Council, concerning the periods for which loans should be granted for electric lighting plant, has now been made public. This matter is of considerable importance, for the London Borough Councils have for some time passed been granted longer periods than their provincial brethren. It should be mentioned that outside London the Local Government Boards have this question to deal with, and they have for some years been in the habit of granting only 30 years, as an all-round period, as against 42 years inside London, under the regime of the London County Council. It has now been decided to adhere to the following scale in London, viz., 60 years for freehold land, 50 years for buildings, 30 years for mains, 20 years for plant, 12 years for house connections and 10 years for meters. Although probably the average period will not be much reduced, yet the graduation is a far more sensible one than before. A little more elasticity of this sort in the provinces would also do good, for there are undoubtedly periods far too short for some plants, and far too long for others.

Dr. Drysdale, the head of the Physics Department of Northampton Institute, London, has been delivering a lecture as chairman of the students' section of the Institution of Electrical Engineers. It consisted of one long regret at the position of the electrical industry in Great Britain compared with other countries. In this respect, it is quite familiar, for not so very long ago this sort of thing was quite rampant here, and a good many people fail to see the need for the resuscitation of such arguments. But perhaps it was an essentially students' lecture. At the same time, much of the lecture was undeniable, but no remedies were given. Everyone knows that the state here has never seriously assisted industry, and that the National Physical Laboratory has done good work in spite of hopelessly inadequate support. But where the remedy? The following paragraph may be given: "It might be said that this was a commercial country, and that the great thing was to make things pay; but a comparison of company finances here and abroad showed that poor dividends were paid here, while in Germany high dividends were paid, and in America, the stock of the General Electric Company stood at 180, though the company had recently raised an additional four millions of capital for extensions; and that of the Westinghouse Company stood at 155." G.

Dominion of Canada.

Ottawa, December 15.—The City Council of London, Ont., dealing with the telephone question, has notified the Bell and Independent companies that it considers the following a reasonable rate: Business telephones, $35; residence, $15; combination, $48; office extension sets, $5, subject to five per cent. discount.

The Canadian Pacific Railway has decided to adopt the telegraphone, by which telegraph wires can be used for temporary telephonic purposes without disturbing telegraph work. Some time ago officials of the company made experiments with this mechanism on a special train. The train was stopped and telephonic connection established with Montreal and other stations within a few minutes by the simple expedient of stringing a wire from the telephone instrument in the car to the telegraph wires.

The Kakabeka Falls power plant at Fort William, Ont., has been put into operation by the Kaministiquia Power and Light Company. Connection has also been made with the Ogilvie Milling Company's new mill, one of the largest and most modern in the country capable of turning out 6,000 bags of flour a day. The successful development of the Kakabeka Falls power by the enterprise of Mr. Charles R. Hosmer and his associates means much for the twin towns of Fort William and Port Arthur.

The Ontario Railway and Municipal Board has approved of the by-law passed by the City Council of Ottawa providing for the expenditure of $50,000 in extending the civic lighting plant, the board considering that the extensions were necessary in the public interests. W.

Winnipeg, Man., December 15.—By a vote of 4,839 to 926 the ratepayers decided in favor of a municipal telephone system and the ousting of the Bell Telephone Company's system. This is looked upon as a victory for the supporters of the provincial government's telephone policy which provides for the municipal ownership of exchanges and government ownership of all long-distance lines within the province of Manitoba. During the next few weeks a number of rural municipalities and provincial towns will vote on the same question.

The Canadian Pacific Railroad has contracted for 1,000 electrical horsepower from the Kakabeka Falls Power Company, Fort William, Ont., for use in its yards at that town.

The Lethbridge Electric Light Company of Lethbridge, Alberta, has decided to install the meter system. Manager Freeman states the rates have not yet been decided upon but the meters will be installed early in 1907.

Charles H. Mitchell, hydro-electric expert engaged to report upon electric energy available for Prince Albert, Saskatchewan, states that from 1,000 to 1,500 horsepower can be developed in the Shell River at a cost of from $100,000 to $150,000. On the Saskatchewan River it will be a much bigger proposition and at least 10,000 horsepower can be developed there at a cost of approximately $350,000. For $1,000,000 a concrete dam can be built to develop over 100,000 horsepower. The council is now considering the question. Particulars may be had of J. H. Lamont, M. P. P.

The contractors at Fort Francis, Ontario, are ready to commence work on the large power dam. The power house has been planned for and will be 250 by 110 feet and 45 feet high. It will contain 23 units of power, each dynamo being of 1,000 kilowatts capacity, which will be capable of running a 20,000-barrel flour mill, a 300-ton pulp mill and several other industries. R.

New York.

New York, December 15.—Four passenger trains operated by electricity were run from the Grand Central Station on December 12th. The event, unaccompanied by any formal celebration, inaugurated the electrification of the New York Central's suburban lines, all of which, within a comparatively short time, will carry electric trains only.

The four trains were Yonkers locals, over the Harlem Division. There were three new cars to each train, each car electrically lighted, and voted by the passengers to be far superior to the old suburban equipment. Each train was run by electricity as far as Highbridge, where a locomotive was attached. From Highbridge to Yonkers steam was used, as electrification beyond Highbridge was not complete.

The equipment for the New Gansevoort and Oliver Street stations of the Borough of Manhattan, comprising 10 multi-stage, centrifugal pumps, each with a capacity of 3,000 gallons per minute, will be driven by 10 Allis-Chalmers induction motors of 800 horsepower each, which are being supplied in accordance with the specifications of the Department of Water Supply, Gas and Electricity. The stations in which these pumps and motors will be installed are identical in every way and for the present are laid out to accommodate eight pumping units, the piping being so arranged that it will only be necessary to remove the blank flanges from the tees to make the present arrangement of piping suitable for the operation of 10 units.

Lexington Avenue is to have a double-deck subway from Thirty-fifth Street to One-hundred-and-twenty-ninth Street, according to a resolution passed by the Rapid Transit Board on December 13th. Local trains will run on the upper level and the lower level will be used for express trains. It is planned that the lower set of tracks be placed about 35 feet below the street level.

The two sections of the north tube of the new East River tunnel at the Battery, through which the subway will enter Brooklyn, were joined on December 15th. Thomas Mullin, superintendent in charge of the excavations, walked through from the Manhattan end to the Brooklyn end.

On December 12th, 30 city officials made a tour of Brooklyn to investigate traffic conditions. They were taken over the various lines on a special train furnished by the Brooklyn Rapid Transit Company. In the party were Controller Metz, President McGowan, Borough President Ahearn, President Alexander Orr and John H. Starin of the Rapid Transit Company, and Bridge Commissioner Stevenson. After the trip Controller Metz, Borough President Ahearn and Commissioner Stevenson had a talk at the controller's office. They agreed on a plan to relieve the Williamsburg Bridge crush by the construction of several surface-car loops between the Bowery and Chrystie Street, in Delancey Street, the loops to be used by the rolling stock of the Brooklyn Rapid Transit Company. The officials believe that this will do much to relieve the crush at the Williamsburg Bridge.

The State Railroad Commission granted permission on December 11th to the Hudson and Manhattan Railroad Company, which is constructing the so-called McAdoo tunnels under the North River, to issue a mortgage of $100,000,000. President William G. McAdoo appeared on behalf of the application, and described the progress which has already been made with the work. "The two tunnels under the Hudson to Morton Street, on what we term our uptown line, are already completed," he said. "Between these, up Greenwich, Morton and Christopher streets to Sixth Avenue, both tubes are practically finished, with the exception of 500 feet in the southern tube. Work is also going on rapidly between Twelfth and Eighteenth streets on Sixth Avenue."

Mr. McAdoo stated that there would be no grade crossings where the tunnels cross, and went on to discuss the hopes his company has of promoting the comfort of the passengers. "We shall probably use the third rail," he said, "and our cars are to be fireproof steel. They will be of the latest construction, and we are using every effort to devise means to avoid crushes on the platforms and in the cars themselves.

"There will be doors in the middle of the cars as well as at the ends, and at the terminals we intend to provide separate platforms for loading and unloading the cars. The history of New York traffic has shown that accommodations are overtaxed as soon as they are provided, and we wish to be ready to handle the great increase in the number of passengers to New Jersey which is sure to occur." C. I. C.

Ohio.

Cleveland, December 15.—The sale of the Toledo and Western electric railway to J. R. Nutt and associates has been confirmed by Judge Tayler of the United States District Court. Attorneys for the minority stockholders have given notice that the matter may be appealed. They asked that the sale be modified, so that creditors would receive the benefits from any reduction of claims.

Kerlin Bros. of Toledo have purchased the plant of the Kenton Gas and Electric Company, the consideration being $100,000, of which $30,000 is cash and the balance is to be paid on taking possession in April.

The Ohio Electric Specialty Company of Cleveland has changed its name to the Tregoning Electric Manufacturing Company.

Business men of the Central Market district of Columbus are urging that more electric arches be installed on Fourth and Town streets.

The Columbus Railway and Light Company has declared a dividend of one per cent. on the capital stock, payable January 15th to stock of record on December 31st.

The Indiana, Columbus and Eastern electric railway has purchased property on East Rich Street, Columbus, on which to erect an interurban station. It is in the vicinity of the Scioto Valley Traction station.

For the purpose of operating the Toledo and Western railway lines, recently purchased by a syndicate headed by J. R. Nutt of Cleveland, the Toledo and Western Railroad Company has been incorporated. It is said that the property is owned by the syndicate, and for the present will need no financing. The company will probably be utilized in an operating capacity only at this time.

The Columbus Public Service Company has made a bid of 2¼ cents for the state-house lighting, using alternating current. The Columbus Railway and Light Company offered to furnish direct current at three cents or alternating current for 2¾ cents. The commission appointed to install an independent plant will hardly conclude that it is worth while when private corporations are willing to take the business at these figures.

Cleveland has another new street-railway company, which is supposed to have been formed for the purpose of protecting the rights that have been granted the Forest City Railway Company and to receive such franchises as may be granted in the future. It is known as the Low Fare Railway Company and has an authorized capital

stock of $250,000. In view of the decision of Judge Phillips on the demurrer of the Forest City to the petition of the Cleveland Electric, asking that all the grants to the former be declared void, it is interesting to know just what the new company expects to do. W. B. Colver, secretary of the Municipal Traction Company, is one of the incorporators of the new company, as is Attorney W. H. Greenlund, who has had quite a little to do with the three-cent-fare companies heretofore. Mr. Colver has secured one or two grants, and it is supposed that these will be used as a basis of operations for the new company, if the Forest City's grants should be declared void by the courts.

Grants on Harvard Street and Marcelline Avenue, in the village of Newburg Heights, have been made to J. J. Stanley and C. F. Emery, respectively, on the two-cent-fare basis, with transfers to the Cleveland Electric lines for a five-cent fare. Both these gentlemen are officers of the Cleveland Electric.

The East Liverpool Traction and Light Company is preparing to extend its line from Empire to Vanport or Beaver, Pa., and will soon have a large force of men at work. The Ohio River Railways Company and the Steubenville and East Liverpool Railway and Light Company, Ely companies, have recently disposed of $2,750,000 bonds to an eastern syndicate for the purpose of carrying out plans that have been formulated for connecting the Pennsylvania towns with Ohio and West Virginia points. O. M. C.

Michigan.

Grand Rapids, December 15.—Free transportation over the interurban railways will cease with the beginning of the new year, in accordance with the provisions of the new interstate commerce law which prohibits the issuance of passes. The new law applies to the interurban electric roads as well as to the steam roads on account of the traffic arrangements of the companies and through ticket-selling and freight-billing agreements with the Lake Michigan steamship lines.

The Kalamazoo, Gull Lake and Northern Railway Company has been organized in Kalamazoo. Dr. J. T. Upjohn of that city was elected president, Martin P. Huyck of Chicago, treasurer, and Edward D. Tosmer of Chicago, secretary and vice-president. In addition to running a line from Kalamazoo to Richland, Gull Lake, thence on to Gun Lake and Grand Rapids, the company has the franchise for the "Taylor" loop in Kalamazoo and has laid part of the same. Work on the extension to Gull Lake will begin early in the spring of 1907, and cars will be running before the season closes. The trolley system will be used.

Henry W. Melenbacker, proprietor of the Clarendon Hotel, this city, has a fender device that he is now having perfected, and hopes to put on the market. The fender is of the standard steel-tube variety, with a basket of woven ropes. It is equipped with rollers that prevent injury from dipping or striking high places while the car is under way.

Kalamazoo is to have an amusement and Chautauqua park, conducted by the Michigan United Railways. Ever since the Michigan United Railways came into possession of the street-car property in Kalamazoo it has been looking about for a suitable place to construct a large first-class amusement park. It is planned to have it in readiness for the opening of the summer season next year. The Pine Lake and Waverly Park summer resorts owned by the Michigan United at Lansing are to be improved and new features added. L. W. B.

Indiana.

Indianapolis, December 15.—The Indiana Union Traction Company was robbed of over a mile of heavy copper wire near Alexandra on the night of December 12th. The thieves cut down the wire from the poles while carrying a current of 550 volts.

The Indianapolis and Cincinnati Traction Company has just sold to Joseph Zeigler of Anderson $33,000 worth of copper wire. There was something like 100 tons of the old wire that went to the junk dealer, the company having replaced the old and light wire with new and heavier copper cables in order to carry a voltage sufficient to operate the several divisions.

The Marion Heat and Light Company has reduced the minimum rate for resident lighting from $1.50 to $1 a month. George R. Tidd, manager, says the reduction is voluntary.

The City Council of Knightstown has decided to install a 300-horsepower gas engine in the electric light and waterworks plant in order to provide adequate power. Knightstown claims to have operated both plants as municipal property for several years with splendid success.

The City Council of Marion is asking for bids on equipment that will sufficiently increase the capacity of the present municipal electric-light plant, which now supplies current for lighting the street, to permit the city to engage in the commercial light and power business in competition with the Marion Light and Heat Company, a private corporation which now has the exclusive sale of commercial light, and announces a reduction of rate.

The Indiana Supreme Court has recently decided that where a city engages in the business of operating an electric-light plant for commercial as well as municipal purposes, through the agency of electric-light commissioners, chosen by the Common Council, it is liable for injuries or death caused by the negligence of operation of its machinery and wires exactly as a private company would be.

The Frankfort, Delphi and Northern Traction Company has been incorporated, capitalized at $100,000. The company proposes to furnish light and power to the cities and towns along the proposed line. Abe Strause heads the incorporators.

The Indianapolis, Crawfordsville and Danville (Ill.) Traction Company has filed articles of incorporation, capitalized at $600,000. The line will be operated in connection with the Indianapolis and Northwestern branch of the syndicate property.

Indiana traction men are becoming greatly concerned over the threatened one-cent-a-mile law to be considered by the incoming Legislature. John F. Joyce of Terre Haute, a member of the General Assembly, has prepared a bill creating a rate of one cent a mile on all electric roads in Indiana. This bill is likely to receive considerable support on the alleged ground that electric roads can be operated at least one-half cheaper than steam lines.

The Newcastle Electric Belt Railroad Company has been organized to build an electric railway around the city of Newcastle, connecting all the factories and the numerous florist houses, for which Newcastle is famous, to afford all these shipping facilities. The incorporators are Myer Heller, T. B. Millikan and C. W. Mauch.

Charles Shelton, superintendent of transportation of the Indiana, Fort Wayne and Wabash Valley Railway, has resigned and gone to Philadelphia to assume a similar position.

An electric railway company is being promoted to construct an interurban railway to connect Dillsboro, Aurora and Versailles. William Rowland, Jr., W. Flemming and J. H. Green of Dillsboro are promoting the line, and when completed and in operation it will displace the only stage line in operation in Indiana.

The first of the bi-weekly excursions from Indianapolis to St. Louis over the Northwestern Traction line, and the Clover Leaf line, was run on December 8th and proved quite a success, many people taking advantage of the low rates to spend a day in St. Louis. S. S.

Pacific Slope.

San Francisco, December 13.—Electric lighting and power, and electric street-railway services in this city were more or less interrupted and damaged a few days ago by the 60-mile gale which blew down many brick walls of buildings that had been ruined by the fire. The falling walls carried away many of the trolley and feed wires and caused almost complete suspension of electric-car traffic for a time. The United Railroads' electric generating station at North Beach was unroofed, necessitating a temporary shutdown of the plant. The original roof of this building was destroyed by the earthquake of April 18th, having been of very light steel construction.

The United Railroads is steadily extending the reconstruction of its local lines as modern electric-trolley roads. It is announced that the Powell Street and Sacramento and Clay Street cable lines are to be operated again before many weeks. This lends color to the reports that the California Street Railroad Company, which has a cable system in operation, is to be acquired by the United Railroads.

There is without doubt some foundation for the report that E. H. Harriman, who owns a controlling interest in the Los Angeles Pacific Railway, an electric road extending from Los Angeles to several of the beaches and suburban towns, has plans on foot for buying the control of the H. E. Huntington system of electric roads and power plants operating in Los Angeles and the surrounding territory. It is said that the knowledge of the proposed improvements and extensions of the Los Angeles Pacific have had an influence in facilitating the negotiations. The Los Angeles story as to the contemplated betterments says that plans have been completed for extensions and improvements on the Los Angeles Pacific. Three concrete subways, five miles in length, are planned to carry the electric lines through the hills north and west of Los Angeles. The City Council has instructed the city clerk to advertise for bids for franchises corresponding with the four drafts of franchise ordinances introduced by the Harriman interests for the purpose of connecting and extending the lines of the Los Angeles Pacific and the Interurban systems. The same interests have architects completing plans for a nine-story passenger station and office building, to be built at Fourth and Hill streets, at a cost of $1,000,000. The materials are to be steel, granite and reinforced concrete, and the total floor space will be nearly 16 acres. Work on the new four-track route is to be commenced about January 1st. There are to be two main subways. One will parallel West Fourth Street, from Hill Street to Vermont Avenue, the second will pierce the Temple Street high land joining North Hill Street to Sunset Boulevard.

The City Council of Pasadena, Cal., has taken steps to sell its municipal electric-light and fire-department bonds, regardless of the fact that the application of the Edison Electric Company for a restraining order is still pending in the courts. The bonds, which have been approved by Dillon & Hubbard, include $125,000 for the acquisition and construction of an electric-light plant; $30,000 for extension and improvements to the fire department, including the perfecting of the fire-alarm telegraph system. The total issue authorized is $200,000 of four per cent. bonds.

The contract for the extension of H. E. Huntington's Garvanza electric-car line out New York Street to Ash Street, Los Angeles, has been closed. The residents of New York Valley subscribed to a bonus of $10,000 in order to secure the line. The Highland Park district will also be benefited by the new road.

The Los Angeles Interurban Railroad Company has made application to the secretary of war for permission to build an overhead-trolley road across a portion of the military reservation near San Pedro, Cal.

The Palms Light and Water Company, which was recently incorporated with a capital stock of $1,000,000 by W. R. Wheat, M. R. King and others, contemplates expending $100,000 on the improvement of its suburban tract near Los Angeles. A lighting system and a water plant are included in the projected improvements.

The wireless-telegraph equipment for the Navy Department's new station at Tatoosh Island has been shipped to the navy yard at Bremerton, Wash., and will be installed soon. The location of this station at the entrance to Puget Sound makes it of great importance in the chain of wireless-telegraph plants now extending as far south as San Diego. The reporting of arrivals and departures of vessels will benefit commerce also.

The Mount Hood Electric Company's franchise has been transferred, through the efforts of S. B. Cobb, to the Mount Hood Power and Railway Company, which is composed of the same persons as the original corporation. The reincorporation was effected for the purpose of increasing the capital stock and bond issue. Although the railway project will not go ahead at once, an electric power plant is to be installed on the Sandy River as soon as the money raised on the bonds is available. The power is to be transmitted to the city of Portland, Ore., and surrounding towns. The plant is to be increased to large proportions as the business grows. A.

Northwestern States.

Minneapolis, December 15.—The General Electric Company's new power plant at Taylors Falls, Minn., has been completed and tested. Everything was found to be properly constructed, and the new power is now available to the patrons of the company in the Twin Cities.

There is talk of putting in an electric-light system at Pewaukee, Wis.

The council at Pierre, S. D., has closed a contract with the Westinghouse company for installing an electric-light plant.

The Public Service Company of St. Cloud, Minn., has leased 1,000 additional horsepower from the St. Cloud Water Power Company and will install considerable new machinery.

H. C. Fredericks has sold his interest in the Fargo (N. D.) Electric Company to W. T. Lawrence.

The city of Barnesville, Minn., has secured a loan of $28,000 from the state for the purpose of constructing an electric-light plant.

A new electric-light plant is to be built at Tracy, Minn., at a cost of $12,000.

An agreement has been reached between Virginia and Eveleth, Minn., regarding the proposed franchises for an interurban railway system on the iron range. The two cities will grant similar franchises to either the Northern Traction Company or to the Mesaba Traction Company, and it is thought that actual construction work will be started early in the spring. R.

The annual report of the board of railroad commissioners of South Dakota points out the rapid development of electric railways and recommends that the statute limiting the control of the board to steam roads be amended to include the electric lines.

George P. Baldwin is promoting an electric company to utilize the waterpower of Spearfish Creek, near Spearfish, S. D. The new company has bought the water rights of the Cascade Water Company and the Electric Transmission Company. About 3,000 horsepower can be developed.

The Janesville Power Company has sold its power plant at Waterloo, Iowa, which has been closed for three years, to persons from Cedar Rapids. The plant will be placed in operation at once.

W. P. Isstas has resigned as superintendent of the Wheaton (Minn.) Electric Light Company. R.

Illinois.

Peoria, December 15.—The new concrete smokestack for the Peoria Gas and Electric Company has been completed. It is 200 feet high with an internal diameter of 13 feet.

The Economy Light and Power Company of Joliet, which controls the Jackson Street dam, has absorbed all the Monroe-Gaylord rights and will at once erect a new power house below Joliet. The Chicago Sanitary District owns some water-power privileges in Joliet at South Street, but these are disputed by the new concern, which expects to control all the waterpower rights in the Desplaines channel from the Jackson Street dam to the junction of the Illinois and Kankakee rivers. The company expects to develop 15,000 horsepower, and plans are being prepared for the power house, which will cost over $1,000,000.

Stockholders of the Rock River Traction Company have authorized the issuance of bonds to the amount of $2,000,000, to construct a line from Sterling to Rock Island and from Rock Island to Geneseo and Princeton, with a branch to Morrison. The lines to be built will aggregate 125 miles, and will follow the Rock River, taking in all the important towns and cities.

City Electrician Lyons is installing new inking registers on the police and fire-alarm circuits, replacing the old chemical ones formerly in use. These, with the use of a time stamp, give a permanent record of all calls received.

B. F. Wasson of Clinton, who is the head of the telephone system that covers DeWitt County, delivered an address before a graduating class in electrical engineering at Purdue University on "The Evolution of the Telephone."

The Illinois Traction Company expects to open the line between Champaign and Decatur the coming week.

The Aurora Specialty Manufacturing Company has been incorporated by Frank Zimmermann, Fred A. Dolph and Charles A. Love, to manufacture electric specialties. Capital stock, $25,000.

In the sleeping-cars being built for the Illinois Traction Company the berths are contained underneath the floor, and because of this the floor is nearly two feet higher than the ordinary car. During the day these coaches are parlor cars, with revolving chairs; at night the berths are lifted from beneath and the chairs take their place under the floor. The charges on the car will be about half the charge on the regular Pullman car.

V. N.

PERSONAL.

J. W. Duntley, president of the Chicago Pneumatic Tool Company, has returned from Europe. He reports an increase of 25 per cent. in the company's foreign business over that of last year.

Sir Oliver Lodge, the noted English scientist of London, has issued the text of a scientific catechism which he designed for the use of teachers interested in the religious education of the young.

W. I. Bell, who has been in charge of the construction of the Illinois Traction Company's new power house in Peoria, Ill., will go to New York, where he will be connected with the new electric plant of the New York Central suburban lines.

F. B. Church of Westinghouse, Church, Kerr & Co., New York, was in Spokane recently looking over power sites on the Spokane and Pend-d'Oreille rivers. He is reported as having been impressed with the possibilities for the development of electrical power in that region.

The death of Gen. John M. Hood, president of the United Railways and Electric Company, is reported at Baltimore, Md., after a short illness, following nervous breakdown. He was born in Howard County, Maryland, in 1843. General Hood served in the confederate army during the civil war.

Prof. Henry Fairfield Osborn of New York city was elected secretary of the Smithsonian Institution on December 4th to succeed the late Prof. Samuel T. Langley. Professor Osborn is the first vice-president of the American Museum of Natural History of New York and is also widely known as an eminent palæontologist and educator.

Mr. Sydney Irving Wailes, manager of sales of the National Brake and Electric Company of Milwaukee, was married on November 27th to Miss Adelaide Harrington Brown in Los Angeles, Cal. Mr. Wailes is well known to the electrical fraternity through his energetic efforts for the company he represents. He has many friends who congratulate him.

The marriage of Clifford L. McCalla, formerly assistant general manager of the Washington Water Power Company of Spokane, to Miss Agnes Purves, at Sydney, N. S. W., is announced. They will return to Spokane early in January. Before going to Spokane Mr. McCalla represented the General Electric Company in the installation of tramways at Sydney.

P. J. Dielmann, general manager of the Consumers' Light, Heat and Power Company of Topeka, Kan., has accepted a position as general manager of the Osaka Gas, Light and Coke Company of Osaka, Japan. He will be succeeded by L. G. Treleaven, who has been, for a number of years, connected with the People's Gas Light and Coke Company of Chicago.

J. B. Ingersoll, chief electrical engineer of the Spokane and Inland Railway Company, has been appointed general manager and chief electrical engineer of the road, and also of the Spokane Terminal Company. Mr. Ingersoll succeeds F. A. Blackwell, Mr. Blackwell finding it necessary to devote more time to his various other interests. He will continue as chairman of the board of directors of the Inland Empire system.

ELECTRIC LIGHTING.

The City Council of El Paso, Texas, has granted a 21-year electric-lighting franchise to a private company.

The Corpus Christi (Texas) Ice and Electric Company has been incorporated with a capital stock of $65,000.

A bond issue of $10,000 has been authorized for the purpose of building an electric-light and water plant at Northport, Mich.

P. J. Robertson of Dallas, Texas, has been granted a franchise for an electric-light and power plant in Childress, Texas.

George W. Meyers is preparing to install an electric-light plant in Washington, Ill. The company will petition for a franchise to establish the plant.

The City Council of Saundersville, Ga., has voted to issue $30,000 in bonds for the purpose of establishing a storage plant and an electric-light system.

The Houston Lighting and Power Company of Houston, Texas, has appropriated $300,000 to be expended in placing its wires underground. The work will be commenced early in the year. The company's plans for the coming year also include the expenditure of $175,000 for the installation of another unit to its power plant. A turbine engine will be used.

Railway-mail clerks are rallying to the support of the joint resolution introduced by Senator La Follette providing that within one year all railway postal cars shall be lighted by electricity. At the last annual convention of their association in Chicago the clerks adopted a resolution urging such legislation. Senator La Follette is said to have statistics which show that more mail matter is destroyed in wrecks by fire caused by the explosion of gas and oil used for illuminating purposes than from all other causes combined. The headlights of nearly all passenger locomotives are now lighted by electricity generated by a small dynamo, and it is said that the expense of lighting postal cars by electricity would be small.

ELECTRIC RAILWAYS.

The Oklahoma Railway Company has been incorporated with a capital stock of $5,000,000 by Frank Wells, G. G. Barnes and Carlos Holmes of Oklahoma City. The purpose of the company is to build an interurban electric line, having a total length of 170 miles and connecting some of the principal cities in the two territories.

Conrad Wolfe of Spokane, president of the United Copper Railway Company, announces that six miles of electric railway will be built from Chewelah, Wash., to the mines at a cost of $40,000. The line will be used for hauling ore to the Spokane Falls and Northern Railway, giving the mines direct connection with the smelter.

E. D. Thomas, vice-president of the Commercial Trust Company of Lewiston, Idaho, makes the announcement that the building of the electric railway between Lewiston and Grangeville is now an assured fact. Arrangements have been made for the purchase of all supplies, and the contracting engineers will be on the ground in the very near future. The people who are buying the bonds are putting $6,000,000 into the project.

PUBLICATIONS.

One of the first advance New Years greetings comes from the American Circular Loom Company of Chelsea, Mass., in the shape of a pretty card.

Bulletin No. 101, recently issued by the Wire and Telephone Company of America, is descriptive of the hand telephone and the Houghton binding post, which are made by that company. The bulletin is excellently illustrated and contains a complete enumeration of the advantages claimed for the apparatus which forms the completed hand telephone.

A bulletin entitled "The Power of Niagara" has been issued by the Niagara Falls Power Company of Niagara Falls, N. Y., and the Canadian Niagara Power Company of Niagara Falls, Ont. The bulletin contains a short history and a description of the plants operated by the companies. It is well illustrated with views of the power houses, generators, switchboards and of the falls, also containing maps showing the location of the properties owned by the companies and the territory within 500 miles of Niagara. The advantages obtained by using power supplied by the companies are briefly set forth and the advantage of the Niagara frontier as a manufacturing location are described.

A particularly attractive wall calendar for 1907 is that distributed with the compliments of John L. Gleason of Jamaica Plain, Mass. It is embellished with a "portrait of a noted bird fancier," and anyone who looks upon the picture will admit the correctness of the designation, for Grimalkin herself is shown peeping over a fence in eager-eyed expectancy, with a serviceable slouch hat set rakishly on one ear. Mr. Gleason's molding and conduit boxes—Fancleve trademark—are illustrated on the back of the calendar.

A new catalogue on electric-railway supplies is being distributed by the F. Bissell Company of Toledo, Ohio. Although the first book for this field the company has ever issued, it is a good one and covers the field thoroughly. Nearly all of the hundreds of articles listed are illustrated. Only strictly electric-railway items are shown. Poles, cross-arms, Kuhlman transformers, switchboards, panel boards and accessories for power stations, trolley and feed wire, cables, strand, etc., are shown in the general catalogue, which will be sent on request to the F. Bissell Company.

SOCIETIES AND SCHOOLS.

A meeting of the Electrical Section of the Western Society of Engineers was scheduled to be held in the society rooms, Monadnock Building, Chicago, Friday, December 21st, at 8 p. m. Mr. R. F. Schuchardt, M. W. S. E., was down to address the meeting on "The Rotary-converter Sub-station," the address to be illustrated with lantern-slide views.

Officers of the Spokane and Inland Empire Railway Company and the Washington Water Power Company contributed $9,500 to the Spokane Y. M. C. A. building fund a few days ago. The officers gave the receipts of one day's business, in addition contributing $2 for every $1 taken in fares. The waterpower company's share was $5,000, the Inland railway contributing $4,500.

The recent meeting of the Illuminating Engineering Society of New England was held at the American House, Boston, and was called to order by Dr. Louis Bell. A paper was read by Mr. W. E. Holmes on the "Flaming Arc." He gave some very interesting experiences of this lamp in its earlier stages of commercial use. The paper was afterward discussed by Messrs. Cowles, Marks, Bell and Gifford. Mr. A. T. Sampson then read a paper, written by Major E. L. Zalinski, on "Fixture Design," which was afterward discussed by Messrs. Ryan, Clifford, Bell and Marks. Prof. H. E. Clifford read a paper by F. N. Olcott upon "Fixture Location in Residence Lighting," upon which a discussion followed, participated in by Messrs. Cowles, Clark, Bell, Holmes and Sampson.

MISCELLANEOUS.

The Wolverine Park Company has been incorporated for the purpose of establishing an electric park at Vandercook's Lake, near Jackson, Mich. The capital stock is $100,000. The promoter is George Detoir of Lansing, Mich.

The power house of the Swift Packing Company's plant in East St. Louis has been destroyed by fire at a loss of $40,000. The building contained an arc-light generator, a 1,000-light incandescent dynamo and a 330-horsepower engine.

The report of the Allgemeine Elektricitäts Gesellschaft for the year ended June 30th last, shows that the output of electrical machinery was numerically greater by 34 per cent. than for the previous year. The increase reckoned in kilowatts was 26 per cent. and in value of receipts 20 per cent. The total number of employes was 33,906, as compared with 30,366 in the previous year.

Almost any bearing that requires oil in it will work harder in winter than in summer, as the oil is bound to be more viscous when cold than when warm. It is for this reason that experienced men who have tried it suggest that a possible solution of difficulties in lubrication may be found in the use of flake graphite along with some thin mineral oil. The lubrication will be as good, if not better, and the drag and slowness will disappear, it is said.

Wireless-telephone communication has been successfully carried on between Berlin and Nauen, Germany, 24 miles, according to a daily-paper cable dispatch, dated December 14th. "The conversation," according to the dispatch, "was carried on partly by Herr von Sydow, under-secretary of the State Postal Department, who received perfectly intelligible repetitions to his questions. Professor Slaby says, while the problem is solved, the limit of distance is not yet known. He sees no reason to set any limit, and believes that the time is coming when a man will be able to speak wirelessly with a friend in any part of the world. The method employed today consists of the use

of the microphone in connection with the ordinary wireless-telegraph apparatus."

The total production of coal in the Indian Territory during 1905 was 2,924,427 short tons, which had a value on the spot of $5,145,358. Cheap fuel oil which had been thrown on the markets in enormous quantities by the oil-well developments in southeastern Texas, and which induced many of the railroads to adopt crude petroleum as a locomotive fuel, naturally cut off an equivalent outlet for Arkansas and Indian Territory coals.

TRADE NEWS.

The dissolution is reported of the electrical supply firm of Campbell & Wangelin of Boulder, Colo.

John Cunningham, Jr., has purchased the business of the Newburg Plumbing and Electric Company at Fort Worth, Texas.

In the United States court at Milwaukee the Allis-Chalmers Company has brought suit against the National Brake and Electric Company. Associated with the plaintiff corporation is N. A. Christensen, whose patents are involved. It is asserted that the defendant company is wrongfully manufacturing motor compressors, the patent for which was secured by Mr. Christensen. The right to use the patent was granted by Mr. Christensen to the National Brake Company, in which he was financially interested. It is said, however, that after the company went into bankruptcy, as a result of the Bigelow defalcation, the right was relinquished and not renewed. Then Mr. Christensen entered into a contract with the Allis-Chalmers Company, giving it the sole right to manufacture the motors and compressors.

Cecil B. Smith, hydro-electric expert engaged by the city of Winnipeg, Man., states that bids for the $3,600,000 power plant to be erected by the city of Winnipeg on the Lac du Bonnet River will be called for early in February. Mr. Smith is in favor of several distributing stations being erected, and the plans will probably be altered to meet his suggestion.

G. A. Nisbet, well known through his connection with the G. I. Company and also later with B. S. Barnard & Co. in New York, has severed his connection with the latter concern and started in business for himself as manufacturer's agent, with headquarters at 39 Cortlandt Street, New York city. Mr. Nisbet will handle various styles of incandescent lamps, including miniature and standard lamps; also switch and panel boards, knife switches, and specially designed switches for high-tension circuits. He is particularly desirous of securing a few first-class western connections that wish a New York agency. As Mr. Nisbet has made a most excellent name for himself in the East, and numbers among his friends many of the best buying concerns east of Pittsburg, his services should prove of value.

BUSINESS.

Edmund Land, superintendent of equipment of the Citizens' Telephone Company of Grand Rapids, Mich., and J. C. Kelsey of Chicago, will form an electrical engineering company in Chicago, to engage in consulting engineering and the construction of telephone plants. Mr. Land will leave the Citizens' company and remove to Chicago January 1st.

The function of Dixon's flake graphite is to build up minute irregularities in bearing surfaces. Amorphous graphite, or any other form of graphite, or finely powdered mica or talc, would, it is said, fill up such irregularities, but will be washed out by the oil used in lubrication or by the condensation of steam, whereas the thin flakes of Dixon's Ticonderoga graphite are impaled in the minute irregularities and are built up into a veneer-like coating of marvelous smoothness. In fact, the surfaces are built up so that there is a graphite-to-graphite bearing rather than a metal-to-metal bearing, and seizing is made impossible. The Joseph Dixon Crucible Company also has issued a booklet telling about the Dixon graphite brushes for commutators. For the convenience of users it gives the result of tests and observations made by Prof. Albert F. Ganz of Stevens Institute.

ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued (United States Patent Office) December 11, 1906.

837,941. Automatic Fire Alarm. James H. Marchant, Schenectady, N. Y. Application filed April 20, 1906.

A slotted post is connected with one branch of the electric circuit; a spring plate is secured in the slot in the post, and a boss is mounted upon the spring plate, and is provided with a seat for one end of a fuse block. A contact post is connected with the other branch of the electric circuit, and located in the path of the spring plate. A resisting support is provided with a seat for the other end of the fuse block and a fuse block is interposed between the resisting support and spring plate with its opposite ends located in the respective seats and adapted to hold the spring plate out of contact with the contact post.

837,951. Telephone-call Register. Joseph J. O'Connell, Chicago, Ill., assignor to the Western Electric Company, Chicago, Ill. Application filed July 19, 1902.

A counting train comprising rotatable cylinders has teeth adapted to be introduced successively into the path of a traveling mechanism which co-operates therewith. A circuit including a responsive device is controlled by the transmitter mechanism, so that the number registered upon the train of counting cylinders is transmitted to the responsive device.

837,979. Massage Machine. George F. Trotter, St. Louis, Mo., assignor to the Triplex Vibrator Company, St. Louis, Mo. Application filed May 21, 1906.

A pivotally-mounted applicator-carrying device is eccentrically connected to the armature shaft of an electric motor, and a pivotally-mounted member carries the device and has its pivot arranged at aproximately a right angle to the pivot of the device and adjacent one end thereof.

837,994. Magnetic Separator. James C. Winder, East Point, Ga., assignor to E. Van Winkle Gin and Machine Works, Atlanta, Ga. Application filed May 5, 1906.

A support of non-magnetic material has slots in it. Three magnetic bars are spaced apart and sustained by the support, and a magnet comprising three plates projecting through the slots in the base is secured respectively to the bars. Thimbles separate the plates and helices are wound on the thimbles to energize the central plate with one polarity and the end plates with the opposite polarity. Means are provided for securing the plates, thimbles and helices together.

838,005. Electrical Circuit Interrupter. Albert M. Bullard and William H. Matthies, New York, N. Y., assignors to the Western Electric Company, Chicago, Ill. Application filed September 9, 1905.

Contacts in two local circuits, each containing a relay, are controlled by the relays so that they reciprocally control each other's circuits and are alternately energized and de-energized. An external busy-tone circuit has a contact controlled by one of the relays.

838,006. Automatic-exchange Circuit. Albert M. Bullard, New York, N. Y., assignor to the Western Electric Company, Chicago, Ill. Application filed March 10, 1906.

A number of telephone lines extend from sub-stations to the automatic exchange, where there is a selctor for each line. A trunk line extends between the automatic exchanges and a manual exchange and a signal is associated with the trunk line at the manual exchange. A selector at the automatic exchange is adapted to connect the trunk line with any one of the telephone lines, and means, controlled from a sub-station of the line, with which the trunk selector makes connection, and by the individual selector of the called line, are provided for operating said signal.

838,017. Former for Armature Coils. William H. Foot, Wilkinsburg, Pa., assignor to the Westinghouse Electric and Manufacturing Company, Pittsburg, Pa. Application filed May 8, 1905.

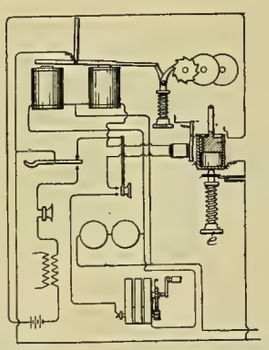
The base has a curved surface and a pair of trapezoidal tools are supported thereon, one of which has a movable portion. Means are provided for adjusting the portion toward and away from the other tool.

838,021. Controlling Means for Electric Motors. Fletcher D. Hallock, Wilkinsburg, Pa., assignor to the Westinghouse Electric and Manufacturing Company, Pittsburg, Pa. Application filed June 2, 1905. Renewed January 20, 1906.

The controller has a rotatable, contact-carrying drum which has a stationary contact-carrying plate substantially perpendicular to it. A circumferentially-adjustable, radially-disposed contact arm is mounted upon the drum to engage the contacts on the plate.

838,028. Phantom Telephone System. Thomas P. Jordan, Dallas, Texas, assignor to E. H. Cary, Dallas, Texas. Application filed October 3, 1904. Renewed December 20, 1905.

The main circuits are provided with local circuits. Phantom circuits are connected to the main circuits at points of approximately equal potential, and inductive means for causing silence in the receivers of the local circuits are provided, so that cross-conversation and disturbances between the main circuits and phantom circuits are eliminated.



NO. 838,115.—TELEPHONE METER.

838,034. Electrical Machine. Benjamin G. Lamme, Pittsburg, Pa., assignor to the Westinghouse Electric and Manufacturing Company, Pittsburg, Pa. Application filed February 21, 1905.

The core of the electrical machine has one set of slots adjacent to its surface and another set of slots more remote from the surface. Conductors are located in the slots, the numbers of conductors per slot being in inverse ratio to the numbers of slots in the corresponding sets.

838,048. Electric Motor. Samuel L. Nicholson, Pittsburg, Pa., assignor to the Westinghouse Electric and Manufacturing Company, Pittsburg, Pa. Application filed September 25, 1905.

There are cylindrical stationary and rotatable members, one of which has a portion adapted to be actively inductive, that is of materially greater length than the corresponding portion of the other. Means are provided for longitudinally adjusting one of the members.

838,090. Automatic Switch Mechanism. Augustus C. Durdin, Jr., Chicago, Ill., assignor to Erwin & Co., Chicago, Ill. Application filed January 13, 1906.

The switch is operated by a vibratory diaphragm which is actuated by fluid pressure in a diaphragm chamber.

838,096. Massage Machine. Christian G. Fenstermacher, Philadelphia, Pa. Application filed April 26, 1905.

A frame is provided with a crank and crank-shaft. A lever supported within the frame has one of its ends fitted to an opening in the crank and the other adapted to a flesh brush, and a yoke swiveled to the frame forms a bearing for the lever so as to receive the thrust when pressure is applied to the flesh brush.

838,103. Car and Air-brake Hose Coupling. William W. Gordon, Washington, D. C. Application filed August 15, 1906.

Means carried by the coupling knuckle constitute one terminal of an electric connection.

838,115. Telephone Meter. Newman H. Holland, Brookline, Mass., assignor of one-half to Charles Bate, Quincy, Mass. Application filed January 31, 1902.

There is a recording instrument at each station, a device located at the station for signaling a central office and a circuit controller for the transmitter circuit at each station. Means are provided by the signaling device, when central office is signaled, for actuating the controller, to prevent the use of the transmitter; and common means, independent of the means operated by the signaling device, are provided for operating the recording instrument and the circuit controller. (See cut.)

838,117. Telephone Signal. Thomas P. Jordan, Dallas, Texas, assignor of two-thirds to George A. Carden, Dallas, Texas. Application filed June 15, 1906.

Means, actuated by a current passing over the bell-ringing circuit permit a signal to move into an operative position, and means actuated by a current passing over the talking circuit restore the signal to an inoperative position.

838,126. Station Indicator. Peter J. Mann, Pittsburg, Pa. Application filed May 3, 1906.

A display web is fed by an electromagnet provided with a movable core. Means are provided for energizing the magnet. A bracket is secured to the magnet, and is provided with a bore designed to guide the core, and is also provided with a guide slot. A pin projects from the core and is mounted in the slot, and a spring-retracted rack bar is carried by the core.

838,133. Single Push-button Automatically Controlled Electric Elevator System. Frederick W. Newell, Hastings-upon-Hudson, N. Y., assignor to the Otis Elevator Company, Jersey City, N. J. Application filed June 19, 1905.

Motor-controlling means are provided for reducing the speed of the motor and varying such reduction of speed in accordance with the load, and electromagnetic means comprising "up" and "down" coils are provided for controlling said motor-controlling means.

838,136. Combined Telephone and District-messenger System. James G. Nolen, Chicago, Ill., assignor of one-half to Frank B. Cook, Chicago, Ill. Application filed November 26, 1902.

A call box is associated with the subscriber's telephone set and connected with the line, the call box involving a signal-receiving device located in a conducting path extending from one side of the line to ground, whereby the central operator may employ the usual busy-test for operating the signal. The box is normally in condition to prevent the passage therethrough of any of the currents employed in telephoning.

838,138. Automatic Apparatus for Preventing Collision of Railway Trains. Maurice Privat, Angoulême, France. Application filed January 23, 1904.

Mechanism actuated upon the movement of piston normally under fluid pressure causes the shutting off of the motor, and puts in operation the brakes of the train. Means are provided for holding the piston in a retracted position against the fluid pressure and means are provided for releasing the piston upon contact of part of the means with a track-stop.

838,139. Telautograph Apparatus. Foster Ritchie, Acton Hill, London, England. Application filed March 12, 1904.

The pen-lifting mechanism includes a magnet, a circuit therefor, and a microphonic contact arranged in shunt to the circuit.

838,141. Signal Apparatus. Hermann Sandvoss, Neuss, Germany. Application filed April 5, 1906.

A tubular casing is combined with an inclosed expansible liquid and a headed plunger. An elastic mantle

surrounds the plunger and is secured to the plunger head and casing. A contact on the plunger is adapted to operate an alarm.

838,144. Dynamo-electric Machine. William Stanley, Great Barrington, Mass. Application filed May 22, 1905.

The rotor and stator windings are connected together, and means external to the windings are provided for inducing upon the circuits thus formed alternating electromotive forces competent to urge alternating magnetizing currents through them.

838,160. Compound Brake for Cars. William D. Baldwin, New York, and August Sundh, Yonkers, N. Y. Application filed March 7, 1905.

Actuating means are provided for supplying the brake, and electric means operate the actuating means. An electroresponsive device is in circuit with an electrodynamic brake and is connected to the actuating means for holding the first-named brake applied or increasing the action thereof independently of the electric means.

838,163. High-tension Insulator. Frank G. Baum, San Francisco, Cal. Application filed October 24, 1905.

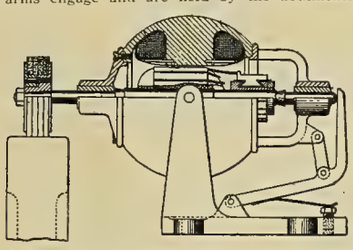
The main-insulating member has petticoats, a tubular supplemental insulator secured thereto, and a line-wire-attaching frame extending through the tubular insulator.

838,165. Battery Cell. John W. Brown, Cleveland, Ohio, assignor to the National Carbon Company, Cleveland, Ohio. Application filed June 4, 1906.

One of the electrodes is separated from the other part of the cell by an insulating partition which is impervious to moisture, so that the cell is rendered inactive until the partition is removed, but becomes active by the mere removal of the partition.

838,171. Electric Switch Base. Nathan W. Crandall, Hartford, Conn., assignor to the Perkins Corporation, Hartford, Conn. Application filed February 27, 1906.

The base is formed of insulating material and has abutments on its front face, and a locking plate is secured to the front face. Stop-shoulders and outwardly projecting arms engage and are held by the abutments.



NO. 838,393.—GOVERNING DEVICE FOR DYNAMOS.

838,175. Controller for the Trolley Poles of Electric Cars. Alfred J. Edwards, Auckland, New Zealand. Application filed August 22, 1906.

A weight, capable of vertical movement, is mounted upon the end of the car and catches are provided for retaining the weight in a raised position. A wire passing freely and vertically through the weight is connected at its upper end with the control rope. Means upon the bottom end of the rod engage with the under side of the weight, and means mounted upon the wire engage with the catches, when the wire is drawn up.

838,177. Electrical Contact Shoe. Thomas Fildes, Richmond Hill, N. Y., assignor to George Cook, Allendale, N. J. Application filed February 20, 1906.

The shoe has its sides converging toward one end and beveled in the direction of their height, the sides being provided with an opening extending entirely through them.

838,192. Telegraphic Relay. Isidor Kitsee, Philadelphia, Pa., assignor of one-half to William J. Latta, Philadelphia, Pa. Application filed February 26, 1906.

A siphon recorder has a non-conducting tail at one terminal. The tail is partly immersed in a conducting liquid and terminals of electric circuit containing an electromagnet reach into the liquid. The non-conducting tail is adapted to move in the region between the terminals and to move out of the region in accordance with the impulse actuating the siphon.

838,216. Explosive Coherer Powder. Ferdinand Schneider, Langenfeld, Germany. Application filed October 5, 1905.

A filling for wave-responsive devices, consists of an intimate mixture containing an explosive and adapted to become heated upon the passage of electricity therethrough sufficiently to fire the explosives.

838,235. Electric Fuse. Leonard B. Buchanan, Woburn, Mass. Application filed April 2, 1906.

The filling material consists of infusorial earth from which the clay and volatile elements have been substantially removed.

838,244. Automatic Ringing Device for Telephone-exchange Systems. William W. Dean, Elyria, Ohio, assignor to the Dean Electric Company, Elyria, Ohio. Application filed January 16, 1906.

The line circuit has a signal device connected to it. A non-inductive controller is responsive to current in the line for determining the application of the signaling current to it.

838,251. Spark-coil Box for Motor Vehicles. Russell Huff, Detroit, Mich., assignor to the Packard Motor Car Company, Detroit, Mich. Application filed September 27, 1906.

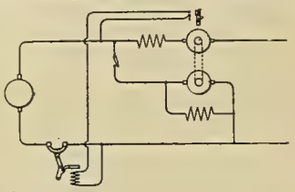
The box has a central and two side compartments. Spark coils are arranged within the side compartments, and a switch in the central compartment is adapted to complete the circuits of either coil independently, according to the position of the switch.

838,260. Binding Post. Ray H. Manson, Elyria, Ohio, assignor to the Dean Electric Company, Elyria, Ohio. Original application filed August 3, 1904. Divided and this application filed November 11, 1905.

A flat piece of metal is bent upon itself to form two limbs, an opening through the bend receives a circuit terminal and means are provided to force the two limbs together.

838,273. Electric Wave-form Tracer. Robert Rankin, Ithaca, N. Y. Application filed August 23, 1905.

There is a vacuum tube and means for generating cathode rays therein. Means are provided for changing the normal path of the rays, and magnetic means are provided for reducing the pressure of the gas in the tube.



NO. 838,407.—SAFETY DEVICE FOR BOOSTERS.

838,280. Mercury-vapor Lamp. Hans V. Siim-Jensen, Copenhagen, Denmark. Application filed April 25, 1905. Renewed November 14, 1906.

A tube has receptacles for mercury electrodes. One of the electrodes has an auxiliary vessel or chamber therein from which the mercury is adapted to be displaced when the tube is tilted, and means are provided whereby the mercury re-enters the vessel or chamber slowly, so that it is gradually withdrawn from the tube portion and the arc lengthened slowly.

838,304. Lightning Arrester. Frank B. Cook, Chicago, Ill. Application filed May 9, 1906.

Suitable electrodes are held adjacent to each other, and a thin di-lectric of softenable material is interposed between the electrodes and has one side portion thereof cut away approximately to the center.

838,315. Control of Electric Motors. William Geipel and Frederick M. T. Lange, Southwark, England. Application filed January 15, 1906.

A rheostatic device has a resistance, the starting and forward ends of which are arranged remote from each other, and means are provided whereby a portion of such resistance extending from the starting end thereof toward the full-speed end can be put out of effective action at the moment of starting.

838,346. Method of Electroplating. Evan L. Livingston, Mulhall, and William McNulty, Allegheny, Pa. Application filed January 25, 1906.

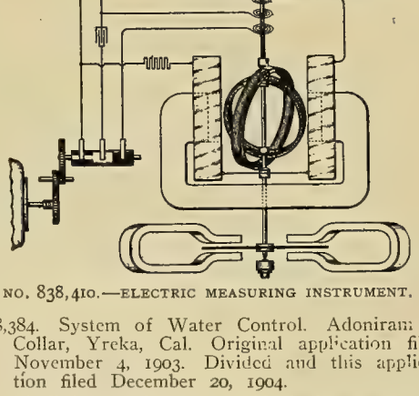
The article to be plated is held by suction and one face of it is protected. The other face is electroplated while the article is so held by vacuum.

838,362. Receiver for Telephones. Louis Steinberger, New York, N. Y. Application filed January 16, 1905.

A longitudinal core is provided at each of its ends with a thread. A casing is mounted upon the core and provided at one of its ends with a thread engaging one of the threads of the core. A threaded member engages the other end of the core and is provided with a flange partially encircling the casing.

838,372. Galvanic Battery. Benjamin J. Blameuser, Chicago, Ill., assignor to the Chicago Compound Battery Company, Chicago, Ill. Application filed June 7, 1905.

A chamber holds a depolarizing fluid and a holder is adapted to contain a supply of the fluid and has at its upper and lower parts independent means for communication with the chamber for the supply of fluid thereto, whereby a continuous circulation of the fluid is afforded while the battery is in action.



NO. 838,410.—ELECTRIC MEASURING INSTRUMENT.

838,384. System of Water Control. Adoniram J. Collar, Yreka, Cal. Original application filed November 4, 1903. Divided and this application filed December 20, 1904.

A discharge main connects with the lower portion of the water supply. A plurality of gates are placed in the main, at different levels. A by-pass connects with the water supply above the main, and connects with the main intermediate of the gates. Electrical means automatically open and close the lower gate.

838,388. Switch-actuating Mechanism. Edgar L. Davidson, Lawrenceburg, Tenn., assignor of one-fourth to James W. Wildes, one-fourth to John M. Forsythe and one fourth to Edgar L. Forsythe, Iron City, Tenn. Application filed October 19, 1906.

A switch-operating lever is adapted to oscillate upon a standard. A spring-pressed bolt upon the lever normally engages the standing, and has an elongated recess in one face. A spring-pressed locking lever normally seated within the recess holds the bolt against movement. A cam mounted adjacent is adapted to actuate the lever to withdraw it from the recess, and manually-operated means are connected to the lever for retracting the bolt.

838,393. Governing Device for Dynamos. Charles A. Eck, Newark, N. J. Original application filed August 12, 1903. Divided and this application filed June 16, 1905. Renewed May 29, 1906.

The dynamo is pivoted transversely to the longitudinal axis of a driving wheel. A friction pulley for operating the armature shaft of the dynamo is adapted to engage with the driving wheel. Means are provided for turning the dynamo around its pivot in one direction when the voltage decreases below a certain point, thereby moving the friction pulley into contact with the driving wheel. The action of the field magnets, when the voltage increases above a certain point, causes the dynamo to swing around its pivot in the other direction, thereby moving the friction pulley out of contact with the driving wheel. (See cut.)

838,404. Relay. Max R. Hanna, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed May 26, 1906.

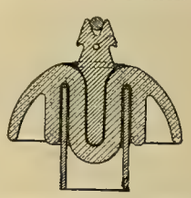
A winding supplied with current from the track circuit is arranged to produce a flux threading a conducting member, and a winding, supplied with alternating current of the same frequency and different phase independently of the track circuit is arranged to produce two fluxes threading the member on opposite sides of the first flux. A signal is controlled by the movement of the conducting member.

838,407. Safety Device for Boosters. John D. Hilliard, Jr., Glens Falls, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed July 2, 1904.

Means are provided, operated by the booster, for breaking the circuit upon a reversal in the direction of rotation of the booster. (See cut.)

838,410. Electric Measuring Instrument. Otto Holz, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed July 14, 1905.

A frequency indicator has means for establishing a magnetic field. A plurality of coils are arranged at an angle to each other and mounted on a pivoted unbiased shaft for rotation in the field. Means are connected to leads from a source of direct-current supply for supplying one of the coils with current impulses, and connections are made from another of the coils across the leads. (See cut.)



NO. 838,482.—INSULATOR FOR LINE CONDUCTORS.

838,423. Method of Producing Electric Coils. Isidor Kitsee, Philadelphia, Pa. Original application filed May 3, 1905. Divided and this application filed June 15, 1906.

A body of conducting material is mounted upon a non-conducting support. The conducting material is given a spiral formation to provide a continuous conductor, the convolutions of which are insulated from each other by a space, and a series of the supports are assembled so that the terminals of the spirit conductors are connected to form a continuous circuit.

838,482. Insulator for Line Conductors. James M. Weed, Denver, Colo. Application filed August 10, 1905.

The insulating material has in its under side an annular recess or socket for the reception of a tubular supporting pin, and in its upper side a central recess or socket for the reception of a wire-supporting pin. (See cut.)

838,495. Block-signal Apparatus. Alexander Bevan, Providence, R. I. Original application filed February 10, 1906. Divided and this application filed October 25, 1906.

A number of electric lamps are grouped together, one of the lamps being normally lighted. An electromagnetic device is provided with a contact member disconnected from and independent of the circuits to close the circuit to a new lamp when the circuit to the lighted lamp is broken.

PATENTS THAT HAVE EXPIRED.

Following is a list of electrical patents (issued by the United States Patent Office) that expired December 17, 1906:

417,217. Electrical Apparatus. C. D. Baker and L. G. Bronson, Chicago, Ill.
417,259. Electrically Propelled Vehicle. W. Main, Brooklyn, N. Y.
417,271. Telephone Exchange Apparatus. J. J. O'Connell, Chicago, Ill.
417,290. Galvanic Battery. E. A. Sperry, Chicago, Ill.
417,304 and 417,305. Electric Circuit. J. C. Wilson, Boston, Mass.
417,338. Method of Operating Electric Railways. E. E. Rice, Baltimore, Md.
417,392. Treatment of Porous Pots for Electric Batteries. E. L. Mayer and H. Liepmann, London, County of Middiesex, England.
417,402. Electrical Conductor. U. H. Balsley, Philadelphia, Pa.
417,407. Electric Stenographic Pen. A. S. Cooper, Santa Barbara, Cal.
417,458. Galvanic Dry Element. C. H. Wolf, Blankenese, Prussia, Germany.
417,474. Electric Fan. P. Diehl, Elizabeth, N. J.
417,487. Automatic Regulator for Dynamos. C. D. Jenney, Indianapolis, Ind.
417,525. Electric Semaphore-setting Apparatus. F. Stitzel, Louisville, Ky.
417,526. Electric Semaphore-setting Apparatus. F. Stitzel and C. Weinedel, Louisville Ky.
417,654. System of Electrical Distribution of Currents. C. J. Van Depoele, Lynn, Mass.
417,660. Telephone Instrument. W. C. Barney, Baltimore, Md.
417,668. Method of Regulating the Tension of the Electric Current. C. Dihlmann, Berlin, Germany.
417,685. Ceiling Plate for Electric Lights. H. H. Sawyer, Ridley Park, Pa.
417,688. Conduit for Electrical Conductors. J. Tatham, Philadelphia, Pa.

WESTERN ELECTRICIAN

EVERY SATURDAY

Vol. XXXIX. CHICAGO, DECEMBER 29, 1906 No. 26

New Hydro-electric Plant near Bellinzona, Italy.

By A. de Courcy.

As an instance of the rapidly increasing use of hydraulic power for operating electric plants in the north of Italy may be cited the newly erected hydro-electric station on the Morobbia River. This plant was laid out under the general direction of Mr. Bonzago, the electrical equipment for the main station, overhead lines and sub-stations being supplied by the Alioth Company of Switzerland. Most of the current from the station is used at present for light and power in the town of Bellinzona, but the overhead lines extend over the country in different directions, taking in other localities, such as Giubiasco and Mollinago, so that a number of towns are enabled to use the current.

A high fall serves the plant, the net water head being over 1,100 feet, while the river will afford a flow of 1,700 gallons per second. Flowing into the Lessin River, the mountain stream of the Morobbia rises in the mountains lying not far from that river, and can be depended on for a good supply. Before the present station was erected a smaller hydro-electric plant had been in operation for some years past at Corduno, operating on the single-phase system at 2,000 volts. But as this soon became insufficient to meet the demands for power in the town of Bellinzona and elsewhere in the region, it was decided to erect the new plant at a distance of 2½ miles from Bellinzona, near Giubiasco, at the entrance of the gorge of the Morobbia. Here is located a turbine house which is laid out for units of 660 horsepower, using Pelton waterwheels direct-coupled to Alioth three-phase alternators. These machines give the line voltage without the use of step-up transformers, and the line is worked at 5,530 volts. At present three of the above-mentioned units are running constantly in the power house. They are shown in Fig. 1.

From the dam which is erected across the stream the water is led to the turbine house by an open canal ending in a water chamber, and from the latter descends a 30-inch penstock, part of which runs down the slope of the mountain and is almost vertical. The canal leading from the dam has a total length of 2.5 miles, and it is cut in the rock for the greater part, lying on a grade of two per cent. in general. A section of five by 6.5 feet is given to the canal. Where it joins the dam a cut-stone construction is used, while the dam itself is built of beton and faced with masonry.

At the point where the main canal joins onto the penstock is placed a settling chamber. This is shown in Fig. 3 (next page). At the side is an overflow canal, which can be regulated by a gate so as to keep the water-level constant in the settling chamber. The penstock, working on a water head of 1,100 feet, runs on a steep slope down to the turbine house, being laid directly upon the precipitous mountain side. Diameters of about 30 inches are used for the sections of the penstock, and it is built of Siemens-Martin steel, being able to stand a high pressure. The thickness of metal varies from 0.24 to 0.80 inch. The interior of the turbine station is shown here.

The turbines, of the Pelton type, were built in Switzerland by Escher, Wyss & Co. Around the turbine is placed a by-pass conduit which is controlled by a gate-valve in such manner as to open when the pressure becomes too high, and thus keep the water flow about constant. A good regulation of the wheel speed is secured by means of a ball governor, combined with a hydraulic motor. The motor, or differential piston device, acts by water pressure so as to open or close a sliding gate upon the water feed of each wheel. As the water supply to the hydraulic motor is controlled both in quantity and in direction by the ball governor, the speed of the turbines can be regulated very closely.

A description of the Alioth alternators will be of interest. Fig. 2 is an end elevation, partly in section, of the machines shown in Fig. 1. They are of substantial construction, the working parts being well protected by an outer casting which nearly encloses the machine. Air openings are provided which give ventilation for cooling the coils and iron. In these alternators the field is mounted in the interior of the machine, while the armature lies on the outside, being of the laminated ring form. The three alternators which are now running in the station are of uniform pattern, and they are built for a capacity of 500 kilowatts, working normally at the turbine speed, or 500 revolutions per minute. Three-phase current is generated, at 50 cycles, with a working tension of 5,540 volts at the terminals.

Around a drum casting of somewhat light form are placed the 12 pole-pieces of the machine which make up the revolving field. The field coils are of the usual kind and are held in place by an exterior pole shoe which is bolted on the end of the pole-piece. Here the field coil is made up of narrow flat copper strips, having 2.5 millimeters width, and each coil is wound with 134 turns. All the field poles are connected in series. The laminated ring which forms the armature of the machine is held between two ring-shaped end plates, and the latter are pressed together by a

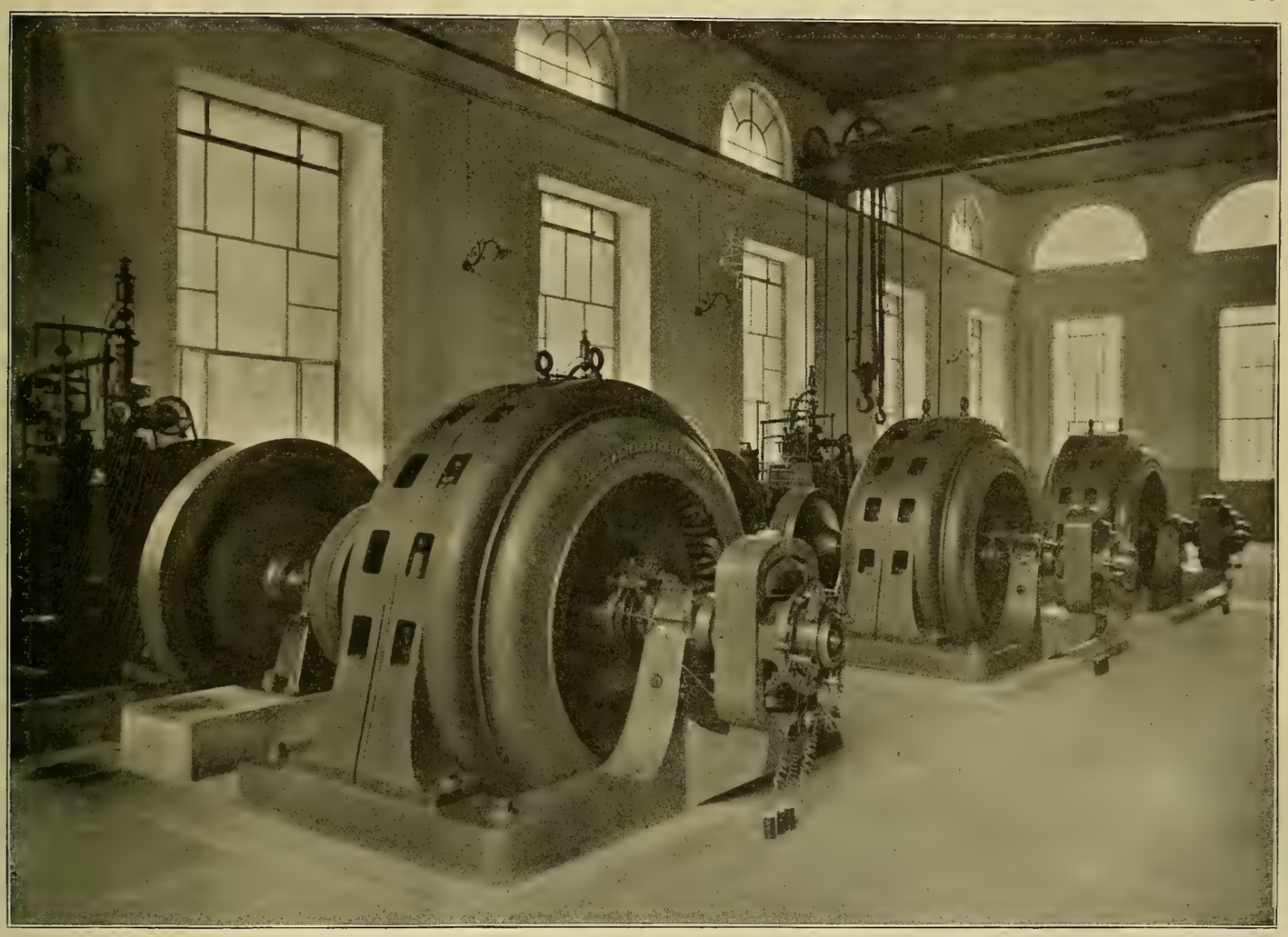


FIG. 1. THREE-PHASE ALTERNATORS DIRECT-COUPLED TO WATERWHEELS IN BELLINZONA PLANT.

series of bolts around the periphery. The ring which is thus formed is held in turn in a cast-iron portion, consisting of two half rings bolted together. Each of the latter castings has a base which allows it to be bolted separately to the base plate of the machine. The outer ring casting extends but a short distance below the floor level.

The armature winding, placed in a set of rectangular slots around the ring, consists of lathe-wound coils, and there are two slots per pole and per phase. There are 12 coils per phase, each coil consisting of 14 turns of a 5.6-millimeter wire. In the slots is previously placed a lining, two millimeters thick, of mica insulation. The armature winding is connected upon the star system. Upon the armature casting is bolted a circular

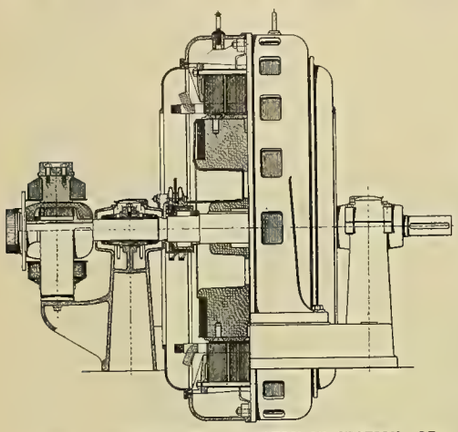


FIG. 2. END ELEVATION, PARTLY IN SECTION, OF ALIOTH ALTERNATOR.

piece which comes down over the ends of the armature coils on each side of the machine and gives them a good protection. Fixed on the outer end of the machine is a two-pole exciter of the upright pattern.

Shortly after the Bellinzona plant was completed the municipality had a series of tests made upon the alternator under the direction of Professor Wyssling. It was found that the loss in the machines when running at no load was 20 kilowatts upon a total capacity of 500 kilowatts. In this case the alternator under test was made to run as a motor, the current being taken from the other machines of the station. The efficiency of the machine at half load lies between 92 and 93 per cent., while at full load it reaches 95 to 95.8 per cent., this on a non-inductive load. On the same tests the drop in voltage for full load was found to be 190 volts upon 5,530 volts, or about three per cent. The resistance of the armature is 0.317 ohm per phase.

Located in a separate room, the switchboard (Fig. 4) is mounted independent of the wall in an iron framework, and is faced with a set of white marble panels. Three of the panels have now been equipped, one for each of the main alternators. Mounted in the framework back of the board are the three-pole switches of the machines, as well as the fuse blocks, the latter being of the porcelain tube pattern. On the marble panels are placed the indicating instruments, including voltmeters, ammeters, etc., while the base below the panels contains the hand wheels for the rheostat. On the bus-bars are connected two general voltmeters. Mounted above the switchboard are the lightning arresters.

The overhead lines leaving the power house are mounted on iron and wood poles, using triple-bell porcelain insulators in all cases. A solid construction is employed for the iron poles, which have been supplied by Buss & Co. of Basle, and they are built of four pieces of angle iron in pyramid form, carrying the insulators mounted upon brackets at the top. The lines which run to Bellinzona and Giubiasco consist of three-millimeter and six-millimeter wires, respectively. Transformer posts, installed by the Alioth Company, are located at Bellinzona, Giubiasco, Mollinago and Castione. With the exception of the former, the transformers are placed upon the poles. In Bellinzona there have been erected seven transformer posts of special form.

Fig. 3. Settling Chamber at Junction of Main Canal and Penstock.

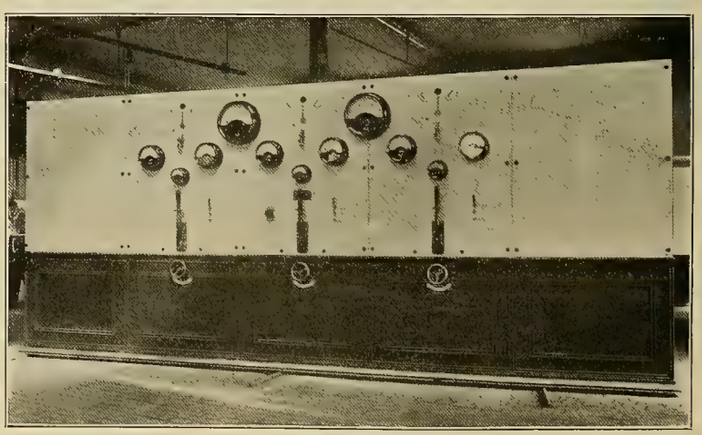


Fig. 4. Switchboard in Power Plant.

NEW HYDRO-ELECTRIC POWER PLANT NEAR BELLINZONA, ITALY.

Peculiar Cotton-mill Fire in Montreal.

In a report on a recent fire in the Dominion Cotton Mills at Montreal, Can., the insurance inspector finds conditions which are of interest. The mill in which the fire occurred is supplied with motor-driven machinery, the main current supply being 2,200-volt, 60-cycle, two-phase, from the Montreal Light, Heat and Power Company.

On the afternoon of the fire, the high-tension current was suddenly cut off at the power company's sub-station, and the motors in the mill at once slowed down. For some unknown reason the current was again thrown on to this circuit at the sub-station without notifying the mill electrician, as should have been done. The result was that two, possibly more, coils of the synchronous motor were immediatley burned out. The electrician noticed that something was wrong, and went immediately to the high-tension switchboard and pulled the main switch on one of the power panels. A short-circuit took place across the switch, and the heat was so intense that the electrician was forced to run from the room. It is not definitely known whether the arc itself spread from one panel to the next or whether the burning of the insulation from the wires on the back of the panels in turn caused short-circuits at the other panels. However, almost immediately the entire switchboard room was filled with flames and the insulation on the wires on the outdoor circuits leading to the tower was soon on fire, showing that there were very heavy short-circuits on the switchboard. It was estimated by the electrician that the arcing continued on the switchboard for about 10 minutes. The fire was extinguished after about a half an hour, but not before considerable damage was done.

The inspector points out the following lessons to be drawn from this fire:

Rooms containing switchboards or other apparatus forming centers of large electrical power should be non-combustible throughout; should not be used for storage of supplies.

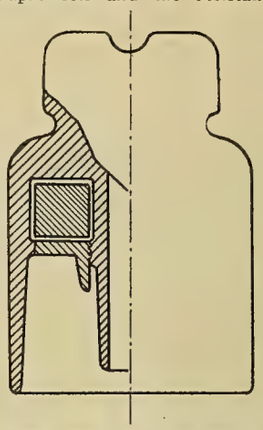
Some ready and safe means should be provided for controlling the high-tension current outside of the property.

While there is nothing new in these conclusions it is probable that there are other plants in which they have not been observed, and a disaster like the one here related should hold a lesson for them.

A recent report on conditions at Eau Claire, Wis., in Bradstreet's, says that 75,000 horsepower is available within 50 miles of that city. This power has only recently become available on account of the fact that the exhaustion of the timber supplies has caused many of the lumber companies to stop using the streams for logging purposes.

Combined Pupin Coil and Insulator.

Pupin load coils are coming into use in Europe for telephone lines of considerable length, especially in Germany, where there appears to be the greatest progress in this direction. Such coils are placed upon the pole lines and are spaced the proper distance apart. But as some good means must be provided for protecting the coils against the weather, some of the constructors have been looking for the most practical method of carrying this out. A good solution seems to be that shown in the accompanying sketch. What is novel in this case is the combination of the porcelain insulator of the line with the coil itself, so as to contain the latter within the insulator. The drawing shows how this is carried out so as to lodge both the Pupin coil and the resistance for the lightning arrester, the latter being placed on the pole.



COMBINED PUPIN COIL AND INSULATOR.

An insulator is used of the single-petticoat form, and it is made with an annular chamber near the upper part. Coil and resistance are placed together and form a ring which fits into the chamber of the insulator, leaving a small clearance. Once in place a screw cap working upon the core of the insulator closes up the chamber at the bottom. Melted insulating matter is then run in around the coil through a hole in the cap, so as to hold it solidly in place and prevent any moisture from reaching the coil through the joints of the cap. By this method of construction, the main body of the insulator remains in a single piece, and it is as strong and as easily made as an ordinary insulator.

Illuminating Engineering Society.

The election of officers of the Illuminating Engineering Society will be determined at the annual meeting on January 14th. Secretary A. H. Elliott, 4 Irving Place, New York city, is sending blank ballots to the members, which should be filled out and returned to him or sent to a proxy in time for the meeting. Following are the members' nominees, the council nominees being the same except as shown by names in parentheses: For president, Dr. Clayton H. Sharp; for vice-president, Dr. Louis Bell; for managers, Mr. F. N. Olcott, Mr. E. L. Elliott (Mr. E. L. Elliott, Mr. J. E. Woodwell); for secretary, Dr. A. H. Elliott (Mr. V. R. Lansingh); for treasurer, Mr. V. R. Lansingh (Dr. A. H. Elliott).

A new constitution, approved by a majority of the council, is submitted as a substitute for the present constitution. Votes for or against adoption should be recorded on the ballot. In the proposed constitution it is stated that the objects of the society shall be the advancement of the

theory and practice of illuminating engineering and the dissemination of knowledge relating thereto. Among the means to this end shall be meetings for the presentation and discussion of appropriate papers; the publication as may seem expedient of such papers, of discussions and communications; and, through committees, the study of subjects relating to the science and art of illumination, and the publication of reports thereon.

Some Simple Testing Methods.

By Charles H. Coar.

The widespread use of electrical currents for diversified applications has necessitated the making of a large number of scientific testing instruments, many of which are specially designed to be used in certain kinds of testing only. To meet the demand for testing instruments there has been placed on the market a large number of galvanometers, voltmeters, ammeters, Wheatstone bridges, ohmmeters and other forms of slide-

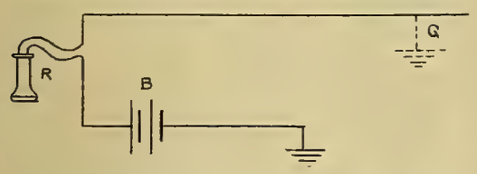


FIG. 1. SIMPLE TELEPHONE TEST FOR GROUND.

wire bridges, so that the field is large to select from.

Quite a number of these instruments are costly and perhaps little understood, and these facts enhance the value of any simple testing method which may afford fairly efficient tests with inexpensive apparatus.

To one who has never had occasion to use an ordinary telephone receiver, in conjunction with a current for testing, the use of this familiar method will come as a pleasant surprise, for it is truly remarkable what a large number of tests may be made by means of this simple combination.

While such an arrangement may not be of much practical use in absolutely establishing the location of certain faults, the presence of these faults can be readily detected, and in some instances located, by this means. For instance, such faults as grounded or short-circuited apparatus, open conductors, defective insulation, the presence of static electricity, etc., can be detected with the aid of a telephone receiver.

An ordinary receiver is a very sensitive instrument, and the flow of the smallest part of an ampere through the windings of it will produce an audible sound.

Therefore, by so arranging a receiver in a test that the sound will, as it is emitted, indicate certain conditions, fairly good results can be obtained. It is to be noted that receiver tests are to be applied to "dead" apparatus or circuits carrying but small currents, for the windings in a receiver are composed of small wire and are unable to withstand any great amount of current.

The ordinary receiver may be wound to a resistance of from 50 to 100 ohms, but does not, as a rule, much exceed the latter figure unless for

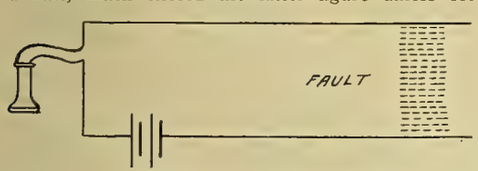


FIG. 2. TEST FOR DEFECTIVE INSULATION.

some special circuit or purpose, in which case they are sometimes wound as high as 5,000 ohms. It may be mentioned that the head receivers, provided with a head-band for holding the receiver to the ear, will be found most convenient during testing, for then the hands are left free for other operations.

A very simple test is shown in Fig. 1, wherein the receiver (R) and battery (B) are employed in series to detect the presence of the ground (G), on a wire as shown.

The method is self-explanatory, but it may be mentioned that, by first obtaining a click from the full strength of the battery (B), some idea may be had as to the nature of the fault, whether it be of high or low resistance, by noting the loudness of the click emitted during the test.

In Fig. 2 a similar test is shown to detect the presence of a short-circuit or partial short-circuit between two wires, such as might occur through defective insulation. The arrangement is practically the same, as will be readily seen.

From these diagrams it will be evident that many simple applications of this apparatus may be used to good advantage in locating grounds, short-circuits, opens, continuity, etc., such as are liable to occur in any electrical system. A small gas-lighter battery and a head receiver combine to form what may be truly classed as a compact and efficient testing appliance. It may be safely said that the larger share of telephone troubles are located and repaired through receiver tests of this description.

One of the most useful instruments for detecting and locating trouble by means of a mechanical movement visible to the eye may be found in the ordinary portable type of voltmeters. Here a current flow actuates a mechanism, so that a needle is deflected over a divided scale a certain number of divisions to represent a certain value.

A voltmeter in reality is an ammeter in that the movement of the needle depends upon the amount of current that traverses the coil. In other words, a voltmeter is an ammeter arranged to read in volts or potential differences. When a current passes through the windings of a voltmeter a certain deflection is obtained which is proportional to the current, and therefore the greater the current, the greater the deflection. Hence the deflections may be considered to represent the deflecting strength of the current passing through the voltmeter. Ohm's law, $I = \frac{E}{R}$, tells us that the current is directly proportional to the electromotive force divided by the resistance; hence if the resistance remains constant the current flowing must be proportional to the electromotive force producing it.

Therefore, by fixing the resistance of a voltmeter, its scale can be so calibrated as to read in volts, which must be in proportion to the current passing through it. The only great differences between voltmeters and ammeters is in their resistances. The resistance of voltmeters is high, as in ordinary practice these instruments are bridged to circuits, and without this precaution they would consume much current. Ammeters, be-

FIG. 3. VOLTMETER RESISTANCE TEST.

ing placed in series or connected around a shunt, are confined to low limits, so as not to offer any great resistance to the circuits in which they are placed.

Commercial voltmeters vary in resistance from a few hundred ohms to as high as 50,000, some being wound to higher resistances for special purposes. This would all depend upon the range of field they are to cover and the service to which they are to be connected. The resistance is usually so proportioned that the current flow is very small, a few thousandths of an ampere.

For illustration, let us assume that we have a voltmeter reading from 0 to 150 in volt divisions, with a resistance of 15,000 ohms. Then the current flowing through the voltmeter to produce a full deflection would have to equal

$$\frac{150}{15{,}000} = 0.01 \text{ ampere.}$$

Suppose now we insert a resistance of 15,000 ohms in the circuit. Then the current flowing would be decreased to

$$\frac{150}{15{,}000 + 15{,}000} = 0.005 \text{ ampere.}$$

With this arrangement, using the same potential, all readings would have to be multiplied by two to obtain correct values, and the voltmeter's range would thus be increased from 150 volts to 300. It is unusual to find the resistance of a voltmeter in a round number, so that in getting a proper resistance for a shunt or series value a rather inconvenient figure may result.

However, the resistance of a voltmeter is usually known, being in most instances stated on the instruments or containing case, so should it be desired to increase the range, say 10 times, a resistance nine times that of the voltmeter would have to be placed in series with it.

Portable voltmeters are usually provided with two scales, a high and a low scale, a favorite form having a high scale reading from 1 to 150 volts in volt divisions, while the low scale reads from 0 to 15 in one-tenth-volt divisions. In such an instrument it is common to provide a single binding post, which serves as a common connection to each scale, this post being marked positive.

In a very useful method for determining high-resistance faults by means of a voltmeter, the series arrangement, as shown in Fig. 3, is often used. As illustrated, the method consists merely of placing the voltmeter and battery in series with the fault at (X). It is necessary that the full voltage of the battery and the resistance of the voltmeter be known in making this test.

The formula for this test is $X = r\left(\frac{V^1}{V^2}\right) - r$,

where

X = the resistance of the fault.
V^1 = the full voltage of the testing battery.
V^2 = the voltage reading obtained through the fault.
r = the resistance of the voltmeter.

For example, let us assume (Fig. 4) that it is desired to test the insulation resistance of a generator and some lighting mains, as shown, and

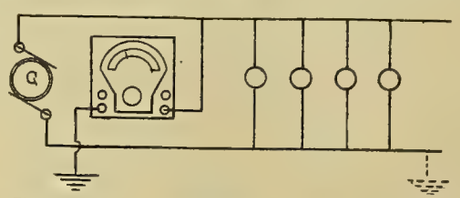


FIG. 4. TEST OF GENERATOR AND LIGHTING MAINS.

that by previous test we found the full voltage of the machine to be 110 volts. This would be obtained by connecting the voltmeter directly across the generator feeder terminals. Then, by arranging the voltmeter as shown in Fig. 4, we get a deflection of two volts, which may be due to leakage as a result of poor insulation. Having these two factors, and knowing our voltmeter resistance, which in this example we will assume is 18,000 ohms, the problem would arrange itself according to the formula in the following manner:

$$X = 18{,}000\left(\frac{110\,V^1}{2\,V^2}\right) - 18{,}000, \text{ or } 972{,}000 \text{ ohms,}$$

the insulation resistance of the circuit in question.

This action will be readily understood when one considers that the higher the resistance in series with the voltmeter, just so, in proportion, will the current be lessened, and, as before mentioned, the current is dependent on the voltage; hence the reading in volts proportionate to the resistance.

This method is used in all instances where high resistances are encountered, and as such has a very wide range of adaptability.

To measure low resistance, the fall-of-potential method is used, wherein a coil of known resistance is employed, as shown in Fig. 5. In this test the idea is to first note the drop of potential around the known coil, after which the known coil is substituted, and the drop of potential around this is noted. By a comparison between the two readings thus obtained the resistance of the unknown coil is determined by the following problem or formula:

$$X = \left(\frac{V^2}{V^1}\right) r, \text{ where}$$

X = the unknown resistance.
V^2 = the reading obtained around the unknown coil.
V^1 = the reading obtained around the known coil.
r = the resistance of the known coil.

For example, let us assume in Fig. 5 that we have a coil (R) whose resistance is known to be

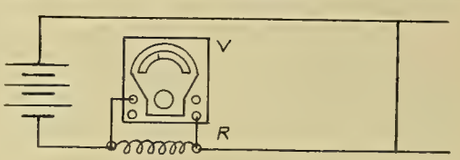


FIG. 5. FALL-OF-POTENTIAL METHOD.

100 ohms, and that in the arrangement as shown we obtain a reading of five volts. Then, by substituting the unknown coil in place of the known coil (R), we obtain another reading of 10 volts. According to the formula, the resistance of the unknown coil would be:

$$X\left(\frac{10\,V^2}{5\,V^1}\right)100\,r = 200, \text{ or } 200 \text{ ohms.}$$

In a similar manner the voltmeter may be used in absence of an ammeter to detect the amount of current flowing in a circuit. In this test Ohm's law, $I = \frac{E}{R}$, is utilized in the following manner:

Let us assume in Fig. 6 that it is desirable to know the amount of current flowing through the

coil (X). By arranging a voltmeter as shown around a coil (R) whose resistance is known we obtain a certain reading, which is due to the fall of potential around this coil. Let us assume that the coil (R) has a value of 100 ohms and that the drop of potential as noted around the coil by the voltmeter is 10 volts. Then 10 volts is expended in forcing whatever current is passing through this coil.

By the formula, $I = \frac{E}{R}$, we have $\frac{10}{100} = 0.1$ ampere. Therefore 0.1 of an ampere must be flowing through the coil, and since the current in a series circuit must be equal in all parts, it is

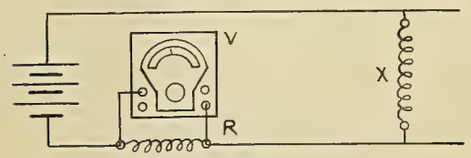


FIG. 6. TEST FOR CURRENT FLOW.

reasonable to suppose that this amount of current must be passing through the coil (X), which is the truth.

One other voltmeter test which depends upon the fall of potential can often be utilized to good advantage to determine the internal resistance of a source of current, such as a battery. In this arrangement (Fig. 7) a shunt coil (R) whose value is known is also used.

In making this test it is first necessary to know the full voltage of the battery in question on open circuit, as may be determined by placing the voltmeter directly across the battery terminals. The coil (R) is shunted around the battery, as shown, and a second reading obtained, when the following formula is used to derive a result:

$$X = \frac{(V^1 - V^2)}{V^1} r, \text{ where}$$

X = the internal resistance of the battery.
V^1 = the reading on open circuit.
V^2 = the reading obtained around the shunt.
r = the resistance of the shunt.

For example, let us assume that on obtaining a reading on open circuit we get 10 volts, and around the shunt (R), having a value of 20 ohms, we obtain a reading of 9.5 volts. According to the formula, the internal resistance would be

$$\frac{(10\ V^2 - 9.5\ V^2)}{10\ V^2}\ 20\ r = 1.$$

Therefore, the internal resistance of the battery in question is one ohm.

Knowing the internal resistance of a battery, there are several other tests that may be made

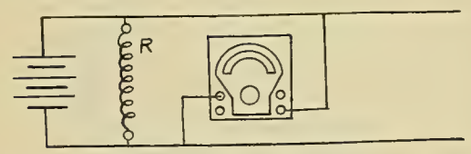


FIG. 7. TEST FOR INTERNAL RESISTANCE.

by the fall-of-potential method, but the above-described tests are the most used.

In describing these voltmeter tests nothing but the direct-current type of instrument has been considered, although similar tests are feasible with alternating-current apparatus in the measurement of non-inductive resistances.

One of the most adopted methods of testing utilizes the Wheatstone-bridge principle, which depends upon the relation that divided circuits bear to each other. The two fundamental laws upon which the action of this bridge depends are:

First—No current will flow between points of equal potential.

Second—The drop in potential along the various parts of a circuit is proportional to the resistance of these parts

It is reasonable to suppose that if two circuits are provided for the same current to flow over, and that one of these circuits has twice as much resistance as the other, this circuit would receive but half as much current as the circuit of lower resistance

Let us refer to Fig. 8, where the circuit arrangement of a Wheatstone bridge is shown, in which (A) and (B) form what is known as the ratio or short arms of the bridge; (R) forms the rheostat arm, and (X) represents the point where the object to be measured is introduced. (G) is the galvanometer, and a source of current is shown. The ratio or short arms are alike, and usually consist of three coils each, a 10-ohm, a 100-ohm, and a 1,000-ohm coil.

These coils are usually arranged to be placed in and out the circuit by means of brass blocks and contact plugs. The rheostat arm has a series of coils arranged in different values, so that various steps may be obtained between 1 and 1,000 ohms by means of this arm. Different manufacturers arrange the coils in different manner, but the principle of operation must of necessity remain the same.

Now, referring to Fig. 8, and working out the bridge formula, $X = \frac{B \times R}{A}$, or $\frac{1{,}000 \times 5}{100} = 50$, or X = 50 ohms, as shown. Before a balance in the bridge arms can be obtained the points marked (3) and (4) must be of equal potential as they are when the (A) arm bears the same relation to the (R) arm as the (B) arm does to (X). When this condition exists no current will flow through the galvanometer, and the needle therefore remains at zero, indicating the fact that a balance has been obtained.

Let us trace the battery current through this operation. Current flows from the positive post to point (1), where two paths are offered it to flow over, one having 10 times the resistance of the other. The current assumes this proportion over (A) and (B) up to (3) and (4), where, if the same relationship may be obtained over (R)

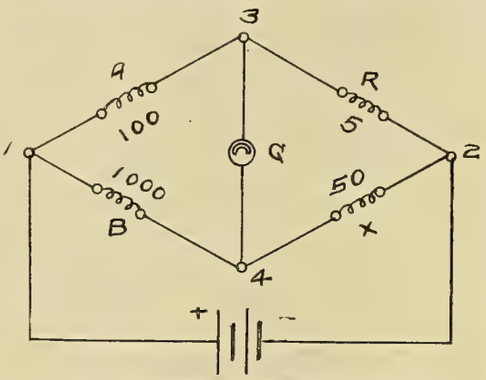


FIG. 8. WHEATSTONE BRIDGE ARRANGEMENT.

and (X), the current continues on to point (2), via the arms (R) and (X), thence to the negative post of the battery.

However, if the resistances in the (R) and (X) arms should disarrange the current proportions taken over the (A) and (B) arms, then a flow of current necessarily has to take place through the galvanometer, due to the fact that an unbalanced condition exists, hence the relationship and the formula.

There are various forms of bridges, but the idea is to describe some of the simplest methods of utilizing this principle, for often a regular Wheatstone bridge cannot be obtained.

A comparatively efficient form of a Wheatstone bridge may be constructed on a yardstick by means of a piece of resistance wire, a standard coil and a telephone receiver. The arrangement for making a resistance test is shown in Fig. 9, where the yardstick is shown, reading from 0 to 36. A bare resistance wire is drawn fairly taut over the stick and a battery connected to the terminals, as shown. The standard coil (A),

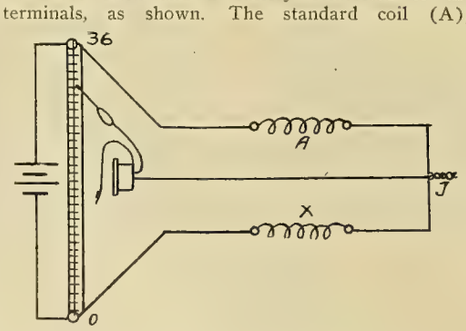


FIG. 9. A HOME-MADE WHEATSTONE BRIDGE.

whose resistance is known, the unknown coil (X), including the receiver, which is provided with a "feeler" terminal, are connected as shown, when the combined arrangement is essentially a Wheatstone bridge of the slide-wire principle.

In Fig. 9, let us assume that the (A) coil has 10 ohms resistance and that it is desired to know the resistance of (X). The "feeler" is tapped along the resistance wire until no sound is heard in the receiver, which indicates that a balance has been struck. We will presume that this occurred at a point marked 30 on the stick. Then, according to the formula, the standard coil (A) must bear the same relationship to the coil (X) as the distance covered on the yardstick in securing a balance does to the remaining distance. Thus $\frac{30 \times 10}{6} = 50$, or X equals 50 ohms.

An arrangement of this kind can be used to

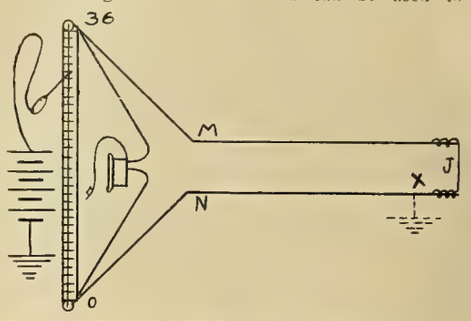


FIG. 10. YARDSTICK WHEATSTONE BRIDGE FOR LOCATING GROUNDS.

good advantage in locating grounds in cable conductors, as shown in Fig. 10, where the scheme shown is identical with what is known as the Varley loop test. As shown in Fig. 10, no standard resistance is used, but it is necessary in this instance to know the linear distance of the circuit under test.

In Fig. 10, let us assume that (M) and (N) are two wires forming a pair in a telephone cable 3,600 feet long, and that the (N) wire has a ground on it, as shown at (X). The good wire is connected to the 36 end of the yardstick, the bad wire to the zero end, and the wires are joined together at (J), as shown. With the other apparatus arranged as shown, let us assume that a balance is struck at 12 on the yardstick, when, according to the formula, we would derive the number of feet to the fault as follows:

$$\frac{12 \times 2 \times 3{,}600}{36} = 2{,}400,$$

or 2,400 feet to the fault from the observer.

In this arrangement we have substituted feet for ohms. This test may be made more evident by understanding that the point 18 on the yardstick should be the balance point if the ground was located at the center of the joint (J). Any movement or displacement of the ground from

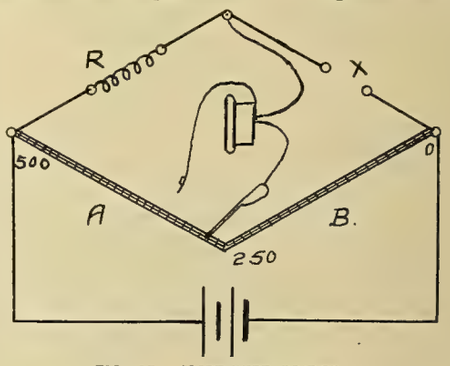


FIG. 11. SLIDE-WIRE BRIDGE.

this point, which is presumed to be the center of conductivity between the wires (M) and (N), must be calculated to mean just so many more feet added to one side of either (M) or (N). Hence, in seeking a balance, the balance will be found a proportionate distance from the point 18 on yardstick. Most any of the tests made with a Wheatstone bridge may be made with this simple apparatus, if sufficient known quantities can be obtained, such as the length of the cable in the example cited.

The most ordinary form of the slide-wire bridge is a most useful instrument, and this may be constructed in permanent form by anyone having electrical junk, coils, switches, etc. The only practical difference between an ohmmeter and a Wheatstone bridge is in the method of introducing the resistance. In the Wheatstone bridge, as already explained, the resistances are introduced step by step by contact plugs or switches, while in the ohmmeter two arms are formed by the bare resistance wire as the contact is made with the same through the "feeler." A Wheatstone usually employs a galvanometer to detect a balance, while a telephone receiver is, in most instances, used with the ohmmeter.

The similarity between the two instruments may be better understood by reference to Fig. 8 and

Fig. 11. In constructing an ohmmeter it is essential that a slide wire of as high resistance as possible be used, and, inasmuch as this wire is subjected to considerable handling, the size cannot be too small without impairing the strength and lasting qualities of the same. The following list may be used as a guide in selecting any of the wires mentioned for this purpose:

COMPARATIVE RESISTANCES OF DIFFERENT METALS, COPPER BEING 1.

Copper	1
Norway iron	7
Soft steel	8
Eighteen per cent. german silver	18
Ferro nickel	17
Thirty per cent. geiman silver	28
S. & B. wire	32
Climax	50

In Fig. 12 is shown one arrangement for constructing an ohmmeter. The bus-bars (i. e., the parts shown by the heavy black lines, which connect the various portions of the scale wire and binding posts) should be made of heavy copper, so as to offer no appreciable resistance. This is necessary, in order that the scale divisions be not irregular, as would be the case if the connecting

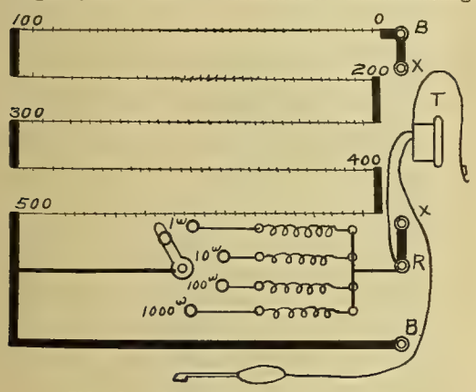


FIG. 12. ARRANGEMENT FOR OHMMETER.

bonds, contacts and binding posts introduced any appreciable resistances in their respective parts.

Four non-inductive resistance coils are employed, as shown, these being arranged so that they may be introduced in the circuit by means of the switch contacts and lever. Coils may be wound non-inductive by doubling the length of wire necessary for the required resistance and winding it in this manner on the containing spools. The scale may be marked up on white bristol cardboard, which should then be shellacked and placed under the scale wire in such manner that a reading may be obtained at any point on this wire.

The "feeler" can be constructed of any metallic object provided with an insulating handle and flexible terminal, to permit moving the same freely over the scale wire. Care should be exercised in making a "feeler," in order that a sharp edge will not be used on the scale wire. The various terminals are marked and are self-explanatory. The scale wire should have at least 10 ohms resistance. Pulsating or alternating currents give better results for testing than does direct current, because any change in current strength in the former is more audible. If direct current is used, it will be necessary to tap on and off the scale wire with the "feeler" until a balance is obtained. The operation has been explained in connection with other tests, and it might be mentioned that with very little change an ohmmeter of this description can be arranged to measure inductance, capacity, electrolytic solutions, etc. As a whole, such an instrument is adapted to rough handling, as there are no delicate movements to become disarranged.

Electrical Committee of the Underwriters.

The annual meeting of the electrical committee of the Underwriters' National Electric Association will be held in March, 1907, in New York city. The day and place of the meeting will be announced later. As usual, the provisions of the National Electrical Code as they now exist will be the principal matter for consideration, and it is requested that any desired change in, or addition to, the Code be forwarded to C. M. Goddard, secretary, 55 Kilby Street, Boston, on or before February 1, 1907, in order that it may be printed in the bulletin, and the committee and other interested parties may thus have opportunity to consider same in advance of the meeting.

Final action on suggestions not received in season for consideration by the committee before the meeting can only be taken by unanimous consent. As heretofore, the meeting will be open to all interested, and such persons will not only be welcome, but are urged to be present and give the committee the advantage of their experience and advice.

Baum's High-tension Insulator.

In the insulation of potentials of 60,000 to 100,000 volts and over, serious difficulties arise by reason of "leakage" or "creepage" of the electricity over the surface of the insulators.

The leakage is due principally to dust and moisture upon the surface of the insulators, which constitutes a film for the conduction of electricity or minute conducting areas between which static discharges may take place. In order absolutely to prevent leakage across the surface of the insulator, it is necessary that the latter be perfectly clean and dry and have sufficient intervening surface between the conductor and its supporting means.

In order to secure a dry surface insulators are commonly made with several "petticoats," so as to present a minimum unprotected surface to the atmosphere to gather dust and damp. In time, however, even the protected surfaces are liable to become covered with a deposit of dust, which greatly impairs the insulation, and since the surfaces are not exposed they are not washed off by the rains under these conditions.

An insulator which it is claimed will meet these difficulties, resist high voltages, operate in rainy weather and not be liable to deterioration from accumulations of dust upon its surface, has recently been patented.

In the patent, which was issued to Frank George Baum, of San Francisco, Cal., the claim is also made that the insulator has the advantage of being of simple, strong and compact construction and is adapted to use with the existing posts and supporting pins.

The accompanying drawing shows an insulator embodying the principles of the invention. The insulator is shown partly in section and partly in side elevation.

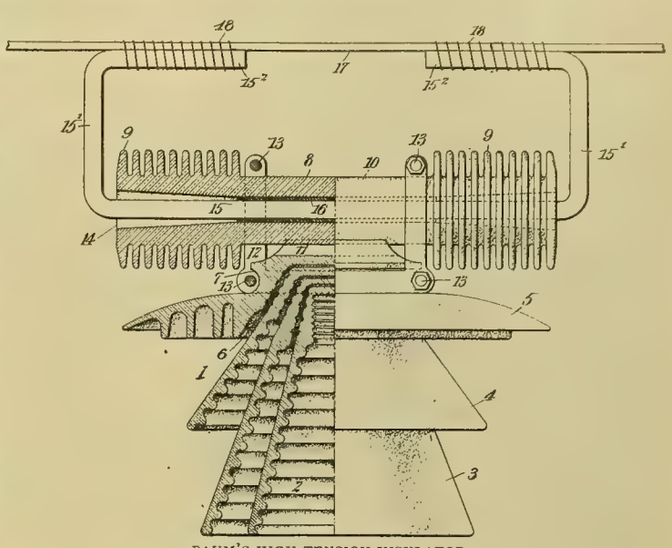
It is understood that the surfaces, which are exposed to the weather to a sufficient extent to be effectually washed off by the rains, are in a position to have their insulation impaired during a storm by the coating of moisture. Therefore, the inventor, in carrying out his ideas, makes use of a combination of weather-washed surfaces with petticoat-protected surfaces.

Referring to the drawing in which like parts are designated by the same reference sign, (1) indicates a petticoated insulator of substantially the ordinary form, having petticoats (2), (3), (4) and (5) on it, each of which has its interior face ribbed or corrugated, so as to provide greater insulating surface.

The cement fillings by which the different petticoats are secured together are shown by (6). The upper petticoat (5) is provided with the usual annular groove (7) for the reception of any clamping or securing devices. Groove (7) is used for supporting a supplemental and weather-washed insulating member, which constitutes an essential feature of the invention. A practical form of this supplemental insulator is shown in the illustration and comprises an insulating tube (8), of porcelain or other material, having annular ribs (9) extending along a considerable distance at each end. The central portion of the tube is conveniently left smooth, as at (10), and fits in the groove (11) on the petticoat (5).

Supporting straps are shown at (12) by which the tube (8) is secured to the body of the insulator (1). In the drawing these straps comprise stamped metal plates, which are slightly bent to surround the tube (8) and the groove (7) and are clamped into place thereon by clamping bolts (13). The particular method of supporting the tube (8) from the insulator (1) is not important, it being merely essential to secure the two together, so as to leave the ribbed ends (9) exposed and out of contact with the main insulator.

The supplemental insulator (8) is provided with means for holding the line wire in place, and the supplemental insulator is shown as having a longitudinal square hole (14) with slightly-flared ends. Within this hole is inserted a supporting frame of metal rod (15), which may be held in place by a layer of cement (16) at its central portion. The ends (15) of the supporting frame are afterward bent upwardly and toward one another, so as to form alined sections (15²), to which the line wire may be conveniently attached. (17) indicates the line wire, which is strapped to the frame (15) by binding wire (18). On account of this arrangement the insulation strain lies between the cement (16) and through the body of the insulators (8), (5), (4), (3) and (2), which is almost an absolute insulation for practical purposes. Surface leak-



BAUM'S HIGH-TENSION INSULATOR.

age may only take place along the interior walls of the supplemental insulator (8), over the entire area formed by the exterior ribs (9), and finally over all of the successive exterior and interior surfaces of the quadruple petticoated main insulator (1). In this action it may be observed that the leakage must always traverse an extensive weather-washed surface—namely, the ribs (9)—and an extensive protected surface—namely, the interior ribbed faces of the quadruple petticoats (2), (3), (4) and (5). The ribs (9) being washed by the rains are always clean and should secure perfect insulation in dry weather. In wet weather the interior surfaces of the petticoats (2), (3), (4) and (5) are in condition to effectively insulate the current.

Chicago Street-railway Situation.

The local transportation committee of the Chicago City Council has selected Bion J. Arnold as the third member of the board of supervising engineers which is to have in charge the rehabilitation of the street-railway systems if the prospective new ordinance outlined in the Western Electrician last week is passed by the Council, which seems probable. Although no contract has yet been signed Mr. Arnold has signified his willingness to accept regardless of the fact that his services are wanted in other enterprises, one, especially flattering, being an offer to go abroad on an engineering work requiring four months' time at a salary of $25,000 and a two per cent. commission on the contract price to complete the work. Mr. Arnold, it is understood, would be in charge of the work in Chicago, including the drawing of plans and specifications. His salary was fixed at $30,000 a year. Both parties to the present franchise negotiations, as well as the public at large, are pleased at the prospect of Mr. Arnold supervising the work, as it insures not only efficiency in the engineering work but the faithful safeguarding of the interests of all concerned.

Considerable opposition is manifest to the mayor's policy of adhering to his campaign promise of demanding a referendum on any street-railway settlement ordinance. The terms of the ordinance, which may be reported to the Council at its next meeting, are considered so favorable to the city's interest and are so promising of speedy improvement to transportation facilities that aldermen and citizens are demanding a speedy conclusion of the negotiations. The Chicago Tribune has been conducting a postal-card vote on the proposition to hold the ordinance over until after the spring election so that the people may vote on the settlement terms before the Council takes action, and on this question the vote stood about four to one at last report in favor of letting the ordinance go to the Council at once.

Minor details of the ordinance have been agreed upon, and on the terms proposed the city would get $1,457,500 as its share of the earnings the first year, estimating the gross receipts of the two companies at $18,000,000. This amount for the city is after allowing 70 per cent. of gross receipts for operating expenses and renewals. After three years, when the lines will be practically rebuilt, only six per cent. of gross will be added to the operating expenses for renewals, which will give the city a bigger percentage.

WESTERN ELECTRICIAN

EVERY SATURDAY.

PUBLICATION OFFICES:

507 Marquette Building, - CHICAGO.

TELEPHONE, MAIN 1746.

Eastern Office, 150 Nassau Street, New York.

Telephone, 5220 Beekman.

Trade Supplied by Western News Co.

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DATES AHEAD.

Chicago Electrical Show (second annual exhibition), Coliseum, Chicago, January 14 to 26, 1907.

Northwestern Electrical Association (annual meeting), Coliseum, Chicago, January 16th, 17th and 18th.

Central Electric Railway Association (annual meeting), Indianapolis, January 17th.

IT IS GRATIFYING to note the probability that, if the proposed street-railway settlement now under consideration in Chicago goes into effect, Mr. Bion J. Arnold will be appointed chief of the supervising commission of engineers at the handsome salary of $30,000 a year. This decision of the local transportation committee of the City Council and its virtual acceptance by the street-railway interests form a well deserved tribute to the fairness, engineering ability and good judgment of Mr. Arnold. It is also a recognition of the high character of Mr. Arnold's work as technical street-railway adviser of the city of Chicago for several years past. The Western Electrician has watched Mr. Arnold's interesting career for fifteen years or more, and it warmly commends his selection for the important position for which the committee of the City Council has named him in advance. He is particularly well fitted for it because he is a Chicagoan with the interests of his city at heart; because he is eminently alert, intelligent and fair-minded; because he is one of the highest authorities in the country on the design and operation of electric railways, and, best of all, because he is an honest man.

CHICAGO'S electrical interests have reason to be proud of the conspicuous success of the Electrical Show of this year, and there is no reason to doubt that next year's exhibition, which will be given next month, will at least equal and probably surpass its predecessor. This exhibition is the only thing of the kind in the country on a large scale, and it may well be considered the National Electrical Show, occurring annually. It is entitled to the cordial support not only of electrical people but of the general public as well.

FROM OHIO comes the news of an interesting legal decision, for the Little Miami Light, Heat and Power Company has won its contention in the courts at Batavia, in that state, that companies engaged in its line of business have the right to condemn property for locations for plants. The company desired a five-acre tract owned by John T. White on the bank of the Little Miami River near Miamiville, but could not purchase it. Condemnation proceedings were brought, but defense was made on the ground of the unconstitutionality of the law providing for such proceedings. The court has decided that the law is constitutional, and a hearing on the question of damages will be had later. This company is developing the waterpower on the Little Miami River, and some of the people living along the stream object on the plea that dams will cause frequent overflows. The question of waterpower development and riparian rights often involves conflicting interests and complicated legal entanglements. Where it can be shown that the greater good is subserved by the power development, the right of condemnation simplifies matters greatly; and it is significant of the trend of public opinion that this right is granted in a populous and wealthy state, having widely diversified interests, like Ohio.

THE VICTORIA FALLS power-transmission scheme for South Africa has been revived, to judge from financial advertisements appearing in English papers, but apparently with all the technical objections to which the Western Electrician made reference some time ago. The scheme is advertised in a flamboyant style which makes it look suspicious at the outset. But it is curious that the London Times, which was formerly conspicuous in criticizing the project in its Engineering Supplement, is now as dumb as an oyster. Coincidently there appears in the aforesaid supplement prominent advertisements, printed in such a manner as to look much like "pure reading matter" and setting forth in alluring if not convincing terms the alleged advantages of the project, stock shares of which can no doubt be purchased by the investing public. This abandonment by the London Times of what seemed to be a just and honorable opposition after getting some advertising has a painful effect. We agree with the London Electrical Review that the "Thunderer" seems to have fallen from its high estate. There has been a good deal of talk of "American journalistic methods" in the office of the London Times; we trust that our English friends will not accept this instance as an example of such methods.

THE INDEX of the current volume of the Western Electrician—Volume XXXIX.—which is concluded with this number—is in course of preparation, and will be distributed in the usual form, free to all subscribers, with the issue dated January 12th or January 19th. It is interesting to note that the total number of pages in the two volumes constituting this year's issue of this journal, excluding indexes and a supplement, is 1,096, the largest number ever printed. Comparing recent years, the figures are: 1906, 1,096; 1905, 1,034; 1904, 1,066; 1903, 1,012. This refers, of course, exclusively to the literary or "reading-matter" pages, the advertising pages not being considered. Each page consists of three columns and contains from 2,500 to 3,000 words, or the equivalent in illustrations. Thus, the total volume of reading matter given this year is between 2,740,000 and 3,288,000 words, less the space occupied by pictures. The number of illustrations is about 1,650, and the whole output is the equivalent of about 23 technical books, of average size, allowing 70 illustrations to each.

The next issue will be the Annual New Years Number and will contain, as in former years, the Western Electrician's Estimates of the Value of Electrical and Auxiliary Manufactures for the year just concluded. In addition, there will be well illustrated reviews of the electrical progress of the year in the United States, in Great Britain and in Continental Europe, a clearly illustrated description of advanced central-station methods in one of the large cities of the Middle West, and several other attractive features, the whole enclosed in a handsome colored cover of special design. The interesting serial on "Wireless or Radio-telegraphy" begun December 1st will run during the early issues of 1907, and before it is concluded another will be begun, giving practical talks on electrical engineering, more especially designed for beginners and men who desire to supplement practical knowledge with technical information.

Other new features are in contemplation, with the consistent purpose of making the paper of increasing usefulness to its readers, to all whom the Western Electrician extends its best wishes for a Happy New Year.

ALLOYS of metals present characteristics of electrical conductivity quite distinct from those of the metals composing them. The subject is one of interest and was considered in a paper on "The Electrical Resistance of Alloys," read by Dr. R. S. Willows before a recent meeting of the Physical Society in London. The speaker said, according to a summary in one of our English contemporaries, that Lord Rayleigh has given a theory intended to account for the high resistance of alloys compared with that of the constituent metals. According to this theory, when a current is sent through an alloy it sets up a series of Peltier effects at the junctions of the dissimilar metals, and hence also a back electromotive force. Since these effects are proportional to the current, they are indistinguishable from a resistance under ordinary conditions. It is this spurious resistance that may account for the difference in behavior of an alloy and a pure metal. The author attempted to put this in evidence by measuring the resistance of an alloy with direct and also alternating currents. At the instant of reversal of the latter the back electromotive force will assist the external electromotive force, and hence more current will pass, i. e., the resistance will apparently be reduced. A bridge method was used, the frequency varying between 10-989 per second. No spurious resistance could be detected. If it were present its temperature coefficient would probably differ from that of a pure resistance. The method was therefore used between temperatures 100° C. and that of liquid air, but again with negative results. A minimum accuracy of 0.02 per cent. was attained. In the discussion Prof. J. A. Fleming said that Lord Rayleigh's theory was ingenious, but it presupposed a coarseness of structure in the alloy. An alloy was probably a substance of the nature of a solution with a fine structure, and it was difficult to see how thermo-electric electromotive forces could be brought into play without discontinuity of material. Mr. A. Campbell said that shortly after Lord Rayleigh advanced his theory he made some experiments to try to detect if alloys showed changes of resistance when tested with alternating and direct currents. The alloy selected was ferro-nickel, as it was expected that this would show the effect strongly, as the constituents give a strong thermo-electric electromotive force. No difference could be detected between the apparent resistance with the direct current and with alternating current of frequencies up to 80 per second, the usual correction for contact difference being found and applied.

Vibrations in Passenger Trains from High-speed Electric Lighting Engines.[1]

By F. W. Huels.

The vibrations in passenger trains caused by the reciprocating action of the high-speed engine of the electric generating sets constitutes one of the principal objections to their use. These engines produce vibrations that are sometimes of considerable magnitude, owing to lack of perfect balance of the reciprocating parts. The vibrations are transmitted back into the train, since the whole train is elastic. Thus a source of annoyance to the passengers is created which railways would be glad to get rid of, and steam turbines are now replacing reciprocating engines in the train-lighting field because they have the advantage of no vibration.

It is interesting and of some importance to know something about the magnitude and character of these vibrations. So far as is known to the writer, no attempt has been made heretofore to make measurements of them.

For measuring vibrations of this kind, instruments known as "seismographs" or "seismometers" are used. This name was originally given to instruments constructed to measure the movement of the ground during earthquakes.

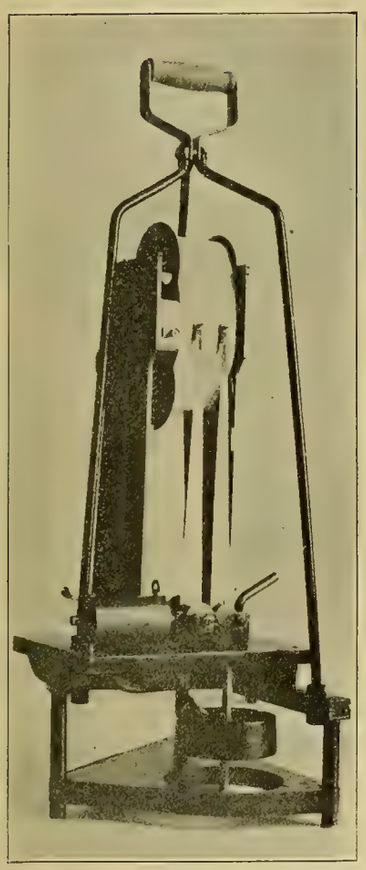


FIG. 1. FRONT VIEW OF VIBRATION RECORDER.

The instrument (see Fig. 1) consists of four principal mechanisms, which may be described as follows:

1. A mechanism for indicating and magnifying the vertical component of the motion.
2. A mechanism for indicating and magnifying the horizontal component of the motion in one direction.
3. A mechanism for permanently recording both vertical and horizontal components on the same record sheet.
4. A base with suitable framework serving to support mechanisms 1, 2, and 3, and which serves to give stability to the apparatus.

The Vertical Motion.—The vertical component of the motion is recorded by the device shown in Fig. 2. A cylindrical brass weight (A) weighing two pounds, is supported upon the lever (B). The spindle (C) is solidly fastened to (B), and at right angles to it, by means of the collar (D). Spindle (C) is then mounted upon a base by means of the pivots (E) and (F). At one end of (C) is the pin (G). Mounted upon (C) is a coil spring (H), consisting of 30 turns of No. 12 iron wire. One end of this spring is fastened around the pin (G) and the other end is solidly soldered into a collar (I). Collar (I) fits into the support (J) and is so arranged that the torsion of the coil spring can be regulated. A light aluminum pointer (K) carrying a pencil at its upper end is mounted upon the collar (D). It magnifies the displacement of the weight (A).

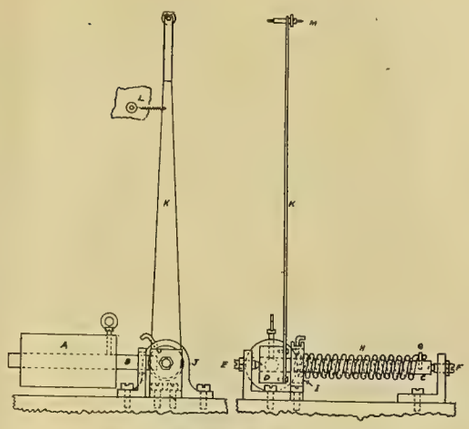


FIG. 2. DEVICE FOR RECORDING VERTICAL MOTION.

The operation is as follows: When (A) is moved downward and released, it returns to its normal position. This normal position is horizontal and it is kept there by placing the proper tension upon the spring (H). When (A) is moved upward there is a tendency to continue upward. A small spring (L) may be attached to the pointer (K), its tension being regulated to bring the weight back into its normal position.

Now, for up and down movements of the points (E) and (F) corresponding to movements of the base of the instrument, some point in (A) tends to remain stationary on account of the inertia of its weight. As already mentioned, the resulting relative movement is indicated and magnified by the pointer (K), and a record of it is made by the pencil point (M) at the end of the pointer.

It can be seen that a horizontal displacement of the points (E) and (F) will have no effect upon the weight (A) and will produce no displacement of the pointer (K). Hence, the device records the vertical component of the movements of the base.

The Horizontal Motion.—The device by means of which the horizontal motion is recorded is shown in Fig. 3. Such movements are detected by pendulums.

A spindle (A) is pivoted at the points (B) and (C). Hanging from the spindle, and rigidly fastened to it, is a circular piece of cast-iron (D) weighing 4¼ pounds. An aluminum pointer (E), carrying a pencil point at its upper end, is also fastened to the spindle.

By examining the diagram it will be seen that when the points (B) and (C) are quickly moved to the right or left, some point in the weight (D) will remain at rest, on account of the inertia of the weight. This will cause a multiplied record of the displacement to be made by the pointer (E).

A vertical displacement of the points (B) and (C) will cause no movement of the pencil point with respect to (B) and (C). Consequently, this contrivance will be unaffected by the vertical component of the motion, but will record the horizontal component.

The Recording Mechanism.—For permanently recording the vibrations, a strip of metallic paper, 2½ inches wide, is made to pass under the pencil point by means of clockwork. The paper is unwound from one roller and wound upon another.

Metallic paper and ordinary paper have been used. Brass points, black lead, and indelible copying lead have been used for pencil points. Experience has shown that brass points do not make a satisfactory mark. By using metallic paper and either black lead or indelible-lead points a fine record is obtained on the smooth surface of the metallic paper. A further advantage of using indelible points is that the record may be strengthened and permanently fixed by dampening it. This makes a very satisfactory method.

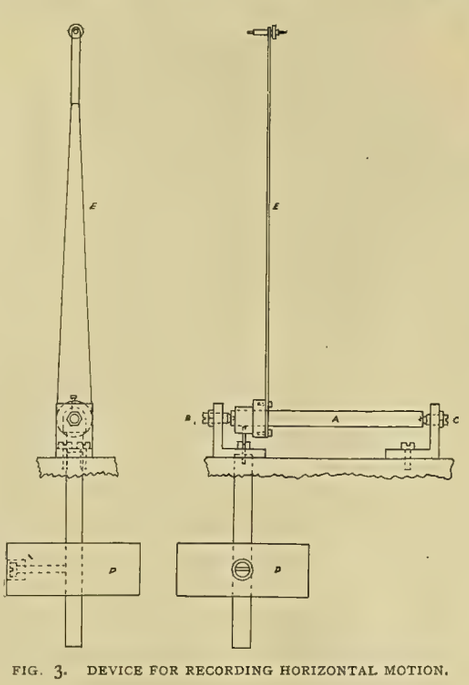


FIG. 3. DEVICE FOR RECORDING HORIZONTAL MOTION.

The Base and Framework.—These three mechanisms, that for the vertical motion, that for the horizontal motion, and the clockwork for driving the paper, are all supported by the necessary framework upon a heavy iron base. A handle is also provided by means of which the instrument can readily be carried about.

The instrument whose characteristics have just been described was set upon the floor of the car under test and allowed to operate. A record was obtained which showed the horizontal and vertical components of the motion of the car floor at that particular point. The instrument, being portable, was next set up on various cars of the train and at various points on the cars.

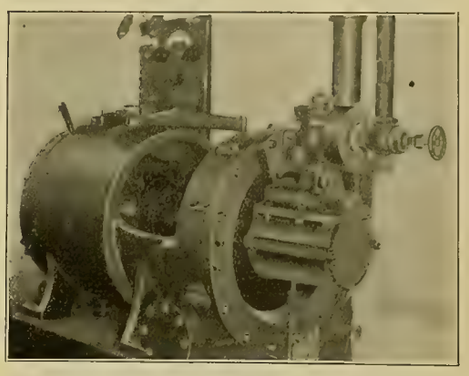


FIG. 4. 25-KILOWATT STEAM-TURBINE LIGHTING SET.

Through the courtesy of the Chicago, Milwaukee and St. Paul Railway Company and the Chicago and Northwestern Railway Company, it was possible to make tests of the nature and magnitude of the vibrations produced by the generating sets in use on some of their finest trains. The records were taken on trains that were as nearly alike as possible in all respects. Twenty-kilowatt Westinghouse engines and 25-kilowatt Curtis turbines were tested on both trains, the only difference being that the sets in the case of the Chicago, Milwaukee and St. Paul trains were crosswise and in front of the baggage car, while in the Chicago and Northwestern trains they were lengthwise and in the rear of the baggage car. (Fig. 4 shows the turbine set and Fig. 5 the reciprocating-engine set.)

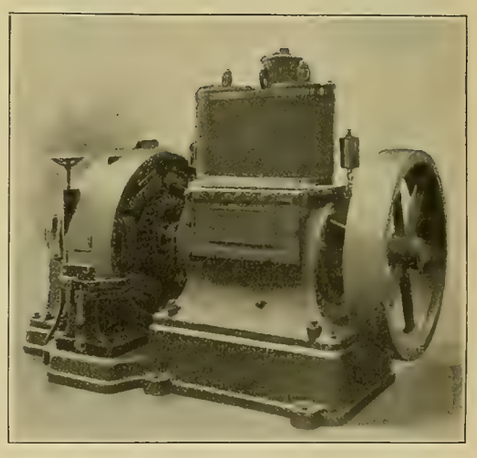


FIG. 5. RECIPROCATING-ENGINE LIGHTING SET.

From the experiments recorded, and from general observations, it appears that reciprocating-engine train-lighting sets as installed at present, produce vibrations of considerable magnitude, due to unbalanced forces set up in them by the reciprocating motion of their parts. It appears that the vibrations produced are of a complex character, and that they can be resolved into components. In this work the vibration of the car floor was resolved into vertical and horizontal components, the horizontal component being determined longitudinally in the car.

The vibration frequency is in the neighborhood of 400 per minute, and, since the lighting engines run at this speed, it may be said that there is one vibration per revolution of the electric-light engine.

The extent of the vibration is greater in some parts of the car than in others. The minimum vibration seems to be found at the points of sup-

1. Abstract of a paper presented at a meeting of the Western Society of Engineers in Chicago on December 19, 1906.

port of the car floor—the king bolts. The vertical vibration is nearly always greater than the horizontal vibration, but exceptions to this have been observed.

The buffers and vestibule plates transmit the vibrations from one car to the other, but as the cars are not rigidly coupled together, the energy of the vibrations is largely lost in the flexible joints. The vibration is greatest in the vicinity of the lighting set and becomes less as the distance from the set increases.

The amount of vibration depends upon the manner in which the train comes to a stop. When the train comes to a stop with the buffers and vestibule plates tight together, much vibration is felt in the train, but when the buffers and plates are loose, less vibration can be detected.

Another point in this connection is that as soon as the train comes to a stop vibrations are felt. But, in starting up again, as soon as there is a pull on the drawbar, and before the locomotive driver wheels have made a quarter turn, the vibration disappears. At the instant of starting, the buffers are pulled apart, so that the vibrations are not readily transmitted.

The records plainly show that the trains equipped with turbine lighting sets are exempt from the annoying vibrations which are likely to traverse a train from a reciprocating-engine set.

Aside from the vibratory effect of these lighting sets, noises are produced which are annoying at times. With the reciprocating-engine set, when the steam pressure is low, a knocking or pounding of the engine takes place when under load. This noise is transmitted back into the train for a considerable distance. The speed (400 revolutions per minute) is low enough so that each separate knock can be heard. With the turbine set, a humming or buzzing sound is observed. The higher speed of the turbine (3,600 revolutions per minute) makes a noise characteristic of high speeds.

The Apprenticeship Course from a Student's Viewpoint.

At the meeting of the Purdue University Branch of the American Institute of Electrical Engineers on December 18th, Mr. S. E. Brown gave a very interesting talk on "The Apprenticeship Course from a Student's Standpoint." Mr. Brown is a member of the senior class and has finished the apprenticeship course as offered by the Western Electric Company of Chicago.

The talk was based on impressions obtained while taking the above course. It was brought out that, as far as the apprenticeship course alone is concerned, it was not necessary to be thoroughly versed in all the deeper points of electrical engineering in order to creditably complete the course. But at the same time the college graduate finds it much easier to learn than the man who has had no technical training.

The course, as laid down by the larger electrical manufacturers, is arranged to allow the man taking it considerable range of choice, but at the same time advances the training in logical sequence, as it should. In this way, while his choice is rather wide, he is at all times under the direction of the company, which can by this means get a pretty good line on the capabilities of the man.

The apprenticeship course seems to be of especial value to the technical man with no "practical" training. It brings him in contact with men who have not, possibly, had the advantages of a technical training. He learns their point of view. He learns to differentiate between theory and practice. He learns many other things in a short time that it would ordinarily take a much longer time to learn.

It semes that if a man just leaving college can possibly afford (financially) to take the course with one of the large companies, he should by all means do so. The larger manufacturing companies are to be preferred, because they offer greater facilities for getting the training than an apprenticeship course is expected to give.

During the discussion following the talk by Mr. Brown, Mr. W. T. Small and Mr. A. F. McKee told of their experiences while on the course offered by the Westinghouse company. This talk was the first of a series on the subject of apprenticeship courses that will be given before the close of school in June. Representatives from the several larger manufacturing companies are to speak on the courses from their companies' viewpoint.

Production of Platinum in 1905.

The production of platinum from domestic ores in the United States in 1905 was 318 ounces, valued at $5,320, as compared with 200 ounces, valued at $4,160 in 1904; with 116 ounces, valued at $2,080 in 1903; with 64 ounces, valued at $1,814 in 1902; with 1,408 ounces, valued at $27,526 in 1901, and with 400 ounces, valued at $2,500 in 1900. In December, 1904, the price of ingot platinum at New York advanced from $18.50 to $19.50 an ounce; in April, 1905, it was $20.50; in February, 1906, it advanced to $25, and in September, 1906, it was $34 an ounce.

WIRELESS OR RADIO-TELEGRAPHY.

By D. McNicol, A. M., A. I. E. E.

Chapter V.

Electric Wave Detectors.

The Branly tube (Fig. 8, Chap. III.) was the earliest form of electric-wave detector which in any way resembled the modern types of detectors used in wireless telegraphy.

Fig. 22 shows a view of the original imperfect-contact coherer, as used by Marconi, with its connections, in which (C) and (C′) are capacity wings, (p) coherer, (B) and (B′) battery, (R) Morse relay, and (T) mechanical decoherer. Various combinations of nickel, silver, iron, steel and carbon filings have been used, different mixtures being favored by different experimenters.

A very sensitive mixture, and one which has been found to be quite constant in action, is made as follows: With a fine file prepare equal parts of nickel and silver filings, place them in a small iron crucible and heat over a gas burner. After the particles have reached a white heat they should be removed, and when cold should be pulverized as fine as possible.

Many explanations have been advanced regarding the theory of coherer action. One explanation is to the effect that the electric waves, or the constant differences of potential acting at the coherer electrodes, the magnitude of which is increased gradually, produce an ionization of the dielectric and therefore, its higher conductivity. The forces necessary for this are relatively small, owing to the smallness of the insulating layers.

After the dielectric strength of the intervening medium is destroyed, an equalization of the potentials at the coherer electrodes takes place, which is accompanied, in consequence of the comparatively high resistance to be overcome thereby, by mechanical and heat effects, and which breaks through the layer of oxide, separating the particles, and welds them together. This hypothesis is interesting, as it gives a plausible explanation without assuming the existence of sparks between the particles of metal contained in the tube.

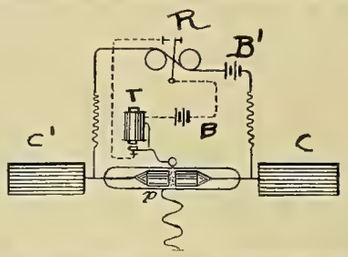


FIG. 22. MARCONI ORIGINAL IMPERFECT-CONTACT COHERER.

A communication from Huth, which appeared in the Physikalische Zeitschrift, in August, 1903, and another from Hurmuzescu in the Annales Scientifiques de L'Universite de Jassy, June 27, 1903, gave the results of painstaking experiments with coherers to determine the theory of their action. The latter-mentioned physicist experimented especially with the object of ascertaining whether the variations of the resistance of the coherers under the action of the waves, depend upon the time during which the latter act. He measured the duration of action, and made observations of the variation during this period.

The conclusions reached indicated: First—In a general way, metallic filings become good conductors of electricity under the action of electric waves. Second—All coherers present a minimum in the value of their electric resistance relative to the time during which the electric wave acts. Third—This change of resistance is permanent for most of the systems. There are, however, a number of cases, where this modification ceases at the same time as the cause which has brought it about. These are the systems, carbon-carbon, metal-carbon, iron-mercury, etc., or the coherers with spontaneous decoherence. Fourth—But all these systems lose the property of spontaneous decoherence on account of a feeble oxidation, or of a too rapid fatigue of the coherer by employing electric waves of too great intensity. These phenomena of auto-decoherence have been obtained for a great number of systems, in the first period, at the beginning of each experiment. Fifth—For certain systems, such as iron-manganese, silver-manganese, the action of the waves diminishes their resistance at first, then, when the waves are allowed to act again, an increase of the electric resistance of the coherer is found. These systems, therefore, behave in the first phase like ordinary coherers, in the second phase like anti-coherers. Sixth—A large number of ordinary coherers, when their contact surfaces are moist or dipped into a dielectric containing water, present the two above phases, that is, by the first action of the waves, their resistance diminishes, to increase toward its original value by a subsequent action. According to the different conditions, the first phase is more or less abbreviated and it can even disappear in some of the systems. In this latter case one deals with anti-coherers. Seventh—All these phenomena depend upon a layer between the contact surfaces; the intervening dielectric influences this layer, be it through the interval, or through the oxide, or through gas condensed on the surfaces themselves.

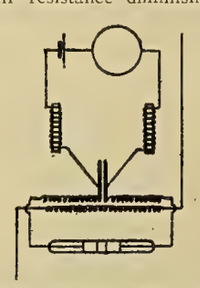


FIG. 23. MARCONI RECEIVER USING INDUCTION COIL WITH DIVIDED SECONDARY COIL.

Hurmuzescu offered the following explanation of the results of his experiments: "The existence of the minimum of variation of the electric resistance of the coherers, relative to the time during which the electric wave acts, leads to the common explanation for the coherer and anti-coherer. For the former the action of the electric waves would be simply to diminish the resistance down to the vicinity of the minimum. This minimum would correspond, for a system, to the maximum coherence; that is to say, the formation of chains between all the grains following the direction of the current. For the latter these metallic chains, formed by the small sparks jumping over between different grains, would find themselves interrupted on account of the introduction of new resistance into the path, owing to the oxidation due to the sparks themselves. These oxidations depend on the nature of every metal and the dielectric with which it is in contact." This explanation, however, admits of the existence of sparks passing between the particles.

One of the Marconi patents, covering wireless-telegraph receivers (No. 668,315), describes an arrangement using a specially-designed induction coil with its secondary wound in two parts, the aerial wire connected to one end of the primary, and a capacity to the other end, the coherer being connected to the outer ends of the secondary with a condenser across the inner ends and a local circuit connected to the condenser. (See Fig. 23.)

Another Marconi patent describes an arrangement very similar to the above, but with the secondary circuit of the induction coil undivided. (See Fig. 24.)

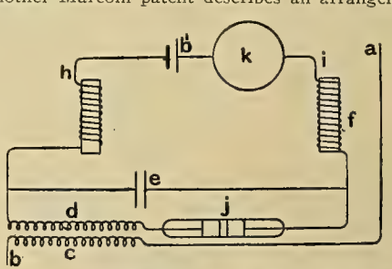


FIG. 24. MARCONI RECEIVER USING INDUCTION COIL WITH SECONDARY UNDIVIDED.

It will be observed that the vertical conductor has a path through the primary of the induction coil to earth, the secondary winding acting as a transformer, raising the pressure of the received oscillations which affect the coherer. In Fig 24, (C) is the primary winding of the coil, (d) the secondary, (a) aerial wire, (b) ground connection, (j) the coherer, (e) condenser, (K) Morse relay, (b′) battery, (f) and (h) choke coils. One particular advantage of using the induction coil in this way is that atmospheric disturbances are greatly lessened, as there is little chance for the aerial con-

Note.—This series of articles was begun in the issue of December 1, 1906. It will be complete in ten chapters. In reference to the repetition in the title it may be explained that wireless telegraphy is the popular name for the transmission of intelligible signals through space by Hertzian waves, while the term radio-telegraphy was officially adopted by the Berlin International Wireless Conference and promulgated November 3, 1906.

ductor to accumulate a charge of electricity while there is a direct path to ground through the primary winding of the coil.

In addition to those coherers of the imperfect-contact type which have for their sensitive element particles of metals, there is another form of coherer based on the same principles, but of different design, namely the moving-contact device. Fig. 25 shows a view of such a detector designed by Fessenden (similar arrangements have been used by Popoff, Marconi, Slaby-Arco, Lodge and others).

By referring to the figure it will be observed that clock-work mechanism rotates a large wheel in contact with a smaller wheel, the two forming the cohering faces of the detector. When subjected to the action of Hertz waves, the electrical resistance of the moving contact is greatly reduced, such reduction of resistance continuing as long as waves are passing continuously, and upon cessation of the waves high resistance is instantly restored by virtue of the change in surface of contact. For short courses this form of detector is quite reliable, but its long-distance possibilities are very limited.

The form of moving-contact coherer used by Dr.

FIG. 25. FESSENDEN MOVING-CONTACT COHERER.

Lodge in England is as shown in Fig. 26, and consists of a small steel disc, which is rotated continuously in contact with a column of mercury, between which is interposed a thin film of oil, the operation being as follows: When the impinging waves set up oscillations in the resonator circuit a difference of potential is created, due to the cumulative effect of the waves, which disrupts the oil film, and at that instant cohesion takes place between the solid and

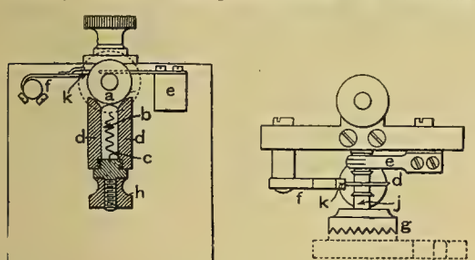


FIG. 26. SIDE ELEVATION AND PLAN OF THE LODGE MOVING-CONTACT COHERER.

fluid metals, the high-resistance state being immediately accomplished by the disc revolving and exposing fresh surfaces. The disc is revolved by clock-work gearing. A sectional and plan view of this Lodge detector is shown in Fig. 26, where (a) is the rotating disc, (d) (d) the trough of mercury, (b) an amalgamated platinum wire spiral, which is connected to the binding post (h). A copper brush (c) makes connection with the steel disc through

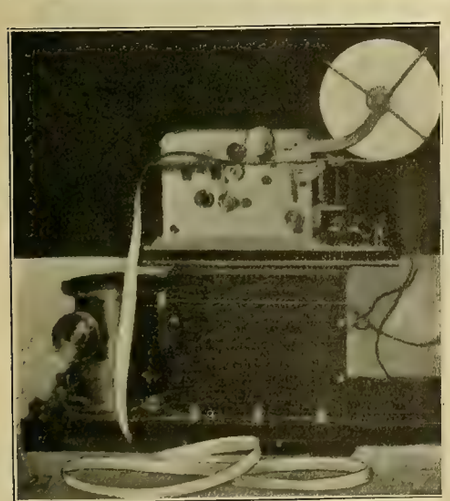


FIG. 27. SIPHON RECORDER IN CONNECTION WITH MOVING-CONTACT COHERER.

the axle (j). A spring (f), having a small piece of felt (k) attached, rests lightly upon the disc, serving the purpose of keeping the contact surface of the disc clean and free from foreign particles before and after cohesion. A potential difference of one volt breaks down the oil-film resistance. In circuit with the coherer is connected a siphon recorder, which reproduces the signals on tape, as is the custom in submarine cable working. (See Fig. 27.)

To demonstrate the operation of moving-contact coherers, the writer recently made use of a phono-

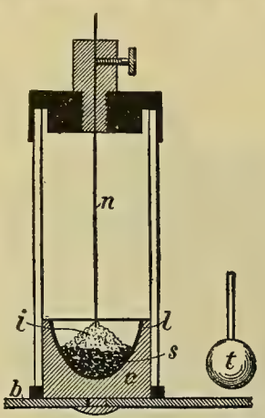


FIG. 28. MASSIE ELECTRIC-WAVE DETECTOR.

graph mechanism in the following manner: A shaved phonograph record was dipped in aluminum paint so as to give it an even coat over its entire surface inside and out; when thoroughly dry the record was placed on the cylinder. Above the record, and insulated therefrom, was fastened a support carrying an adjustable needle, so adjusted that when the cylinder was made to revolve, the

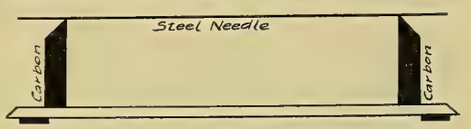


FIG. 29. STEEL-CARBON DETECTOR.

needle would be in contact with the moving surface of the cylinder. With the needle forming one terminal of the coherer and the record coated with metallic paint the other terminal, the connections were the same as with other types of detectors. A telephone receiver was used to receive the signals, and a remarkably clear and distinct signal was the result. The device, however, could not be recommended for any but short-distance service.

Mr. W. W. Massie of Providence, R. I., has invented a detector of the filings type, which has some commendable features. Fig. 28 shows a view of this detector.

A metal bridge (b) represents one of the terminals and also supports the cup (c), which latter is lined with silver and partly filled with silver filings (s).

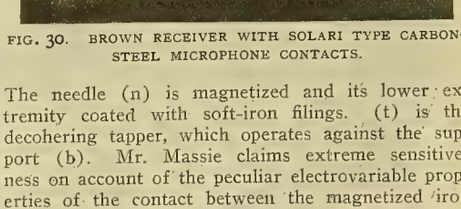


FIG. 30. BROWN RECEIVER WITH SOLARI TYPE CARBON-STEEL MICROPHONE CONTACTS.

The needle (n) is magnetized and its lower extremity coated with soft-iron filings. (t) is the decohering tapper, which operates against the support (b). Mr. Massie claims extreme sensitiveness on account of the peculiar electrovariable properties of the contact between the magnetized iron particles and the silver filings.

Mr. Massie has also invented a detector of the steel-carbon type, something similar to the detector used by the United States Signal Corps. (See Fig. 29.)

Knife-edge carbon plates, properly supported, form the terminals of the detector, the connecting contacts being made by laying a steel needle over the top, and resting on the sharp edges of the carbon plates. In the Massie device the steel needle is held in place by horseshoe magnets, which provide a gentle but constant pressure of the needle upon the carbons.

The Brown receiver, using the Solari type of carbon-steel microphone contacts, is shown in Fig. 30.

One of the difficulties encountered in the manu-

FIG. 31, BRANLY TRIPOD WAVE DETECTOR.

facture of sealed coherers has been the impossibility of entirely exhausting all the air from the tube. When air, even in small quantities is present, the metallic particles oxidize rapidly, and lessen sensitiveness of the detector. To overcome this difficulty Tissot of France proposed that a small bag of carburet of calcium be placed in the tube when sealed, in order that any remaining moisture might be taken up after the tube had been sealed off.

Still another coherer of the imperfect-contact type is shown in Fig. 31. This is the detector used in the Branly-Popoff system of wireless telegraphy. As will be noted, by referring to the cut, a round disc of metal has fixed into it three rods of tempered steel, tapering and pointed at the ends. The points of these small rods are rounded off and given a high polish. The tripod thus formed is placed on a metal surface which has been slightly oxidized. The cohering effect under the action of electric waves takes place between the polished and oxidized surfaces and the polished points, thereby low-

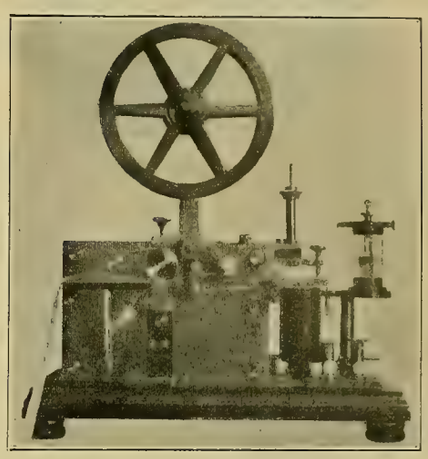


FIG. 32. BRANLY RECEIVER.

ering the resistance of the local receiving circuit Return to high resistance is accomplished in the same manner as with the filings coherer, by mechanical jar.

Fig. 32 shows the Branly receiver complete. The detector, mounted on an extension of the armature lever, is shown on the right. The steel tripod is visible, resting on the oxidized metal base and enclosed in a glass case. Decoherence is effected by the up-and-down motion of the armature lever in the act of making signals.

[To be continued.]

A Large Producer-gas Power Plant.

The new plant of the Iola Portland Cement Company at Dallas, Texas, will have the largest producer-gas power installation in the world, it is said. At other plants of the Iola company both gas engines and steam engines have been employed, so that in selecting the type of prime mover for its new plant it was with a knowledge of the capabilities of the respective powers. The Loomis-Pettibone gas-generating system, built by the Power and Mining Machinery Company of Cudahy, Wis., will be furnished in three units having a total capacity of 4,500 horsepower. Bituminous coal and Texas lignite will be the fuels used, the Loomis-Pettibone system being adapted to the gasification of either fuel without changes in the apparatus, and the resultant gas is guaranteed to be fixed, clean and suitable for use in gas engines.

Four single-tandem, double-acting gas engines, each with a normal capacity of 1,100 brake horsepower, will be furnished for this plant by the Snow Steam Pump Works of Buffalo. These engines will be direct connected to alternating-current 25-cycle electric generators of 810 kilowatts capacity each, and will operate in parallel. Continuous operation, 24 hours a day, seven days a week, is required of the power plant.

High efficiency is promised by the builders of the power apparatus, and their guarantees of a kilowatt an hour at the switchboard from 1½ to 1¾ pounds of bituminous coal or from 2½ pounds of lignite, when operating at three-quarters to full load, assures the Cement company of cheap power.

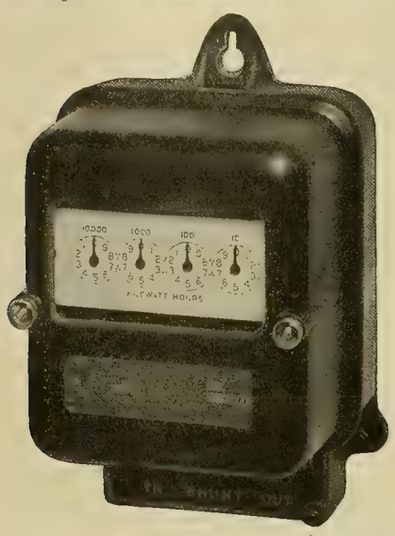
Meters.

By Robert C. Lanphier.

Part III.

The third class of motor meters are the so-called mercury motor meters. Meters of this kind have been made in England for many years, but very little attempt has been made to utilize the principle in this country until within a few years.

The first mercury meter made was the Halsey, for direct current, brought out about six years ago, and of which only a few were put on the market. This meter followed very closely the idea of certain English meters, and would have been quite satisfactory if the mechanical construction had been equal to the electrical ideas involved.



TYPE D SANGAMO WATTMETER FOR DIRECT OR ALTERNATING CURRENT.

It was purely an ampere-hour meter, having no shunt winding whatever.

The Sangamo type "C" meter for direct current was the next mercury meter made, and this meter has been on the market until very recently. It is now superseded by the type "D" Sangamo, which is made for both direct and alternating current, differing somewhat in the electrical details as arranged for use on one current or the other.

The principle of the mercury meter is really the oldest of that in any meter, as Faraday performed an experiment over 70 years ago, bringing out fully the principle since used in all mercury meters. He had a copper disc with its edge immersed in mercury, and supported on a horizontal shaft, the disc being embraced by a strong permanent magnet, having a pole on each side of it and in the line between the shaft and the mercury contact. When he passed a direct current through the shaft, then down across the disc to the mercury contact, so that the current passed through the field, rotation of the disc resulted, due to the reaction between the current and the magnetic field near it, according to laws which have since become well recognized as fundamental.

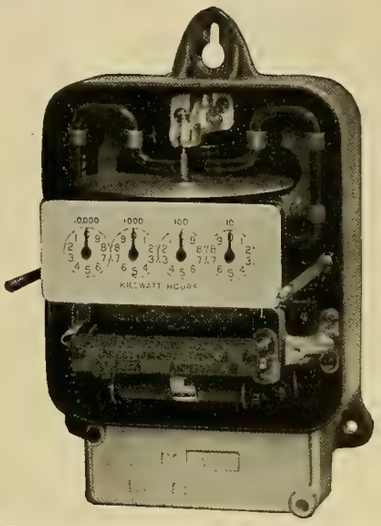
In the type "D" Sangamo meter the Faraday principle has been utilized with such modifications as were necessary for making a commercial meter. The armature in this meter consists of a copper disc immersed in mercury and held within a chamber of insulating material, so that the mercury cannot be spilled. Current is led in and out of the armature by means of copper contacts imbedded in the walls of the chamber and in contact with the mercury inside. A pair of field poles is arranged very close to the disc on the lower side, opposite each other and near the edge of the disc. Across the upper side of the latter is a soft steel plate acting as a return for the magnetic lines that pass up and down, from and to the pole pieces below the disc. The poles are energized by means of a yoke at their lower ends having upon it either a shunt coil for the direct current or a series coil for the alternating-current meter.

In the direct-current type "D" meter the load current, or a part of it, passes directly through the armature immersed in the mercury, and a constant field is produced in the laminated magnet by means of a shunt coil upon the yoke. The reaction between this field through the two poles, and the load current passing across the disc from one side to the other, causes reaction proportional to the power, as in the case of a commutator meter, and this motion is transferred to a recording train above the mercury chamber, the shaft also carrying the damping disc at the top, which is acted upon by permanent magnets in the usual manner. The effect of the permanent magnets in the Sangamo type "D" meter is not varied by moving them, but by adjusting a small piece of iron so as to shunt more or less of the magnetization between the two magnets, thereby varying the damping effect on the disc.

In the alternating form of the type "D" Sangamo meter a small transformer is placed back of the laminated magnet yoke, having its primary connected across the circuit, as the shunt coil is connected in an induction meter, and its secondary—of low resistance and of very low potential—is connected to the contacts leading current to the disc in the mercury.

This transformer keeps a current of considerable volume constantly circulating through the disc and then is reacted upon by the field produced by a series coil on the same yoke, which carries the shunt coil in the direct-current meter. The rotation produced is proportional to the power, and the balance of the meter is arranged exactly as for direct current, including the train and damping arrangement.

The weight of the rotating element in these mercury meters is nearly all taken off the jewel by the buoying effect of the mercury in which the armature is immersed.



INTERIOR VIEW OF TYPE D SANGAMO WATTMETER.

This covers all of the meters used in the United States at the present time, so far as I am aware.

There are various special forms and modifications of the regular meters which are of interest.

First, prepayment meters. Prepayment meters or prepayment devices to be attached to ordinary integrating meters are similar in principle to the devices which have been used for gas meters for some years, but have to be different in construction from the latter.

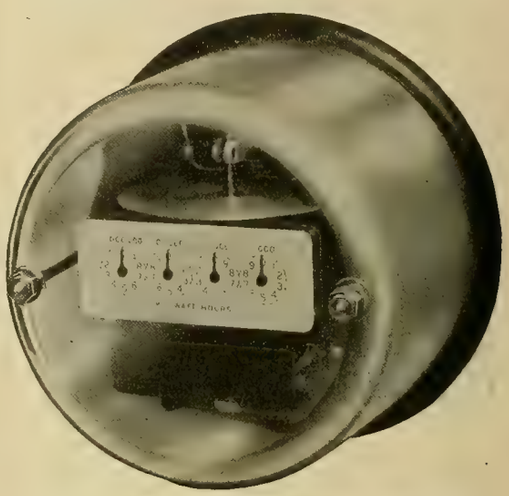
Generally speaking, any prepayment device for an electric meter consists of a crediting mechanism which can be wound up after the introduction of the necessary coins in the coin slot and which debits against the consumer, as current is used, by means of a debiting device operated from the integrating train of the meter, the ultimate purpose of the mechanism being to cut off the current after the crediting mechanism has been brought to zero caused by the debiting action of the train against it.

Prepayment meters, or prepayment devices attached to the meters, are very desirable in some cities where there is a floating class of customers who cannot be relied upon to pay their bills if presented in the usual way.

Maximum-demand meters are of value in connection with the regular integrating meters for the purpose of obtaining the maximum demand from each customer so as to determine upon special rates according to the conditions and according to the maximum demand which such customers may be expected to make upon the station.

The Wright meter which I have already referred to is practically the only one in use now for this work.

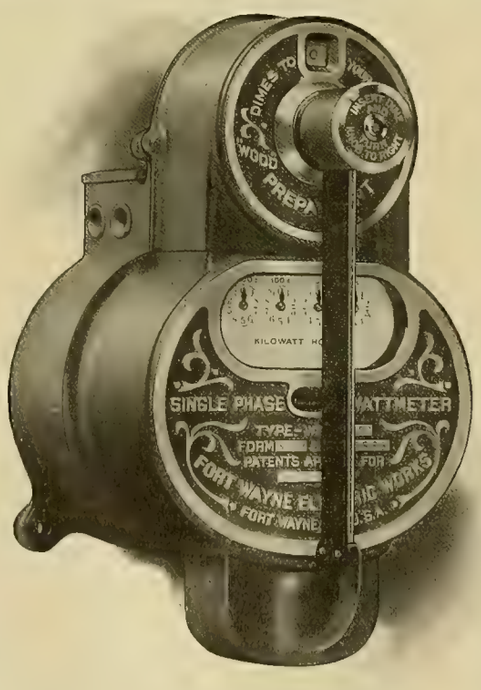
Multiple-rate meters in which two dials are provided for recording at different times of the day have also been in some use, but not extensively. With these meters, the gearing to the two trains is arranged so that one train will be thrown on to the armature shaft during part of the day and the other train at a different time when it is desired to give a different rate to the consumer of current, the gearing in the trains being arranged so they will record at different rates for the same rate of rotation of the armature. The transfer of one train or the other has been effected either by a clockwork device within or connected to the meter, arranged to operate at a certain hour, or by means of a special controlling wire and magnet system within the meter which could be operated at any desired time from the station.



TYPE D S, ROUND PATTERN, GLASS FRONT SANGAMO WATTMETER.

Meters for use on street-railway cars and on railroad lighting equipments are also coming into considerable use, and for the former purpose are very valuable in checking losses due to faulty motors and bad handling of the cars on the part of the motormen.

Storage-battery meters are of special construction, being arranged with a dial which has a hand moving forward as the battery charges and moving backward upon discharge at a higher rate so as to allow for the average loss in charge according to the efficiency of batteries with which the meter is to be used. A storage-battery meter of this kind is very valuable for giving an indication at any time of the number of ampere-hours which may be drawn from the battery before exhaustion.



TYPE W FORT WAYNE SINGLE-PHASE PREPAYMENT WATTMETER.

WESTINGHOUSE SINGLE-PHASE PREPAYMENT WATTMETER.

The one other modification of meters which has met with considerable favor in Europe and which has been introduced in this country is money-

dial meters, that is, one in which the train is geared so as to read in dollars and cents for a given rate per kilowatt-hour instead of reading in watt or kilowatt hours.

This is desirable for allowing the customer to get an idea of his bill at any time instead of having to be told about kilowatt-hours, rates, etc. The use of these meters has been so slight in this country up to the present time that it is difficult to predict just what their value will prove.

A very interesting point in connection with alternating-current metering is the metering of

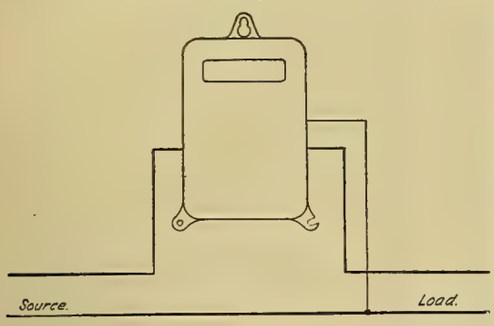


DIAGRAM FOR CONNECTING TYPE C-6 THOMSON WATTMETER, TWO-WIRE 100-600 VOLT.

power on polyphase systems, particularly three-phase. This is coming up more and more all the time to central stations, as polyphase motors are now being used much more widely than heretofore, and it is necessary to take particular care in metering such loads.

Polyphase meters are now made by several companies, these consisting practically of two single-phase meters driving one common shaft so as to record at the total rate of the two driving elements on a single train. The principle is, therefore, the same as if two separate single-phase meters were used.

Some features very peculiar and difficult to explain to the average consumer will arise in the metering of polyphase power with two meters, as now being practiced, although the meters will, if correctly calibrated, give a very accurate measurement of the total power according to the sum of their readings.

In connecting two meters on a three-phase circuit each will have its series coil, say in lines A and B of the system, and the other terminals of their pressure coils will be tapped to line C, in which no meter has a series coil connected. Any one of the lines may be taken as A, B, C, provided this scheme of connection is followed out.

Now, on a non-inductive load, such as lamps, both meters when correctly calibrated and properly connected will rotate forward at an equal

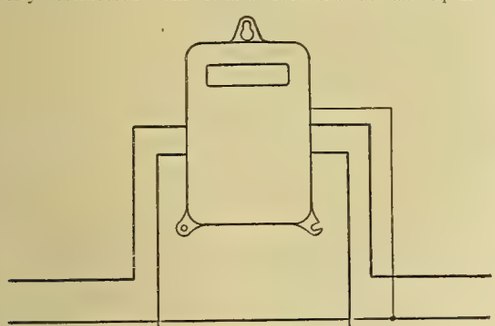


DIAGRAM FOR CONNECTING TYPE C-6 THOMSON WATTMETER, THREE-WIRE 200-800 VOLTS.

rate, but a polyphase load will usually be a motor load instead of lamp load, and with this condition the two meters will never run alike. When the power factor of the load drops to 0.50, as is easily possible with a motor running unloaded, one meter stops absolutely and the other records the entire power. If the load should go still lower in power factor, getting below 0.50, the meter which has stopped will rotate backward, the other one still rotating forward. This is where the most puzzling feature comes in, for the reading of the meter going backward has to be deducted from that of the other, to get the total amount. Of course, with a regular polyphase meter, when the same condition takes place, the disc which has the backward rotation simply pulls against the one having the forward rotation and the result is still forward rotation, so that a regular polyphase meter can never run backward. On power factors from 0.50 up to 0.85, which will be the condition with an induction motor having load upon it, both meters will always go forward, the one which stops at 0.50 power factor continually approaching the speed of the other as the power factor gets better. The principle of this feature can be fully illustrated by linear diagrams, but I will not attempt to go into this here.

In setting up two meters on a polyphase circuit the only absolute safeguard, to be sure they are connected properly, is to test out with a balanced bank of lamps before any inductive load is connected up.

Summary.

To resume the points described in regard to the different meters, I will give briefly the features that a perfect meter should have without meaning to say any meter has all of these features, for I do not believe that a perfect meter has been made yet, or ever will be.

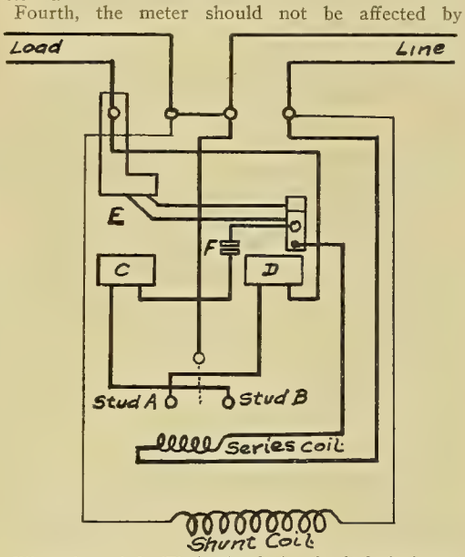
The first point is, of course, that the meter shall be accurate from a reasonably small load to a considerable overload under the normal conditions under which it will be used, and, if an alternating-current meter, that it shall be accurate on inductive as well as non-inductive load.

Second, the adjustment of the meter, after being made, should retain its original condition, that is, the calibration should be permanent.

The mechanical construction should be strong, so that the meter will stand the severe handling, which it is sure to get; but the weight should be reasonably small and the whole meter should be constructed so as to be as near dust and bug proof as possible.

Third, the meter should be proof against effect of lightning discharge on the line, that is, against induced discharges, for no meter can be built which will stand an actual lightning discharge into it.

Fourth, the meter should not be affected by



When the switch (E) is closed the circuit is broken at (F). (C) is the closing coil and (D) the tripping coil. With the spring contact resting against the stud (A) the tripping coil (D) is magnetized and the current switch is opened. When the switch is open the coil is again cut out of circuit. With the spring contact resting against stud (B) the closing coil is magnetized and closes the switch. When the switch is closed the closing coil is cut out of the circuit.

INTERNAL WIRING OF WESTINGHOUSE SINGLE-PHASE PREPAYMENT WATTMETER.

ordinary jarring or vibration, including the effect of its own field, in the case of alternating induction meters.

Fifth, it should not be affected by ordinary changes in voltage, change in temperature, or slight change in frequency, if an alternating-current meter. It should have an ample and quick adjustment for the main speed, for light load, and, if alternating-current, for changing to different frequency. It should have a very high ratio of torque to weight of moving element, and a light-weight rotating element, thereby obtaining immediate response to changes in load.

Finally, the meter should be accurate on a very light load, without showing a tendency to creep when no load is passing.

As to advantages of glass or metal cases for meters, that is a question to be decided by the

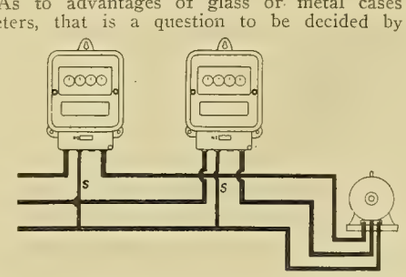


DIAGRAM FOR CONNECTING TWO-PHASE SANGAMO METERS ON THREE-PHASE CIRCUIT.

station, according to the place in which it is expected to use the meters.

Last of all, as to the care of meters, conditions will, of course, vary, according to the number of meters installed and to the size of the station. Some arrangements should be provided in even the smallest plants for making an approximate test on meters as received from the factory, for meters are at the best delicate instruments, and are liable to injury in shipment occasionally, so that it is best both for the station and for the manufacturer to have the meters checked over in this way. If nothing else can be arranged, a good bank of lamps so as to obtain different loads, and a voltmeter, together with a standardized integrating master meter which can be obtained from the manufacturer, makes a very good outfit.

The frequency of tests made on meters in service, and whether such tests should be made on consumers' premises or at the station, is a question not within the province of this paper.

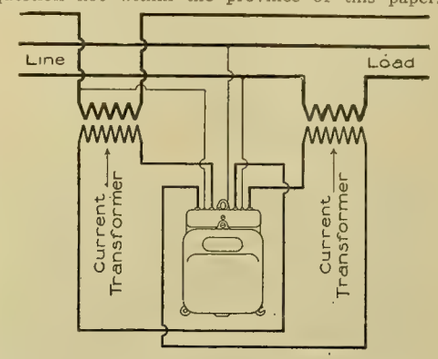


DIAGRAM FOR CONNECTING FORT WAYNE THREE-PHASE WATTMETER.

In conclusion I may say, all the manufacturers of meters are more than anxious now to co-operate with the stations in obtaining the best results possible from their meters, and when troubles arise, as they will inevitably from time to time with all kinds of meters, it is best to give the manufacturer an immediate opportunity to learn of the troubles so that both the station and themselves will be straightened out in such matters as promptly and efficiently as possible.

You all realize that the only reason why meters have been improved so remarkably as they have during the last five or six years is because the trade demands it, and manufacturers have learned from experience what qualifications are necessary to make the meters better for the wonderfully increasing demand that has existed within this period.

[*The end.*]

Chicago Electrical Show.

At this time there remain but five spaces on the main floor of the Coliseum which have not been taken for the Electrical Show, which runs for two weeks, beginning January 14th. More than 30,000 square feet of the main floor has been sold to 150 of the leading manufacturers and jobbers, many of whom will make displays for others as well as themselves. Not a single branch of the electrical field will be neglected, and the exhibits, as a whole, will be greater and more elaborate than they were in the show of a year ago. There will be a number of special days, as already mentioned, and a number of societies will meet during the show. The electrical "Midway" will afford new and interesting amusement features. The show is expected to be the greatest trade exposition ever held in Chicago.

In addition to the list of exhibitors already printed in the Western Electrician are the following:

American Telephone & Telephone Co.
Automatic Electric Co.
Anderson, Albert & J. M. Mfg. Co.
American Clock Co.
American Vibrator Co.
Antiseptic Co., The.
American Electrical Novelty & Mfg. Co.
American Sewer Pipe Co.
American Electric Heater Co.
Bryan-Marsh Co.
Bidwell Electric Co.
Beck Flaming Lamp Co.
Bigley Telephone Co.
Bishop Gutta Percha Co.
Baton Electrical Mfg. Co.
Bossert Electric Construction Co.
Cooper-Hewitt Electric Co.
Chicago Compound Battery Co.
Crescent Wire & Cable Co.
Crawfordsville Wire & Nail Co.
Crescent Co.
Columbia Incandescent Lamp Co.
Colonial Electric Co.
Crouse-Hinds Co.
Dossert & Co.
Dean Electric Co.
D. & W. Fuse Co.
DeBeau Telephone Mfg. Co.
Dale Co., The.
Dittrick-Jordan Electric Co.
Eureka Electric Co.
Engineering World.
Edison Mfg. Co.
Electric Cable Co.
Enamel Metals Co. (Enamcled).
Faries Mfg. Co.
Hamburger, Felix.
Helios Mfg. Co.
Hart Mfg. Co.
Hepburn Telephone Co.
Hunter Illuminated Car Sign Co.
Indiana Rubber & Insulated Wire Co.
Keystone Electrical Instrument Co.
Locke Insulator Mfg. Co.
Lyon Metallic Mfg. Co.
McRoy Clay Works.
Miller Anchor Co.
Nernst Lamp Company.
Nungesser Battery Co.
Nurnberg Flaming Arc Lamp Co.
New York & Ohio Co.
Nuttall Co., R. D.
Oneida Community, Ltd.
Okonite Co., Ltd.
Peirce Specialty Co.
Public Service.
Phelps Co.
Paiste Co., H. T.
Phillips Insulated Wire Co.
Packard Electric Co.
Protected Rail Bond Co.
Reed Electric Cordage Co.
Sangamon Electric Co.
Stanley & Patterson, Inc.
Sarco Co., The.
Sterling Varnish Co.
Speer Carbon Co.
Universal Mfg. Co.
University of Illinois.
Vote-Berger Co.
Western Electric Co.
Western Insulator Co.
Wilson Trolley Catcher Co.
Wire & Telephone Co. of America.
Whitney Electrical Instrument Co.

The Marfa Power Company of Marfa, Texas, has been incorporated with a capital of $15,000.

Gas Engines.[1]

By Paul Winsor.

This paper will deal with the experience that the Boston Elevated Railway Company has had with its two gas-engine plants. These plants have now been in operation, one about four months, and the other (partially) for a few weeks.

A little over a year ago the subject came up of supplying power to two sections of the railway that were rather hard to reach from the present power stations, and as we had for some time been looking into the question of gas engines, it was decided that this was a good opportunity to make a trial of them. Both plants are small, one of 700 kilowatts and the other of 975 kilowatts. The engine load factor in both stations can be made extremely good, as they feed into the trolley lines in multiple with the steam stations of the road.

The equipments of these two plants are radically different. The Sommerville plant has down-draft suction producers and four-cycle single-acting engines, and the Medford plant has up-draft pressure producers and two-cycle double-acting engines.

Unfortunately for this paper, we have run the Medford station so little—through no fault of the equipment contractors—that no figures are available, and I must, therefore, confine most of my remarks to the Sommerville station.

The Sommerville station has been in commercial operation since May 4, 1906, and up to August 31st it has used 1.45 pounds coal per kilowatt-hour.

During May—from May 4th to May 29th, inclusive—but one engine was in use. Since then two engines have been running. The station is run week days from 7 a. m. to 11 p. m. and on Sundays in the afternoon only. The engine load factor has been about 74 per cent.

On June 10th a 30-day test run was begun. During these 30 days the station was run 16 hours per day, from 7 a. m. to 11 p. m., with an engine load factor of a little over 70 per cent. The average Pocahontas coal per kilowatt-hour delivered from the station was 1.31 pounds. This included all the fuel used, whether for running the engines, building fires after cleaning, or in the auxiliary boiler.

From May 4th to September 3d, inclusive—the four months in which the station has been in regular commercial operation—the fuel per kilowatt-hour output has been 1.45 pounds. These figures are as good as the most enthusiastic have ever hoped for. The plant has proven its reliability, and the shutdowns have been very few. There have been no shutdowns of any kind in the gas house. This portion of the plant has run regularly and without any trouble, and has made a uniform grade of good gas.

As a result of my experience with these plants, I am absolutely convinced of the economy and reliability of a gas-engine power station. The fuel consumption will be about one-half as compared with a steam plant, running from less than 1.5 pounds to 1.75 pounds, according to the load factor and almost regardless of the size of the plant, as against three to four pounds in similar steam plants.

The cost of the gas plant, including producers, is undoubtedly considerably higher than the cost of a similar-sized steam plant, and whether the fuel saved will justify the increased capital depends on the price of coal, but it seems that with coal at $3 and upward, there will be a material net saving by the use of gas.

Another advantage of a gas plant is the high efficiency of a small plant, the efficiency being practically the same for engines as small as a couple of hundred horsepower as for those of larger size, which, of course, is not true of a steam plant.

The question is, of course, asked: "What are the disadvantages of a gas-power station as compared with a steam plant?" I am glad to say that they are few. The gas-producing portion of such a station is simpler, easier to operate, and holds its efficiency better than a steam plant. The losses from banking fires are extremely small, and the plant can be gotten into service much quicker than can a steam plant. It is our practice to shut down at 11 o'clock at night and start at seven o'clock in the morning. Fifteen or 20 minutes are required to get the gas plant into full operation, while, of course, with a boiler plant, it takes from one to one and a half hours to get the fires into first-class shape. The ashes have to be periodically removed from the producer. In our plant this has to be done while the producers are out of commission, and takes about three hours twice a week, although the plant can be run a couple of days longer without cleaning, if necessary. With some forms of producers the cleaning can be done while the plant is in operation, but I have had no experience on this point as yet, as our second plant, which has this form of producer, has not been in continuous operation. The wet and dry scrubbers have to be cleaned every few weeks, but this work is certainly no more difficult than the work required around a boiler, cleaning soot from the tube and from the soot chambers.

An ordinary gas man, such a man as would be considered a first-class fireman, can run at least as many horsepower of gas producers as he can of boilers.

The handling of the water jackets is, of course, extremely simple. The problem comes in the ignition, but with a well-designed gas engine, equipped with a duplicate system of igniters, there would be little, if any, trouble.

A gas engine will hold its efficiency much better than a steam engine. With a steam engine, poorly set or leaky valves will interfere seriously with its efficiency. With a gas engine, the effect of improper ignition or valve setting, or even leaky valves, is generally either to cause a knock, therefore at once announcing itself, or to reduce the output of the engine. None of these things materially affect the efficiency without showing also in other ways.

The water required is considerably less for a gas plant than for a condensing steam plant and considerably more than for a non-condensing steam plant. A non-condensing steam plant will use for all purposes from 40 to 50 pounds of water per kilowatt-hour. A condensing steam plant will use from 20 to 30 pounds for steam, and from 600 to 900 pounds in the condenser per kilowatt-hour. A gas plant will use about 200 pounds per kilowatt-hour.

Premature ignition and back-firing have both given us a good deal of trouble, and on both types of engines have at times been so bad as materially to reduce the engine power for the moment. This trouble is now much less than it was, and even if not further eliminated will not interfere with the regular and commercial operation of the plants.

There are many forms of producers that can be used successfully with hard coal, using sizes at least as small as pea, and as small as No. 1 buckwheat, if it is of good quality. Soft coal cannot be used in most of the producers without the addition of tar extractors. Much soft coal has been used at the government testing station at St. Louis, the tar extractors doing their work very successfully.

Soft coal can be used in down-draft producers, such as we have in our Sommerville plant, without any tar getting into the gas, the tar being "cracked" on passing through the hot fires, breaking up into gas and some lamp-black, this lamp-black dirtying the scrubber water to such an extent as to make it objectionable if turned into a clear stream. This lamp-black can, however, easily be separated from the water by allowing the water to become quiescent in a comparatively small tank, the lamp-black rising to the surface.

For many years, and up to very recently, gas engines have been made by comparatively small companies and in small sizes, most of them following closely the early gas engines in being single-acting and having trunk pistons. This form is not adapted to large sizes, it being expensive, if not impossible, to build, and requiring a great deal of oil. Most of the engines have been and are being built on the four-cycle principle, there being, so far as I know, but one large manufacturer of two-cycle engines.

In the last couple of years the large steam-engine manufacturers, such as the Allis-Chalmers Company, the Snow Steam Pump Company and the Westinghouse Machine Company, have been making large gas engines, and there have been a considerable number of engines of from 2,000 horsepower and upward run during the last year, so that today there is no trouble in purchasing engines of standard design in the large sizes. All three of these companies have adopted the successful designs of steam engines to the gas engines, using disk cranks and double-acting cylinders, generally two cylinders in tandem, giving two impulses to each revolution of the crank, as with the single-cylinder steam engine. In the larger sizes they use the two-crank arrangement, with the generator or flywheel between, each crank having two double-acting cylinders. The valves are always poppet valves, both intake and exhaust driven from a lay shaft parallel with the cylinder.

As this problem has been taken up independently by these three large and successful steam-engine builders, and all have arrived at practically the same solution, it is safe to say that the gas engine of the immediate future will be of this type.

Medford Power Station.

The equipment consists of the following:

Gas House.—Five up-draft water-sealed gas producers, nine feet in diameter; one auxiliary steam boiler, coal fired; one 40-horsepower engine, for blowers and tar extractors; five economizers, for preheating the air for producers; five wet scrubbers; two tar extractors; two sawdust purifiers; one 15,000-cubic-foot gas holder.

Engine Room.—Engines—Three single-cylinder Koerting two-cycle double-acting gas engines; cylinder, 25½ inches diameter by 45-inch stroke; speed 100 revolutions per minute; rated capacity, 500 brake horsepower each. Ignition—Duplicate "make-and-break" electrical igniters; igniter current from vibrating magnetos mounted on engine. Generators—Three Crocker-Wheeler direct-connected railway generators; rated capacity, 325 kilowatts; normal voltage, 500 volts; normal amperes, 591. Switchboard—Arranged for three generator and six feeder panels and one station panel, circuit-breakers, recording wattmeters and voltmeter, etc. Overhead crane—The overhead crane is hand-operated and supplied with an eight-ton and one-ton hand hoist. Water supply—The water is supplied from three eight-inch artesian wells of an average depth of about 550 feet. Rating—The normal rating of the station is 975 kilowatts; maximum capacity, 1,300 kilowatts.

Somerville Power Station.

The equipment consists of the following:

Gas House.—Two Loomis-Pettibone soft-coal down-draft producers, nine feet in diameter; one regenerator boiler; one coal-fired auxiliary boiler; one vertical wet scrubber; one Root exhauster, steam driven, with electric motor as auxiliary; one dry scrubber; one 15,000-cubic-foot gas holder for producer gas; one 5,000-cubic-foot gas holder for water gas.

Engine Room.—Engines—Two two-cylinder American-Crossley four-cycle gas engines; cylinders, 32 inches diameter by 36-inch stroke; speed, 140 revolutions per minute; rated capacity, 600 brake horsepower each. Generators—Two Crocker-Wheeler direct-connected railway generators; rated capacity, 350 kilowatts each; normal voltage, 550; normal amperes, 636. Ignition—Duplicate "make-and-break" electric igniters on each cylinder; igniter current supplied by two motor-generators and a storage battery. Switchboard—Arranged for two generators, five feeder panels and one station panel, with circuit-breakers, recording wattmeters and voltmeter, etc. Overhead crane—Hand operated, with an eight-ton and a one-ton hand hoist. Water supply—From Alewife Brook, by two-stage centrifugal motor-driven pumps; filtered by a pressure sand filter. Rating—Normal rating, 700 kilowatts; maximum capacity, 933 kilowatts, or 33 per cent. overload.

Fourth-day Economy Test—July 12, 1906.

Duration of run, hours	16
Kilowatt-hours output	9,480
Pounds of coal, total	13,000
Pounds coal per kilowatt-hour	1.37
Load factor, Electric	84.5%
B. H. P.	72.1%
Cubic feet mixed gas	1,397,000
Cubic feet water gas	50,500
Cubic feet producer gas	1,346,500
Per cent. water gas	3.61
Cubic feet mixed gas per hour	87,400
Cubic feet mixed gas per kilowatt-hour	147.3
Pounds coal	107.5
Mixed gas B. T. U.'s, High	126.5
Mixed gas B. T. U.'s, Low	122.5
Water gas B. T. U.'s, High	288.7
Water gas B. T. U.'s, Low	269.5
Producer gas B. T. U.'s, High	120.8
Producer gas B. T. U.'s, Low	117.0
Cubic feet water—7 a. m.–11 p. m.	32,045
Water-cooled valves	1,038
Economizer	277
Scrubber	7,445
Engines and waste	23,285
	32,045

Third-day Economy Test—July 11, 1906.

Coal Analysis.

	As Received.	Dry Coal.	Combustible.
Moisture	2.30	.....	.....
Volatile matter	18.48	18.90	20.25
Fixed carbon	72.79	74.52	79.75
Ash	6.43	6.58	.....
B. T. U.'s per pound	14.030	14.360	15.380

Third and Fourth Day Economy Test—July 11 and 12, 1906.

Mixed-gas Analyses.

Date	July 11, 1906.	July 11, 1906.	July 12, 1906.
Time	5:05 p. m.	8:25 p. m.	5:12 p. m.
CO_2	3.5	3.0	3.6
O	.2	.2	.2
CO	26.9	27.4	27.2
CH_4	1.2	1.0	1.1
H	9.9	9.1	8.5
N	58.3	59.3	59.4
B. T. U.'s at 60° F.	132.1	133.8	127.5

Exhaust-gas Analysis—July 31, 1906.

Sample taken from elbow at muffler of engine.

No. 1.—A end.		
CO_2	11.7%	volume
O	13.0%	volume
CO	trace	
N	75.3%	volume
	100.0%	

This sample shows that an excess of air of 65 per cent. was being used at time sample was taken.

Discussion (in Abstract).

Mr. Winsor: That plant has been running now another month or more since this paper was written, and still running extremely successfully. Our plant when at load was 820 kilowatts for the station rating at 700. That is about 18 per cent. overload for the hour, but part of that time it was considerably higher. I may say about the rating of these stations, that we have rated the stations down much below the engine rating; the generators are put on more for the normal running of the station, and as they will stand 25 or 50 per cent. overload for a short time, these stations are rated very much as a steam station is rated, and we expect to get from that station of maximum demand about 33 per cent. above its rating and to be able to run it for two or three hours, or indefinitely, at 20 per cent., of course a little too high temperature of the generator, but not too much for the short time we do that.

Mr. Bushnell: I think it will be of great assistance to us in our study of the question if Mr. Winsor would enlighten us a little more on the subject of just what producer gas is and as to its method of manufacture.

Mr. Winsor: There is the natural gas, consisting almost entirely of hydrocarbon; coal gas, hav-

1. Abstract of a paper read before the American Street and Interurban Railway Engineering Association at Columbus, Ohio, October 16, 1906. The author is chief engineer of motive power and rolling stock of the Boston Elevated Railway Company.

ing about half the heat value of natural gas, made from the distillation of coal in a closed retort and consisting of hydrocarbon with a considerable portion of free hydrogen; water gas, with a heat value of about one-third of that of coal gas and consisting very largely of hydrogen; producer gas of about one-sixth the value of coal gas and consisting of carbon monoxide, which will burn with oxygen from the air; blast-furnace gas, which is even lower in heat value than producer gas, and of the same general nature. Coal gas made by the distillation of coal in a closed retort contains a large amount of tar and sulphur and must be thoroughly washed before the gas can be used.

Some think they can handle hydrogen up to 16 or 17 per cent. of the total volume of gas; when they go above that they have trouble. The hydrogen ignites at a much lower temperature than producer gas, and they get premature explosions. Our hydrogen seldom goes above 15 per cent, and if it gets up you will have trouble in back firing.

Blast-furnace gas is free from hydrogen. It is dirty and the engine will not give us so much power, but that is not material. It is very easy to handle in a gas engine. Natural gas is a very strong gas, and it is easy to handle in a gas engine because it is free from the hydrogen; and in producer gas, which is the water gas, or, rather the mixed gases, as it is made, you must keep your hydrogen down.

Thomas Hewitt, Philadelphia: Mr. Winsor has said nothing whatever about the regulation of the engine. That heretofore has been a serious operation, and it is my own belief that the gas engine has been developed sufficiently well for use with direct-current generators, but I am not sure that the regulation has been obtained sufficiently close for alternating-current generators, and I would like to ask Mr. Winsor if that is the case. If it is the case, it seems to me the turbines are doomed.

Mr. Winsor: We are using direct current and have no trouble about the regulation. That is to be expected. I understand that there are a good many gas engines running on alternating current. In fact, at Jamestown, N. Y., I believe they have two running on natural gas. I have not seen them, but the reports to me are very favorable as to governing.

H. M. Beughler, New York: In answer to the question regarding the operation of alternators, I had an experience last year with a 1,400-horsepower Crosby four-cylinder 32 by 36, at Elmira, N. Y., where we operated successfully a 60-cycle apparatus, three-phase; we had absolutely no trouble at all so far as the parallel operation was concerned.

E. P. Roberts, Cleveland: In reference to operation in parallel. We had occasion in the last two years to examine that quite carefully, to such an extent that at the present time we are considering the advisability of putting in a 1,500-kilowatt gas-engine plant 30-cycle railway subpower house for some 150 miles of traffic.

A gentleman called me a moment ago and asked whether it was a fair inference on the paper that if coal cost $3 or more per ton, the gas-engine plant is preferable. I do not think you can take any such general inference, because I think where the coal is less than $3 a ton, it is advisable, as in the case of natural gas. My home is in Cleveland, and we get natural gas from West Virginia at 30 cents a thousand.

We had an occasion recently to advise the installation of a 275-kilowatt gas engine here in Cleveland. In a great many cases that would not pay, but, whether right or wrong, we thought it would after investigating the conditions.

I hope also in the final publication of his paper Mr. Winsor will see fit to submit the fact that he has given us actual figures, from actual operation, which is exceedingly valuable to all of us.

I note, however, that he has a load factor of 84.5 per cent., which, if my rapid figuring here is correct, would indicate that part of the time one engine was operating and part of the time two.

Mr. Winsor: That is correct.

Mr. Roberts: Now then, so much of the efficiency of the gas engine and the efficiency of the steam engine depends on the average load. It is stated here to be 84.5 per cent., which possibly might give the impression, rightly or wrongly, that one or both engines were operating all the time at that load. I think it would be desirable, if he saw fit to do so, to have a load diagram showing when the engines were thrown in and out and what the operation of those were, because the gas engine will not take the maximum overload as compared with the rating that a steam engine will take. That might not be advisable in this case, but the result of the figures given must be analyzed by the load diagram in order to give us the full information.

Mr. Winsor: These stations are practically substations. We had these two districts. The question was of putting in these plants or adding to our present steam plant, and our figures show that our plants have cost about $80 a kilowatt more than our steam plant, and the cost is almost exactly what our additional feeder economizers would cost us, so that the plant stands us today at the same figure as if you had added feeder economizers to our present plant, and we get a very much better voltage out there, which is a decided gain.

I don't suppose the treasurer and the auditor look upon it as amusing, but our water supply, coming from the city, during the month of July cost $1,071, while our coal cost us $550.

About the load factor, we are running, as I say, right in multiple with our steam plant, and these stations are so small, as compared with our total capacity, that you can put any load on them you want.

But on these particular engines with the trunk piston, we find when we run those engines at light load that when we get down to half power or below it they cut off so early that we get a very high vacuum in the cylinder, up to about 12 inches, which sucks oil that is splashed on the metal by the cranks, and that gives us a good deal of trouble. That is one of the causes of preignition.

Mr. Hewett: I would like to ask Mr. Winsor, if it is pertinent, if he will give us the ratio of first costs between these plants and what a condensing plant would have cost in the same locality, assuming that the buildings would be suitable for either plant.

Mr. Winsor: These particular plants cost about two-thirds more on the rating we give them, not on engine rating, but on station rating, about two-thirds more than a steam plant would cost. We took the steam plant at $110, and these plants cost between $180 and $190 on the rating that we give them, which is an arbitrary rating. We tried to give them a rating that compared with our other steam plant, so that we can tell our manager that our plant will give that and a 20 or a 25 per cent. overload on a pinch, which put the cost up.

Mr. Yawger: Mr. Winsor, in his paper, says his plant uses about 200 pounds of water. That strikes me as being quite a good deal of water for a gas plant, although much, of course, depends on how hot he runs the water—how much heat he takes out of every pound of water.

Mr. Winsor: We took out more than 40 degrees. That is, water per kilowatt-hour of horsepower.

Mr. Yawger: Gas engines seem to go in special locations, like locations where there is little water. Two hundred pounds seems like a good deal of water, but if you figure up the amount of water that would actually be wasted in a cooling tower, to take out, say, 40 or 50 degrees, those figures would come down to something like seven or eight pounds of water actually wasted or evaporated in a cooling tower, and having only 200 pounds per kilowatt to handle, it would make the pipes and the cooling tower itself quite a small piece of apparatus per kilowatt.

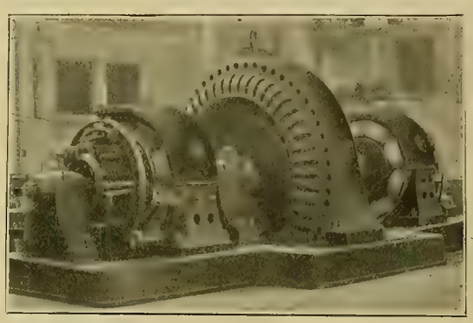
The whole subject seems to line up in this way: Gas engines are at the present time to be looked upon as desirable in special locations—where coal is high, where, as it has been said, it costs $3 and upward a ton; where water is scarce, and where there are other conditions, like the saving in copper, etc. Of course, the cost per horsepower of the gas engine is bound to be a good deal more than the cost of a steam engine unless we learn to make gas engines a great deal lighter per horsepower than we do now. The weight in a large engine will run about 500 pounds per horsepower, and the price of coal seems to be about the same as it has been, and the cost of labor is not getting cheaper, so that I do not see where there is going to be any great thing in that unless it is in a change in design.

Electricity May Replace Steam on the Southern Pacific.

The Southern Pacific Railroad Company, which has already completed its plans for electrically equipping its San Francisco local lines extending from Alameda ferry slip, connecting by steamer with San Francisco, is now said to be preparing to make definite plans for main-line electric traction. Figures are to be submitted by prominent electric manufacturing concerns for electric generating and distributing systems at several points, with a total capacity of 100,000 horsepower. It is proposed to begin the work of conversion on the main line in the mountains in the vicinity of Truckee, Cal., in order to facilitate the heavy traffic on the line from San Francisco to Ogden. A number of water rights are available within practicable transmission distance of the divisions on which the extra power is needed most. It is understood that the company controls water rights in Northern California and Southern Oregon that could be developed electrically to furnish motive power for the operation of the line extending to Oregon. It would take a year or two to accomplish much in this direction, but there are indications that the Harriman lines, which have been considering electric traction in a desultory way for several years past, will make a start at an early date. Several eminent electrical engineers have looked over the ground at Truckee and reported on the situation. The contract connected with changing over the Alameda and Melrose local steam line to an electric-railway system will amount to about $1,881,000, according to the bids received for equipment, etc.

Three-machine Generating Sets for Electrochemical Works.

For use in an extension of its works at Niagara Falls, N. Y., the Niagara Electrochemical Company recently contracted for three motor-generator sets, which are of considerable interest. They are of the synchronous type, operating at 500 revolutions per minute, 25 cycles, 2,200 volts. Each set consists of three machines, the synchronous motor being coupled to a direct-current generator at each end by means of flange couplings. Each direct-current machine generates current at a maximum pressure of 165 volts and has an output of 200 kilowatts, the voltage being capable of variation through a considerable range. The sets have four



ALLIS-CHALMERS THREE-MACHINE MOTOR-GENERATOR SET.

bearings, and the design is such that either direct-current machine can be disconnected, in case repairs are necessary, without interfering with the operation of the remaining machine.

The service which these sets have to perform is exceptionally severe, as the load is continuous day and night, for several weeks at a time, without opportunity for a shutdown of any kind. The current is used for the electrolytic reduction of metallic sodium from sodium hydroxide, and the process is an uninterrupted one. Each direct-current generator furnishes current to a series of pots in which the electrolytic reduction is carried on, and by using three-machine sets the voltage on the series of pots supplied by any machine can be varied independently, thus giving a decided advantage over a single direct-current machine of twice the output.

Each set included in this contract, which was awarded to the Allis-Chalmers Company, will be provided with a three-panel switchboard, one alternating-current motor panel and two direct-current generator panels. The sets will be arranged for starting from the direct-current end, and the synchronous motors will be excited from the direct-current machines. Power for operating will be supplied from the large plant of the Niagara Falls Power Company.

Use of Electricity in Agriculture in France.

An account, given in La Nature, and translated in abstract in the London Times Engineering Supplement, describes the works at Voyenne in the department of Aisne, France. The account indicates what is being done in France in the use of electric energy for agricultural operations.

A company was formed in 1904 to take power from three small waterfalls and to generate about 200 horsepower by this means for distribution throughout the district. In addition to the hydraulic power, the company has a steam engine of 100 horsepower. The current is generated in three power stations and is supplied to 13 villages. Turbines are used to drive alternators which furnish three-phase current at 3,200 volts, with 50 periods per second.

Current is employed both for light and power, and it is used on the farms for grinding, threshing, cake-crushing and other like purposes. The maximum delivery of energy was in June last with 4,145.5 kilowatt-hours, when a total of 19 motors were in use with an aggregate power of 97.95 kilowatts—say, 133.5 horsepower. The price charged for power was 0.50 francs per kilowatt-hour, if the annual consumption reaches 800 kilowatt-hours; beyond this total a reduction is made of 5 per cent. All the wires are overhead, and the high-tension electricity is reduced at the points it is used to 110 volts by transformers placed in boxes mounted on four poles. The area covered by this supply is about 40 square miles in extent, and there are four main lines of wires to the different villages.

The Nevada Power, Mining and Milling Company, which has begun the construction work on a power-transmission line out of Goldfield, Nev., into the Bullfrog district, expects to be in position to sell power in Rhyolite, Nev., by March, 1907. The company will light the town of Rhyolite.

Electrical Equipment for Iron Mines.

The new power plant which Witherbee, Sherman & Co. are erecting on the Lake Champlain shore at Port Henry, N. Y., furnishes an interesting example of the growth of electricity in mining. It is not generally known that the lower Champlain Lake region produces a goodly proportion of the United States' annual supply of iron ore. The various shafts of this company alone yield from 500,000 to 600,000 tons of iron ore yearly, while with the new electrical equipment the ultimate output will be 1,000,000 tons.

Owing to the fact that the principal shafts of the mines are scattered over a considerable area, electricity has been found to be the most flexible form of power transmission and is almost universally used. Power for this purpose is generated at present both by water and steam. At Mineville there is a steam plant with a 750-kilowatt engine-driven generator which supplies current at 3,300 volts for local distribution. This power is supplemented by two small waterpower plants; a 300-kilowatt waterwheel-driven generator unit is located at Wadham's Mills, and a 370-kilowatt unit at Kingdom, about eight miles from this point. At Wadham's Mills, a Morgan-Smith water turbine is used operating under a 48-foot head. Power at the Kingdom plant is furnished by a Pelton impulse wheel under a head of 290 feet, water being carried through a 32-inch pipe, a distance of 1⅛ miles from the reservoir. These stations are situated about 11 miles from Mineville and deliver current at Mineville at a potential of 6,000 volts. This voltage, made desirable because of the saving in transmission, is stepped down to 3,300 at Mineville and is used in conjunction with the 750-kilowatt, 3,300-volt, steam-driven machine to supply power at the various shafts. Induction motors are used for driving hoists, pumps, air compressors, etc., operated at 25 cycles and 440 volts.

The power house which is being built at Port Henry is some six miles from the mines, and will be interconnected with the other sources to supply the increasing demand for power. The station is to be thoroughly modern, being built of monolithic reinforced concrete. Not only the building but the stack will be constructed of this material. "Iron Clad" Portland cement, manufactured by the Glens Falls Portland Cement Company, will be used, mixed with tailings from the mines. Fireproof construction will be employed throughout, and the station is to be a typical example of the use of this building material.

The structure is planned after the Roman style of architecture and is of pleasing design. The main building containing the boilers is 116 feet by 54 feet, while the turbine-generator room measures 39 by 59 feet and extends at right angles from the center of the main structure. By making use of the Curtis turbine much floor space is saved and the building is very compactly constructed.

Steam will be generated by four 500-horsepower Babcock and Wilcox boilers, arranged in pairs on either side of a 175-foot stack, which is situated at about the center of the power house. There is space for two more boilers of the same capacity, one at the side of each pair.

The boilers are hand fired, and coal is conveyed to each by a car on a track running the length of the building. This car is filled from an overhead hopper through a hinged chute. The hopper is filled by a vertical bucket conveyor which carries the coal from a pit filled directly from cars outside the building.

The generating equipment comprises an 800-kilowatt Curtis steam-turbine generator, which will deliver current directly to the line at a potential of 6,600 volts and 25 cycles. The compactness of the vertical unit has permitted a remarkably economical disposition of machinery in the generating room. Space is left for the installation of a second turbine, which will probably be installed at once.

The switchboard is located in a gallery which has a reinforced-concrete floor. On this floor are placed also the motor-driven exciter sets, and space is available for two frequency-changer lighting sets. A supplementary exciting unit is provided by a 25-kilowatt horizontal Curtis steam-turbine generator. The entire electrical equipment for this power house will be furnished by the General Electric Company.

Proposed Extension of Drainage Canal Power Development.

The extension of the Chicago Drainage Canal through Joliet to Bradon's road, two miles below, and the construction there of a waterpower plant capable of development to 40,000 horsepower, is the plan announced by President R. R. McCormick of the Sanitary District.

To accomplish this the trustees will attempt to get the necessary legislation by the next general assembly. They will ask an enabling act, permitting the building of the power plant, transferring the right-of-way of the old Illinois and Michigan Canal south from Joliet to the Sanitary District and canceling the state lease of the Economy Light and Power Company of Joliet, which maintains a waterpower plant upon state land.

It is estimated that $500,000 revenue can be gained from the proposed power plant. The plan also contemplates that Joliet, 40 miles from Lake Michigan, shall have an inland harbor at the end of a ship canal with an average width of 200 feet and a depth of 26 feet. This means the widening and deepening of the Des Plaines River between Lockport and Joliet.

The Economy Light and Power Company of Joliet was organized in 1856, and constructed a dam across the Des Plaines River at Jackson Street, Joliet, on state land. In addition to a small land rental the company paid $1,220 a year for waterpower. When the Drainage Canal was built the Sanitary District was compelled to spend $385,000 for a new dam. The company's rental was increased to $10,457 a year.

The Sanitary trustees, it is said, propose to remove the Jackson Street dam, which now causes fear of an overflow, pay the company what it is entitled to on actual investment and assume its contract to furnish power and light to Joliet. As argument in favor of the abolition of the old Illinois and Michigan Canal, President McCormick said that its income, exclusive of the sale of lands and money granted by the legislature, in the last four years has been $106,964, and its disbursements during the same period $273,205.

Electrical Conditions in Denver.

The report of the Committee of Twenty of the National Board of Fire Underwriters on the city of Denver, Colo., shows that municipal supervision of electricity is under the direct control of the city electrician, who is appointed by the mayor for a four-year term. His department includes two inspectors, stenographer and clerk. The present city electrician, Joseph F. Reardon, was appointed in July, 1904. R. S. Babcock is city inspector for the Rocky Mountain Fire Underwriters' Association.

Both old and new work are examined, but no systematic inspection of old work has been made. An ordinance, passed in 1903, appoints the city electrician sole judge of apparatus and installations; adopts the National Electrical Code, including future amendments, as the standard for all installations, and requires a written permission from the city electrician before current may be supplied for lighting or power. A penalty of from $3 to $180 is provided for violation of any of the electrical ordinances. The city electrician has general supervision over all outside wires and must see to their safe installation. Contractors are graded according to nature of work solicited, are licensed and are charged annual fees.

In April, 1906, 22 new and 83 old installations were inspected by National Board engineers to ascertain local conditions and the nature of supervision in force. The equipments were representative rather than special, and practically all were in the congested-value district, the old installations being in blocks of conflagration-breeding possibilities. In the new work inspected a total of 32 violations was found, and the existence of these was largely due to lax inspection and enforcement. A list of those defects would include flexible cord too long when used for pendants or improperly used, unapproved sockets, unapproved insulation on wires in low-potential systems, and several others occurring only once or twice which should have been remedied.

In connection with outside work, the Denver Gas and Electric Company supplies municipal and commercial light and power, the former by open series arc lamps on 2,500 to 6,000 volts direct current, and incandescent lighting by 2,200 volts alternating current, stepped down to 110-220 volts. Power is by 220-440 volts direct current. The La-Combe Electric Company supplies municipal lighting by open series arc lights on 5,000 to 6,000 volts direct current, and commercial light and power by 2,300 volts alternating current, transformed to 110-220 volts alternating current. All transformers are on poles.

The Denver City Tramway Company operates electric street railways on 550-volt direct current, with ground return, rails being generally fairly well bonded. Rails have been connected to water pipes and pipes to power-house bus-bars in a few places. Trolley wires occur on a majority of the streets in the congested-value district and quite extensively elsewhere No ground wires are used.

The Colorado Telephone Company's wires are underground in the congested-value district, but are run overhead from distribution poles in centers of blocks. Fuses are provided at exchanges, at subscribers' premises and at change from underground to overhead construction.

The following companies maintain low-tension or signaling systems, circuits being properly fused at both ends: American District Telegraph Company, Western Union Telegraph Company and Postal Telegraph-cable Company, together with the city fire-alarm and police-signal systems. Overhead wires offer serious obstructions along many of the streets, and more particularly the narrow alleys of the congested-value district.

As to electrolysis, the water and street-railway companies have jointly made systematic electrolytic tests and found pipes positive to ground in several places, the maximum difference of potential being five volts in the vicinity of the power house, where slight evidences of electrolysis have been noticed. Rails are bonded to the water pipes at four places, the pipes being connected to the switchboard by 500,000-circular-mil cables. Rail bonds throughout the city are of reliable types and apparently retain a majority of the return circuits in their proper courses.

As a whole, electrical conditions are supervised by a fairly efficient municipal department and controlled by a good electrical ordinance. New work is generally in good condition, but many defects discovered in the inspection of the old work should have been eradicated. Overhead wires in the congested-value district are a serious obstruction and should be removed. Conditions with regard to electrolysis, never serious, have been improved by the good bonding of rails.

Copper Market.

Copper metal had advanced on December 21st on the New York Metal Exchange ¼c to 23½ and 23⅝c for lake, 23⅛ and 23⅜c for electrolytic and 22⅞ and 23⅛c for castings. Within the last few weeks many producers have taken in orders at prices approaching these figures, and according to "Copper Gossip," published by The National Conduit and Cable Company, it looks as if the upward movement in prices may continue for some time.

According to the same publication: "A large domestic demand, coupled with good foreign buying, gives producers carte blanche in dictating prices. Quotations have advanced 3½ cents a pound since October 1st, and 5 cents a pound since August 1st. Producers are represented as well sold ahead, and additional urgent requirements are reported coming on the market for the early months of next year. Conditions are remarkably favorable to strong markets, but notwithstanding this fact it can hardly be considered good policy to push prices up so high that consumption will eventually refuse to use material that it cannot employ on reasonable terms. Abnormally high prices are not desirable, especially from the consumers' standpoint. A permanently stable market, on a basis fair for all concerned, is the ideal situation for maintaining healthy trade conditions. Copper is now selling at the highest level in over 25 years, and it behooves consumers of the metal to exercise unusual caution at such a time as this.

"There have been enough orders and specifications for many months past to make high prices effective, and the country has had a run of extraordinary trade movements. Business, perchance, may be maintained in 1907 at a rate favorable to bull markets for raw materials generally, but buyers should watch closely their commitments and not run too great risks. We are in the midst of unprecedentedly active times, and it may prove to be the part of wisdom in the long run not to hasten too quickly in efforts to carry the bull campaign to an extreme limit. If adverse developments are to be prevented later on consumers' interests will have to be taken into serious account and everything done to facilitate obtaining full supplies at reasonable terms by domestic manufacturers. The strong market for copper is due largely to the excellent home demand, and it is not too much to expect that American consumers should receive the preference in the distribution of supplies."

Telephone Communications from Moving Trains.

From a railroad train running at speeds varying from 15 to 35 miles an hour out from Madison, Ind., telephone communications were held on December 21st with Louisville, Cincinnati, Madison, Indianapolis and other points by means of an appliance invented by Dr. Alva P. Jones of Louisville, for which he is said to have refused $100,000 offered by Chicago persons. The invention is said to provide the most important railroad-safeguard appliance since the invention of the air brake, as it enables train dispatchers to communicate directly with crews on moving trains, and gives such crews the same facility of communication with each other.

The test was made from a train on the Carrollton and Worthville branch of the Louisville and Nashville Railroad that had been equipped for the purpose. A Louisville newspaper received the messages through the apparatus while the train was going 20 miles an hour. The test was made under adverse conditions. In the party making the test, besides the inventor, were Theodore Harris and Judge Strouthers of Louisville, James B. Duncan of Carrollton, I. W. Orrell, manager for the Carrollton Telephone Company, and James Gale, president of the railroad. Successful conversations have been held with Cincinnati and other points, and an attempt was made to talk with representatives of the Associated Press, but owing to weather conditions in the East the conversation was not satisfactory.

An English concern has been successful in securing the contract for installing a traction system in Athens, Greece. The value of the contract is said to be about $1,500,000. It provides for an installation of about 60 miles of track. The system will be a trolley or overhead system.

Indiana Telephone Items.

The New Long-distance Telephone Company has completed a new copper-circuit line between Indianapolis and Logansport.

The Dubois County Telephone Company has completed a No. 10 copper line from its exchange in Huntingburg to Princeton, a distance of nearly 50 miles.

Superintendent Baily of the Richmond Home Telephone Company, has had so many inquiries relative to his concrete telephone pole that he has deemed it advisable to patent it and has filed his application. Mr. Baily says that in time concrete poles will be in universal use.

According to a recent tabulation by the Indiana State Tax Board, there are 351 Independent telephone companies doing business in Indiana and operate 182,180 telephones. The total capitalization is $13,678,220, with outstanding bonds of $4,313,360. The gross earnings for the year ended June 30th were $2,802,564, and the net earnings amounted to $476,839.98. The operating expenses are given at $2,219,113, and the improvements made and paid for out of the earnings is reported at $106,611.66. When compared with 1905, the number of telephones increased 37,150 and the net earnings were greater by $47,796.18.

The New Home Telephone Company of Bloomfield is redeeming its bonds at par value. This company has been remarkably successful and will soon be free of debt. Arrangements are being made to enlarge the capacity of the exchange and extend the lines in the spring.

Long-distance telephoning on interurban roads is being successfully worked out in Indiana. Arrangements have been made at Fort Wayne whereby the Fort Wayne, Van Wert and Lima Traction Company serves as a connecting link for points in Indiana, Ohio and Michigan. By these arrangements it is possible to talk over private lines to points in the three states, an extreme radius of about 250 miles.

William H. Butler, manager of the Citizens' Telephone Company of Columbus, has resigned and will retire with the close of the year. Mr. Butler will be succeeded by J. W. King of Indianapolis. The New Long-distance Company owns the Citizen's company's plant.

The $15,000 damage suit of Mrs. Himes of Greenfield against the Indianapolis and Eastern Interurban Railway Company and the Hannah Jackson Telephone Company, resulted in a verdict for $6,000 in her favor. A similar suit is pending by her husband, William Himes. This action was based upon the fact that when attempting to use their telephone, it was found so heavily charged with electricity that he could not release his grip. Mrs. Himes went to his assistance and was also unable to release her hold, and both were badly burned and rendered helpless for a time. The trouble was due, it is said, to the telephone wire dropping on the trolley wire. S.

Ohio Telephone Notes.

Owing to the fact that the workshop inspectors have been making a campaign against the employment of children and persons under legal age at night, the telephone companies in Cleveland and other cities have had to rearrange the time of many of their operators. Girls under 18 years of age are not allowed to work at night, so it has been necessary to change the day operators in many cases to the night shift, in order to put some of the younger girls on day work. The night work is lighter and much easier for the young girls, but the companies preferred to follow the requests of the inspectors.

The capital stock of the Citizens' Telephone Company of Delaware has been increased from $125,000 to $200,000.

The Ashtabula Telephone Company has purchased a lot and will erect an exchange building, as well as make other improvements.

A lot adjoining the main exchange has been purchased by the Cleveland Telephone Company for an addition. Although the company has an immense amount of space in its large seven-story building, it has been crowded for some time.

Directors of the Cincinnati and Suburban Bell Telephone Company have declared a quarterly dividend of two per cent. on the stock. This is an increase of two per cent. a year and puts the stock back upon an eight per cent. basis, a reduction having been made in 1900. The usual six per cent. on the yearly earnings for the girl employes has also been declared for a Christmas present, while the men got turkeys and oysters.

A dividend of three-fourths of one per cent. has been declared on the common stock of the United States Telephone Company, payable January 1st, and 1½ per cent. on the preferred stock, payable January 10th.

The Cuyahoga Telephone Company of Cleveland has declared a quarterly dividend of one per cent. on common stock and 1½ per cent. on preferred stock, payable January 20th and February 1st, respectively.

The Pierpont Bell Telephone Company of Pierpont, Ashtabula County, has been incorporated with a capital stock of $10,000 by D. M. Mallory and others.

A meeting of the district superintendents of the Central Union Telephone Company was held at the office of Division Superintendent E. A. Reed in Columbus on Thursday of last week. The visitors were guests of Mr. Reed at the Ohio Club for dinner. C.

Telephone News from the Northwest.

It is stated that the Tri-State Telephone and Telegraph Company has again entered East Grand Forks, Minn., although it is without a franchise there. Connection was secured by running the wire over private ground from a direction where it was possible to do so without crossing public streets or alleys.

The Northwestern Telephone Exchange Company has opened a new sub-exchange in North Minneapolis, which is called "Hyland."

Articles of incorporation have been filed for the Farmers' Telephone Company of Abie, Neb.

E. M. Lundin and associates have incorporated the Dayton (Iowa) Mutual Telephone Company with a capital stock of $25,000.

The Milwaukee Automatic Telephone Company, in seeking admission into that city, will ask the council for a permit to lay its wires along the streets, and will not attempt to secure a franchise. It is thought that, under the recent decision of the Supreme Court, such a method would be sufficient. R.

Bell Output for November.

The American Telephone and Telegraph Company reports as follows for November:

	1906.	1905.
Gross output	151,208	183,470
Returned	57,711	49,075
Net output	93,497	134,395
January 1 to November 30:		
Net output	1,317,801	1,111,247
Outstanding November 30	7,016,059	5,591,811

The company has declared its regular quarterly dividend of two per cent., payable January 15th.

GENERAL TELEPHONE NEWS.

The Northfield (Minn.) Telephone Company has been incorporated with a capital stock of $25,000.

The Miltonvale Telephone Company has been incorporated at Miltonvale, Kan.

The Washington-Navasota Telephone Company of Navasota, Texas, will construct a telephone system in Grimes, Brazos and Washington counties.

The Citizens' Telephone Company of Grand Rapids, Mich., will have a new home in Reed City when a $3,500 brick structure, 24 by 40 feet, is completed by the company. It will be of the renaissance type of architecture, with pressed-brick front.

The contract for the construction of the newly organized Independent Telephone Company's plant in Omaha, Neb., has been awarded to the Crescent Construction Company of Portland, Ore. The cost of the plant, it is said, will be $1,000,000, and it is to be put in operation within a year.

Among the telephone companies recently formed are noted the Ringwood Telephone and Telegraph Company of Ringwood, Okla.; Winfield Parish Telephone Company, Royal, La.; Farmers' and Merchants' Mutual Telephone Company, Nemaha, Neb.; Dawson County Mutual Telephone Company, Lexington, Neb.

Manager Van Dyke announces that bids are being asked for the construction of a two-story building, 35 by 30 feet, at Wallace, Idaho, to be taken entirely by the Rocky Mountain Telephone Company. The system throughout the town is to be reconstructed, the contemplated improvements to cost $50,000.

According to plans filed at the city engineer's office, the Home Telephone Company will have two underground-conduit systems to supply the business district in Spokane, Wash. The contractor has begun excavating for the $60,000 building to be erected in Spokane. The conduits will be built by the Empire Electric Company, a subsidiary concern of the Home company.

The Quincy Home Telephone Company has completed its line across the Mississippi River from Quincy, Ill., to Hannibal, Mo. On the east side of the river they erected a steel tower, 105 feet high and on the west side of the river the bluff rises 225 feet above the river. A span of No. 10 galvanized-iron wire was placed between the two points, which are 2,600 feet apart. The iron wire will later be replaced by a special steel wire.

Temporary offices have been established in Spokane, Wash., by the Interstate Telephone Company. Wires have been installed and the new service is in operation. Most of the towns in the Idaho panhandle are reached direct by the new system. In addition to Cœur d'Alene, Rathdrum, Sand Point, Wallace, Wardner and the mining towns in the Cœur d'Alene district, the company also has wires to the headwaters of the St. Maries and St. Joe rivers, reaching all of the towns along these streams.

CORRESPONDENCE.

Continental Europe.

Paris, December 11.—A telephone line is being constructed in the Bulgarian port of Bourgas which will connect the town with the leading commercial centers of the region. The principal firms of the town intend to connect their establishments with their agencies in the provinces, and the line will thus be called on to render considerable service. At the same time the erection of the new system will give a market for a large supply of instruments and wiring. In the same locality the Municipal Council seems disposed to go into the lighting of the port and the principal streets, seeing that some of the trials which were made lately show that it would be very satisfactory. Private lighting in a number of residences and stores, also upon many of the docks, would no doubt follow such a move.

In the north of Italy a project is being considered for an electric tramway to run from Gallarate to Pozzolo and Oleggio. The starting point, Gallarate, is a station on the electric railroad which runs through the region from Milan. An assembly, formed of the mayors of the different communes and other authorities, approved the report, which was presented relating to the project, which had been drawn up by the Société de la Mediterranée, which was charged with the building and running of the new line, and decided to recommend the communes to vote the necessary funds for this purpose. At Rome a concession is to be granted by the municipality for the building of a new system of electric tramways, and the matter is in the hands of a syndicate which is formed for operating the lines.

On the occasion of the Paris automobile show a concourse of low-carbon gas generators and motors is to be organized, with a view of demonstrating the utility of such motors for different purposes. They are well adapted for running dynamos, as has been proved in many cases on the Continent. It is desired to bring out the advantages of a compact outfit, composed of a producer, motor and dynamo, and only such complete groups are to be entered in the present competition. A technical commission will give each one of them a thorough test and will draw up a report upon their performance, awarding prizes in which will be considered the simplicity of setting up and working, security and health, and expense of fuel.

One of the most recent hydro-electric enterprises in Italy is the new power plant which was opened up not long ago at Viterbo. It is situated on the River Marta, and a dam is erected across the stream about a thousand feet above the San Savino Fall. From the offtake basin, a canal, one mile long, leads to the main settling basin, which has 120 square yards' surface. A penstock leads from the basin to the hydraulic station, which contains three generating groups, each one giving 500 horsepower. Francis turbines are used here upon a net head of water equal to 180 feet. The wheels are furnished by Riva, Monneret & Co. of Milan, while the electric outfit comes from the Savigliano firm of Turin. Designed for 400 kilowatts, the alternators run upon 10,000 volts and 50 cycles. To supply the town of Viterbo, a pole line runs from the station, containing two single-phase lines, each having a developed length of 10 miles. In the sub-station erected in Viterbo there is a bank of 50-kilowatt step-down transformers, which work upon 260 and 150-volt secondary mains.

In the region of Alsace there are a number of mines which are well equipped with electric outfits for lighting the mines and the buildings, as well as for operating electric motors for many purposes. The Sarre and Moselle Company at Karlingen operates a mine plant which may be taken as an example. A central station is erected having four main groups, giving a total of 2,600 kilowatts and sending 5,000-volt current into the mine. For hauling of the loads five large motors of 500 horsepower are employed, and the system of air fans takes as high as 175 horsepower. The mine uses motors for many other purposes, and these range from one up to a hundred horsepower, operating the shops and different kinds of mine machines, and at present there are about 120 in use.

On account of the increase in the telegraph traffic between Germany and Norway, the administrations of the two countries decided to lay a new submarine cable between Cuxhaven and Arcudal. It is designed mainly for the transmission of messages between Hamburg and Christiania, and is 409 miles in length. This cable was laid a few months ago by the cable ship Stephan.

Great Britain.

London, December 12.—The first electric car has at last crossed Westminster Bridge. This is a consummation which has been devoutly desired for many years, and the London County Council deserves well at the hands of the people of London, to whom this tramway will save many a trudge in the wind and rain. The tracks are laid close to the curb both on the bridge and along the Victoria Embankment, and thus there is left a clear roadway of 40 feet for ordinary vehicular traffic. The conduit construction has been adopted,

and a record created by the speed with which the line has been laid. Some dissatisfaction has been caused by the slight lopping off of the trees that has been necessary, but Parliament put it upon the council to keep near the curb, and therefore the responsibility rests with it and not the council.

The electric-power scheme for the Rand has caused a good deal of controversy in the lay press for a long time, but now that long advertisements are being published concerning the 700-mile transmission scheme from Victoria Falls, a protest has at last been made in the electrical press by Mr. Robert Hammond. This gentleman, it will be remembered, read a paper before the British Association in South Africa last year, in which he gave detailed estimates showing that a steam-driven station, erected at Vereeniging, only a short distance away, could supply a certain stated output at less than two cents a kilowatt. The burden of Mr. Hammond's letter now is to prove that such a scheme could easily beat the other in point of price, and with a much greater security in the matter of continuity of supply.

A new engineering society is being formed in London under the title of Associated Municipal Electrical Engineers (Greater London). As this indicates, the society includes all the London and Greater London municipal electrical engineers, and is really a small edition of the Municipal Electrical Association. Mr. Sydney Baynes, the electrical engineer to the St. Pancras Borough Council, which has the largest and most flourishing municipal undertaking in London, is the first president. A radius of 20 miles is taken as the area of the society, and in addition to the chief engineer of an undertaking, the chief assistant may also claim membership. In connection with the very numerous engineering societies which exist over here, and which all have very similar functions, it is interesting to notice that the proposal to amalgamate the three tramway associations has failed.

The Electromobile Company, which is responsible for the presence of so many private electric vehicles in the streets of London, has made a profit of some $30,000 during the last year. A new garage is being built at a cost of $125,000, and the company challenges petrol or steam cars as regards economy of running, in comparison with electric cars.

One of the most recent wireless-telegraph licenses granted by the postmaster-general was to the National Electric Signaling Company, which at once proceeded to erect its station at Macrahanish, on the west coast of Scotland, for the purpose of experimental work between Great Britain and the United States. Unfortunately, during a severe gale, last week, the tower collapsed, and much expense and labor were thus brought to nothing. The mast was 450 feet high, and was set loosely in a sort of socket. Stays were used as supports, which were anchored to huge blocks of concrete.

Great interest is being taken here in the new Poulsen system of wireless telegraphy, and last week a lecture was given at Newcastle, under the patronage of Lord Armstrong, by Mr. McNeil Maskelyne of London. Mr. Maskelyne read the lecture for Mr. Poulsen, and Sir William Preece, K. C. B., and Mr. John Gavey, C. B. (past and present engineers-in-chief to the General Post-office), were present. It was stated that recently, with one kilowatt, perfect communication, day and night, was established between Copenhagen and North Shields (in England), a distance of 530 miles, 150 miles overland, with a mast only 100 feet high.

A further instance of a large colliery company with several mines close together erecting its own electric generating plant, has to be recorded. This is the Priestman Collieries Company, near Gateshead, some six seams being at present worked. The whole of the mines are equipped for electric working, with ordinary apparatus, but in addition there are two special features, viz., a hoisting plant, consisting of an Ilgner converter set, comprising a 33-brake-horsepower three-phase motor, generator, exciter, etc., all supported on one bedplate, coupled by rigid and flexible couplings, and run at 1,200 revolutions per minute. The other feature is an electric coke-oven loading car, which has a capacity of four tons, and is driven by a 10-horsepower C. C. motor, fed from an overhead-trolley line. G.

Dominion of Canada.

Winnipeg, Man., December 22.—H. N. Ruttan, city engineer, has recommended to the City Council that an additional generating plant be installed for pumping purposes, in connection with the waterworks, to the extent of 1,000 horsepower, at an estimated cost of $80,000.

The ratepayers voted on December 18th for government and municipal ownership of telephones by large majorities in almost every town and municipality. R. P. Roblin, premier of Manitoba, stated that he will at once arrange for the building of at least 1,000 miles of long-distance lines.

City Engineer Keely of Edmonton, Alberta, has left for eastern cities to inquire into waterpower propositions for the purpose of installing a system in Edmonton.

Alderman Gibson of Winnipeg states that the city is in a bad way for electrical power, and many of the street lamps have to be shut off for want of sufficient power. It is understood that the Winnipeg Electric Company will furnish the city with some of its Lac du Bonnet power.

The town of Fort William, Ontario, will build an eight-mile extension to the municipal street-railway system at an estimated cost of $83,000. The materials which will be required include 750 tons of 60-pound T-rails, 2,520 pair of 60-pound angles, 2,520 copper bonds, seven miles of No. 0 trolley wire, seven miles of No. 0 feeder wire and 600 cedar poles. Tenders for the above supplies and other small appliances will be called at an early date. Address A. McNaughton, town clerk.

Col. T. A. Potter of Mason City, Iowa, who is interested in a number of Independent telephone systems in the United States, is in the Winnipeg General Hospital, recovering from an operation for apendicitis.

The Winnipeg Electric Street Railroad Company has issued orders forbidding passengers to travel in the vestibules of its cars and also prohibiting smoking on any of the closed cars. The order is being strictly enforced.

The consulting board of the Winnipeg power-plant construction has decided that Col. H. N. Ruttan, William Kennedy, Jr., and Prof. Louis Herdt will be paid a salary of $40 per day and traveling expenses, while absent from Winnipeg, for a minimum time of service of 45 days, the engagement to date from December 13th. R.

New England.

Boston, December 22.—After devoting several days to practical tests of street-car fenders, with sand-stuffed dummies as victims, the Massachusetts Railroad Commission has concluded its investigations along that line and will now prepare a report for the incoming Legislature. About a dozen fenders were tried, not one of which proved an absolute safeguard to the person struck, without regard as to whether the person was standing or lying on the track. A very few of them demonstrated that they would save the victim from serious injury in case he was standing when struck.

The Consolidated Railway Company has bought the property and franchises of the Bennington and Hoosac Valley Electric Railway Company. The Consolidated company is building an electric railway between Williamstown, Mass., and Bennington, Vt. The Bennington and Hoosac Valley company's officials will operate the road for the present.

The Connecticut Railway and Lighting Company has begun the construction of an electric railway between Branford and Stony Creek, Conn. New York, New Haven and Hartford Railroad Company officials state that the New England Investment and Security Company has no connection with any negotiations relating to the control of the Connecticut Railway and Lighting Company's system of electric railways.

Arthur A. Isbell of North Adams, Mass., is perfecting a wireless-telegraph system, to be installed on Greylock Mountain, in Western Massachusetts, next summer. He has been employed in setting up wireless stations in England and Scotland. He set up a station at the foot of Greylock last summer and caught messages going between Cape Cod and New York.

The Harvey Hubbel Company, manufacturer of electrical specialties and machine screws, is to build an additional factory building five stories high, 114 feet long and 52 feet wide in Bridgeport, Conn.

The Ætna Construction Company of New Haven, Conn., has been incorporated. It has a capital of $200,000 and will build and equip electric railways. Samuel C. Morehouse, A. William Sperry of New Haven and John M. Walton of Norwich, Conn., were the incorporators.

George Burnham of Tuft's College recently lectured on "Electricity and Magnetism" before the Stationary Engineers' Association of Haverhill, Mass.

The Boston Suburban Electric Companies' trustees have declared the regular quarterly dividend and make the following report for the years ended September 30, 1906, and 1905, respectively: Income, $198,780, $164,556; expenses, $45,260, $30,594; net income, $153,520, $133,962; dividends, $117,797, $88,196; surplus, $35,723, $45,766 (deficit); previous surplus, $56,123, $10,358; total surplus, $91,846, $56,124.

John F. Perry of Brookline, Mass., treasurer and principal owner of the Norwood, Canton and Sharon Street Railway Company, died on December 5th. He was born in New Bedford, Mass., in 1850, and had been mayor of that city. He built the Norwood, Canton and Sharon electric railway.

The Massachusetts Electric Companies' report for the year ended September 30, 1906, as follows, the second figures being for 1905: Gross earnings, $7,518,240, $6,734,127; operating expenses, $4,883,552, $4,456,393; net earnings, $2,634,688, $2,277,824; charges, $1,594,502, $1,543,514; balance, $1,040,186, $734,310; dividends, $710,406, $372,448; surplus, $329,780, $361,862 (deficit).

Holders of the Southern New England Telephone Company's stock have taken the entire new issue, amounting to $2,200,000, at par. The company's capital now amounts to $7,700,000.

On December 13th the Boston aldermen, in committee of the whole, voted to grant a franchise to the Metropolitan Home Telephone Company, an alleged competitor to the New England Telephone and Telegraph Company. The aldermen later indorsed this action. The franchise gives locations for wire conduits in any street in the city.

On December 13th the Boston aldermen killed the order authorizing municipal lighting. The vote was seven to five, the measure failing to receive the necessary two-thirds of the votes cast.

The Waltham (Mass.) aldermen have granted the right to carry freight and baggage to the Newton, Lexington and Boston, and Waltham street-railway companies.

The National Wire Corporation of New Haven, Conn., was placed in the hands of temporary receivers this week, at the request of the National Steel and Wire Company. Henry L. Hotchkiss, president of the L. Candee Rubber Company of New Haven, and Homer Wise of New York, vice-president of the National Steel and Wire Company, were appointed receivers. The National Wire Corporation's balance sheet, dated November 26th, shows that the company is solvent, with assets valued at $9,625,579 and a surplus of $94,445. B.

New York.

New York City, December 22.—Bids for city lighting were called for this week. They are to be opened on December 31st, but the contracts will not go into force before January 1st. In round figures $3,250,000 will be spent by the city in 1907 to light its streets and public buildings. This price will be somewhat in excess of what has been spent in former years. Although the price of gas and electric current has gone down in recent years, the growth of the suburbs makes the larger investment imperative.

Complaints from the Board of Health concerning flat car wheels have been heeded and as a result appliances have been installed in shops of the Metropolitan Street Railway Company for the quick repairing of flat wheels. Dr. Darlington of the board says the company is now experimenting with a new steel wheel on the Twenty-third Street cross-town lines, the adoption of which may result in flattened wheels becoming an impossibility.

The Hudson Companies, the corporation building the great system of tunnels which are to connect Manhattan with New Jersey, invited New York reporters over to Jersey City to-day to see the work that is being done toward the realization of the scheme. The tunnels under the Hudson are all either completed or well under way; the great stations in Manhattan are going up, and it will soon be known exactly when it will be possible for the traveler to go all over Manhattan, Brooklyn, and the Bronx, as well as a large part of New Jersey without ever coming to the surface of the earth. As is known, the Hudson Companies are boring four tunnels under the Hudson, two of them running from Montgomery Street, Jersey City, to Cortlandt and Fulton streets, New York, and two connecting Morton Street, Manhattan, with Fifteenth Street, Jersey City. In Jersey City and Hoboken, running parallel with the river, will be another tunnel which, when finished, will connect the Jersey City and Hoboken stations of the Pennsylvania, Erie and Lackawanna railroads.

Jones & Naumburg of this city, who recently replaced the shafting and belting in their factory by individual motor-drive, have purchased from Allis-Chalmers Company a new electric generating unit consisting of one of that company's well-known "Reliance" engines direct-connected to a 200-kilowatt generator. The generator will furnish direct current at 240 volts.

The management of the City Railway Company has issued an order to the effect that on and after New Year's Day passengers on surface cars will obtain all transfers from conductors, and not, as heretofore, at certain points receive them from transfer agents at street crossings. Oren Root, Jr., general manager of the company, believes that the former method occasioned considerable trouble to the patrons of the lines, which will now be eliminated.

The Electrical Trades Society of New York has held its eleventh annual meeting and dinner. The officers elected are: President, R. B. Corey; vice-president, W. E. Carmichael of the Diehl Manufacturing Company; treasurer, B. H. Ellis, of the Manhattan Electrical Supply Company. The directors, holding office for various terms, are: John H. Dale, the Dale Company; John Bray, Western Electric Company; Mr. Corey and Mr. Ellis. C. I. C.

Ohio.

Cleveland, December 22.—Solicitor Stage has announced that Cuyahoga County cannot sell current for light and power from the proposed new plant to be erected for furnishing service to the county buildings that will be included in the group plan at Cleveland. The plan had been to have one lighting and power plant to supply current for

both the city and county buildings, the current being sold to the city.

Options have been secured on all the springs and resort property at Magnetic Springs by the Kenton, Magnetic Springs and Southern Traction Company. It is stated that new buildings will be erected and the property put in excellent shape for a summer resort.

Arrangements have been made by the Indiana, Columbus and Eastern to secure private rights-of-way for its line between Columbus and Newark. At present quite a portion of the line is on the public highway and the cars cannot make the speed required.

Plans for the consolidation of the Cleveland and Southwestern, the Ohio Central and the Cleveland, Ashland and Mansfield, owned largely by the same people, have been approved by the directors of the first-named company. The Cleveland and Southwestern has 135 miles of track, the Ohio Central 29 and the Cleveland, Ashland and Mansfield 43.

The receivership of the Springfield and Xenia Road of Springfield has been ended and the receiver will be discharged soon. The bondholders bid in the property some time ago and most of the payments have been made in bonds. After the expenses and fees are paid there will be little cash for distribution.

The Interurban Station Company of Toledo has been incorporated with a capital stock of $10,000 by John C. Reid, William F. Nutt and others to build a union station upon ground which has been purchased for that purpose.

T. W. Latham and associates of Cleveland have purchased a controlling interest in the Mansfield Railway, Light and Power Company of Mansfield from Rudolph Kleybolte & Co. of Cincinnati. The company operates the local railway and light plants and a line extending to Shelby Junction. It is said that this deal assures the construction of the proposed line from Mansfield to Mt. Vernon and Newark, which would give a short line between Cleveland and Columbus. O. M. C.

Northwestern States.

Minneapolis, December 22.—Preliminary sketches have been prepared for a street-railway system at Grand Forks, N. D. The proposed plans provide for a power plant and 17 miles of track.

The Iowa Railway, Light and Power Company has filed articles of incorporation, to succeed the Marshalltown (Iowa) Light, Power and Railway Company. Hamilton Brown is president.

A special election will be held on January 15th at Ashland, Wis., for the purpose of voting on the proposition of a municipal lighting plant.

A new electric generating station with concrete dam and equipment will be built at Marquette, Mich., by the Municipal Light and Power Commission. The addition to the present plant will cost about $97,000.

The Falls Electric Company's plant at Cannon Falls, Minn., was destroyed by fire. It will not be rebuilt until spring.

The Minneapolis General Electric Company has started operating its new power plant at Taylors Falls, Minn. Only 1,500 horsepower is being generated at present, although the power house has a capacity of 12,000 horsepower.

The Omaha and Council Bluffs Railway Company is planning on spending about $2,000,000 in improvements to its system. Two interurban lines, aggregating 35 miles in length, are planned.

The electric-light plant at Ames, Iowa, is to be improved and new machinery installed.

Efforts will be made to secure an electric-light plant at Blue Hill, Neb.

At a meeting of business men at Brainerd, Minn., the proposition of the Brainerd Hydro-Electric Power Company to furnish the city with power was indorsed, and the council will be asked to give it a contract. R.

Pacific Slope.

San Francisco, December 20.—The Western Power Company is still occupying the center of the stage in San Francisco at present. A fairly complete statement of its financial resources has been given out, although there are rumors that the great consolidation plans are not entirely financed yet. The proposed bond issue of $25,000,000 would hardly be sufficient for building the new electric-power transmission of 175 miles to San Francisco and buying out the Pacific Gas and Electric Company's extensive property in the city and through the state, for which it is understood negotiations are in progress. The latter company's various plants in California have been appraised by a party of engineers and accountants.

The power house will be large enough for eight generating units, but only four units will be installed at first. If the plans to construct hydro-electric generating units of 15,000 horsepower each are carried out, the capacity of the initial installation will then be 60,000 horsepower. It will take nearly two years to complete the system under favorable conditions. The I. P. Morris Company has prepared preliminary plans for waterwheels rated at 18,000 horsepower each. It is also reported that the waterwheels and generators will be carried on vertical shafts, and the pressure pipes will be five feet in diameter. The three-phase transmission lines are to be suspended from steel towers, one-seventh of a mile apart.

Edwin Hawley, who is prominent in the Western Pacific Railway, is president of the Great Western Power Company of California as well as the Western Power Company of New Jersey, with headquarters in New York. The last-named corporation is the holding company while the Great Western Power Company, with its main office in San Francisco, is the operating company and is preparing to build the plant in Plumas County. Work is now in progress in the tunnel on the Feather River. Mr. Viele, of Viele, Cooper & Blackwell, of New York, who have charge of the engineering work, has gone East after making arrangements for pushing the work through the winter with quite a force of men.

The United Railroads, although hampered by strike and riot indulged in by its imported Greek track laborers, has placed several more reconstructed trolley cars in operation. Electric cars are again running on Post Street. Haight Street trolley line is to be started up this week.

The Los Angeles Gas and Electric Company suffered losses estimated at $50,000 on the night of December 19th, as a result of a fire which destroyed the switchboard in the transformer room of the company's plant in Los Angeles, Cal. Nine out of 12 generators were put out of commission and the lighting service was demoralized by the putting out of 300,000 incandescent lamps on the company's circuits. The exact origin of the fire is unknown.

The hydro-electric transmission system, projected by the Eel River Power and Irrigation Company, upon which a good deal of construction work was done last year, will be completed as rapidly as conditions will permit by the Snow Mountain Water and Power Company. Both concerns were financed by George W. Scott, W. W. Van Arsdale of San Francisco and their associates. Work was suspended after the San Francisco fire. A large concrete dam has been built. A 5,400-foot water tunnel, about four by six feet in cross-sections, has been driven through the hills connecting Eel River with a branch of the Russian River. A 20-mile three-phase transmission line will supply the town of Ukiah with electric power and about 125 miles of lines will extend down the Russian River Valley to a number of prospective markets for power.

The proposition to sell the California Street Cable Road to the United Railroads has been rejected by action of the holders of 3,843 shares of the stock at a recent meeting. Although they represented a majority of the stock the dissatisfied faction was headed by J. B. Stetson, the president of the company. There is $180,000 in the treasury and the receipts since the cable road resumed operations, August 18th, with four cars, have been $101,633.

The San Francisco Gas and Electric Company, operating the gas and electric service of San Francisco, under the Pacific Gas and Electric Company, is increasing its service with the growth of the new San Francisco. The Fillmore Street Improvement Association has had 104 arc lights put up along the business portion of this new retail street. It is understood the company is in the market for a 5,000-kilowatt steam turbine three-phase generating set for one of its local stations to relieve the shortage of electric power in San Francisco, although it has three 5,400-horsepower gas engines direct-connected to Crocker Wheeler three-phase generators at its new plant six miles from the city. These three units were to have been ready to provide a supply of power for the United Railroads whenever needed, under a contract effective January 1, 1906. Temporary shortages of power on the United Railroads system have occurred frequently during the last few months, and the new gas engines have not yet carried the load as far as is known. A.

PERSONAL.

A. L. Doherty has been appointed general agent at Beloit, Wis., for the Rockford, Beloit and Janesville Electric Railway Company.

Frank Bracelin of Anoka, Minn., has been made manager of the Northwestern Telephone Exchange Company at Grand Forks, N. D.

William Morrison, the well-known storage-battery inventor, who is now engaged in gold mining in Nevada, is making a brief holiday visit in Chicago.

C. J. Franklin has resigned from his position as superintendent of the lines of the Tacoma Railway and Power Company and will occupy a similar position with the Portland Railway and Light Company. F. A. Boutelle will succeed Mr. Franklin with the Tacoma company.

Louis Glass, general manager of the Pacific States Telephone and Telegraph Company, has returned from a trip to Manila, where he found the Philippine Telephone and Telegraph Company's service much improved in extent and quality. Mr. Glass is president of the latter company, which is a Bell interest, with a good deal of San Francisco capital invested in it. He says that the Filipino girl operators are very satisfactory, and are of necessity proficient in the use of three languages—English, Spanish and Tagalog.

Andrew J. Conlin has resigned the superintendency of the Simplex Electrical Company in Cambridgeport, Mass., and he and ex-Mayor John H. H. McNamee of Cambridge are preparing to go into business together as manufacturers of insulated wire and cables, with factory at Hyde Park, Mass.

Howard B. Holmes, assistant superintendent of the Western Electric Company's Clinton Street (Chicago) plant, whose home was in Park Ridge, Ill., died on December 19th at the age of 34 years. Mr. Holmes graduated from Cornell University with the class of '95. He was with the Crane Company of Chicago for about five years and has been with the Western Electric Company since 1900.

Dr. Herbert B. Harrop, who has been for six years chemist for the Milwaukee Gas Light Company, has been appointed engineer of works of the Rio Janeiro Tramway, Light and Power Company, Rio Janeiro, Brazil, S. A. Dr. Harrop is the author of several scientific works and has a number of industrial inventions to his credit. The company with which he will be associated controls the gas, electric-lighting, telephone and traction facilities in Rio Janeiro.

Mr. E. P. Wright, well known in the telegraph and telephone business, died at his home in Cleveland, Ohio, on December 18th at the age of 70 years. He was born at Hammondsport, N. Y., on April 14, 1836. Soon after Morse's inventions Mr. Wright became an expert operator and is said to have been the first man in the country to read telegraph messages by sound. In 1857 Mr. Wright went to Cleveland as an employe of the telegraph interests, and when the Western Union Telegraph Company was organized he became an official. In 1891, when he retired from active business, he had completed a term of 30 years as superintendent of the fifth district of the Western Union. Owing to his interest in these matters, Mr. Wright became an expert electrician and was the inventor of several instruments and improvements in the telephone line. A repeater invented by him and George B. Hicks is still in use. When the Cleveland Telephone Company was organized Mr. Wright became its first vice-president and was a director at the time of his death.

ELECTRIC LIGHTING.

Tracy, Minn., will install a modern lighting plant to cost about $12,000.

D. M. Dean contemplates establishing an electric-light plant in Valparaiso, Neb.

R. A. Bushnell has asked the city of Wessington Springs, S. D., for an electric-light franchise.

The Sioux City (Iowa) Boat Club will install a private electric-light plant at Riverside Park.

The plant of the Saratoga (Wyo.) Electric Light Company, which was destroyed by fire, will be rebuilt.

The question of issuing electric-light bonds will be submitted to the voters of Lohrville, Iowa, on January 7th.

The Missoula Light and Water Company of Missoula, Mont., has been incorporated with a capital stock of $400,000.

The Caney Electric Light and Power Company of Caney, Kan., has been incorporated with a capital stock of $15,000.

The Chester County Electric Company of Avondale, Pa., has secured a 10-year contract to light the town of Newark, Del.

Work will soon be commenced on the underground system of the Houston Lighting and Power Company in Houston, Texas.

Bids will be received March 7, 1907, for lighting the streets of Natchez, Miss., for a period of 10 years. George T. Eisele is city clerk.

The City Council of Brownville, Texas, is arranging to establish an electric-light plant at that place at a cost of $75,000. F. Champion is secretary.

At a meeting of the Lakewood (Ohio) council on December 17th, a proposition to sell the municipal electric-lighting plant was carried. The plant will be disposed of to the highest bidder.

Bids will be received January 3, 1907, for furnishing all street lighting in Green Bay, Wis., with arc lights of 2,000 candlepower or 1,200 candlepower, the contract to run for a period of 10 years. Plans and specifications are on file. J. E. Shanghneseey is clerk of the Lighting Board.

The Edison Electric Company of Los Angeles, Cal., has ordered for its hydro-electric plant on the Kern River at Edison, Cal., eight Allis-Chalmers direct-current motors, with controllers and gearing equipments, to be used for operating 28-inch gate valves. The motors will be 120 volts, series-wound machines of the vertical-shaft type.

fully enclosed, and especially adapted to the service required. This company has installed on the Kern River at Caliente five 3,200-kilowatt Allis-Chalmers alternating-current generators, direct-connected to Allis-Chalmers hydraulic turbines, forming one of the largest long-distance transmission plants on the coast.

A special election has been ordered in Marion, Ind., to vote a special tax to create a fund for a commercial lighting plant. The city has for the last 14 years owned and operated a plant for street lighting, and it now proposes to compete for the commercial lighting. The council is now securing estimates from various electrical companies to determine the probable cost of equipment.

ELECTRIC RAILWAYS.

At a recent meeting of the Utah Light and Railway Company, plans were drawn up for improvements and extensions of the company's system which involve an expenditure of $3,250,000.

The Rapid River Light and Traction Company of Rapid City, S. D., proposes to build a power plant on Rapid Creek at a cost of $250,000. T. N. Blockhart can be addressed.

The rotary transformer for the Walla Walla (Wash.) Valley Traction Company is being put in place at that city and it is expected that the electric railway between Walla Walla and Freewater will be in operation by January 1, 1907.

The first trip over the extension of the Wheeling (W. Va.) Traction Company's line from Wheeling to Tiltonville, was made in a special car by the officers of the company on December 15th. The line from Tiltonville to Rayland will be finished by January 1st.

The matter of one-cent-per-mile interurban fares is becoming a real issue for the Indiana Legislature, which convenes next month. The several bills seems to have the endorsement of the members of the Legislature and the people in general. The interurban people are organizing to fight the bills.

According to the tax statements filed with the city treasurer of Milwaukee, Wis., the gross receipts of the Milwaukee Electric Railway and Light Company and the Milwaukee Light, Heat and Traction Company for their fiscal year aggregate $4,189,015.48. The total tax to be paid to the city is $209,450.92. The amount paid the city in 1905 was $191,445.34.

The Indianapolis and Eastern Traction Company has been denied a permit for a switch to run cars into its new freight and passenger station, which has just been completed at Knightstown. The council demands that the company stop all the local cars at every crossing inside the corporation limits, and the limited cars at four stops, including the station, and also pave the street in front of the station building. At present the company stops its cars at only a few streets, and the limited cars only at the station.

The Indiana Union Traction Company has let a contract to Shepherdson & Hawkins for all of the construction, with the exception of the steel structural iron work for the new car shops to be built in Anderson. The contract for the structural iron work was let to the Indiana Bridge Company of Muncie. The shops will cover three acres of ground and cost $160,000. The company will repair and build new cars, and do the repair work for the entire system. There will be 18 tracks leading into the main building of the shop, and it will be possible to work at one time on 40 or more cars. The building will be as nearly fireproof as possible.

The York Street Railway Company has purchased the franchises and all other interests of the Philadelphia Companies in York, Pa. As a result the York Street Railway Company will ask from the city the right to build such lines as were formerly requested by the Colonial Street Railway Company and the Penn Park Street Railway Company, both of York, as well as the King Street and Carlisle Avenue Street Railway Company, the York Intramural Street Railway pany, the York Railway and Electric Company, the York and Hanover Western Railway Company and the York and Susquehanna Railway Company. As a preliminary the York Street Railway Company has presented in Select Council bills covering the new arrangement and including the Penn Park and the Colonial Street Railway companies. The company agrees to pay to the city three per cent. of its gross earnings, to sprinkle the streets, to furnish a car for the removal of ice and snow, etc. The company also obligates itself to begin work on the extensions within 120 days from the time of the passage of the bills and to complete the same within three years from that date.

PUBLICATIONS.

The Benjamin Electric Manufacturing Company of Chicago has recently issued catalogue B-17. The catalogue contains a complete illustrated price-list of cluster bodies, both multiple and series interior ceiling forms, pendant forms, weatherproof forms, arc burst and "anti-night" fixtures and supplies. One of the novel articles is a socket which is designed with the lamp projecting at a right angle to the supporting socket. In the front of the catalogue are illustrations of representative modern buildings which have the Benjamin wireless-cluster installations.

The interesting article entitled "America's Amazing Advance," written by Mr. Richard H. Edmonds, editor of the Manufacturers' Record, for the December issue of Review of Reviews, has been reprinted in pamphlet form. Mr. Edmonds says that until we learn to think in billions we cannot measure the meaning of the material development of the United States during the last quarter of a century; much less can we mentally grasp the potentialities which the coming years have in store for us. While Mr. Edmonds treats the general subject very interestingly and goes into the more important developments thoroughly, it is strange that he found a single line sufficient to treat of the very important advances in the electrical development of waterpower and electrical appliances as applied to manufacturing.

POWER TRANSMISSION.

Announcement is made that the Washington Water Power Company will erect a steam-power plant to cost $500,000 near Spokane, to supplement the waterpower plant at Post Falls, Idaho.

George W. Norton represents a company which is considering plans for installing an electric power plant on the Gila River, in Arizona, to supply the desert mines to the northward. The Southern Pacific is expected to build a road down the north bank of the Gila and open things up in that district.

SOCIETIES AND SCHOOLS.

The Western Society of Engineers held a meeting on Friday evening, December 21, 1906. A large number of members and their friends attended. A paper was read by R. F. Schuchardt of the Chicago Edison Company, on "The Rotary Converter Sub-station; Its Make-up and Operation." The reading of the paper was followed by an interesting discussion.

Announcement has been made of the 212th meeting of the American Institute of Electrical Engineers, to be held in the assembly room of the New York Edison Company, 44 West Twenty-seventh Street, New York city, on Friday, December 28th, at 8:15 p. m. Mr. Ray P. Jackson, electrical engineer of the Westinghouse Electric and Manufacturing Company of Pittsburg, will present a paper entitled, "Recent Investigation of Lightning Protective Apparatus." The paper will be discussed by the following members of the Institute: Charles P. Steinmetz, Frank G. Baum, Harold W. Buck, Ralph D. Mershon, Percy H. Thomas, David B. Rushmore and H. B. Alverson.

The thirty-second annual report of the president and other officers of Purdue University has been issued. The report covers the year ended June 30, 1906, and includes a short history of the institution, besides the names of the members of the faculty, instructors, assistants and special lecturers. The report says that in the electrical laboratories some valuable studies on insulation have been in progress. Among the grants and appropriations for investigation that were received is the historic locomotive "Reuben Wells," which was donated by the Pennsylvania Railroad Company. The total contributions to the engineering laboratories for the year represent outlays of not less than $15,000. The total attendance for the year was 2,029, compared with 1,534 for the previous year, showing a very healthy growth.

At the recent quarterly meeting of the board of corporation of the Massachusetts Institute of Technology, Frederick W. Wood of Sparrows Point, Md., was elected to the executive committee. Mr. Wood is president of the Maryland Steel Company and he graduated from the Institute in 1877. This is the first time that a person who was not a Bostonian has been elected to this committee. The treasurer reported that the gifts and bequests received during the last year added $86,866 to the property of the Institute, not including Charles Merriam's bequest of $25,000. For current expenses, the receipts were $504,511, and the expenditures were $508,407. The total expense account for the year ended September 29th was $830,968. The Institute holds stocks and bonds valued at $1,500,000. Its real estate and equipment represents about $2,000,000. It derives income from real estate, notes, funds, etc., amounting to $3,888,800.

AUTOMOBILES.

The result of inquiries made as to the number of automobiles that are in actual use in the United States is printed in the New York Times. It is estimated that there are 140,000 machines. Of this number New York state has issued registration numbers for 35,125 machines; New Jersey, 25,507; Massachusetts, 17,299 machines; Pennsylvania, 13,899. The cars registered in some of the other states are: Connecticut, 3,900; New Hampshire, 1,253; Vermont, 847; Rhode Island, 1,714; Delaware, 1,000; Maryland, 2,611; District of Columbia, 1,579; Michigan, 3,473; Indiana, 3,994; Minnesota, 1,700; Wisconsin, 2,578; Ohio, 8,000; Kentucky, 1,200; Florida, 268; Virginia, 524; Nebraska, 1,050; Missouri, 1,200; Oregon, 548; South Dakota, 598; Washington, 548. From the city of Chicago 4,500 machines are reported in use.

TELEGRAPH.

The board of directors of the Postal Telegraph-Cable Company has adopted a resolution to the effect that owing to changed conditions it has been found necessary to stop all free transmission of messages after January 1, 1907.

The Postal Telegraph-cable Company has announced the opening of a new cable route to South America, giving a direct line of communication with Para, Bahia, Rio Janeiro, Santos, Montevideo, Buenos Aires and other points.

The Western Union Telegraph Company estimates its net revenue for the quarter ending December 31st at about $1,600,000. Deducting interest on the bonded debt and $1,217,024 to meet a 1¼ per cent. dividend will bring the company's total surplus up to $17,009,825. The net revenue for the quarter ended September 30th was $1,660,519.

MISCELLANEOUS.

It is a fair assumption that the following, from a department entitled "For Holiday Shoppers" in a Chicago daily newspaper, was written by a woman: "Interesting to small boys is a machine shop that when attached to the electric-light bulb becomes as busy as possible. There are drills and sledge hammers and mercy knows what not. The separate machines have small belts running to a tiny engine, the larger belt of which is started by the electricity."

The Lloyd Manufacturing Company of Minneapolis, manufacturer of children's vehicles and steel and wire specialties, has ordered from the Allis-Chalmers Company 23 induction motors, ranging in size from two to 15 horsepower, which are to be installed for operating the machinery in the plant. Power will be furnished by an alternating-current generating set, previously purchased.

The Virginia Portland Cement Company of Fordwick, Va., is about to add 2,000 barrels per day capacity to its plant, which will be one of the largest cement plants in the South. There will be a new power house, and the existing mill and the new machinery will be driven by electricity. In the power house two turbines are to be installed, and the boiler capacity increased by 1,500 horsepower. The consulting engineers of this plant are W. S. Barstow & Co. of New York and Portland, Ore.

The city of Columbus, Ga., has lately acquired an addition to its industries in the shape of the Swift Spinning Mills, whose new yarn mill will include 10,000 spindles when in full operation. Contracts have already been placed by the new company for induction motors, transformers, etc., suitable for an electrically driven mill of most modern design. The electrical equipment will be furnished by the Allis-Chalmers Company of Milwaukee. It consists of units ranging from 30 to 100-horsepower capacity in induction motors, and will include a number of oil-filled self-cooled transformers.

The production of copper in the United States in 1905 increased from 812,537,267 pounds, valued at $105,629,845, in 1904, to 901,907,843 pounds, valued at $139,795,716 in 1905, an increase of 89,370,576 pounds in quantity and of $34,165,871 in value. The production of lead in 1905 was 302,000 short tons, as against 307,000 short tons in 1904, and 282,000 short tons in 1903. The value of the production in 1905 was $28,690,000, as compared with $26,402,000 in 1904. Zinc in 1905 showed an increase in quantity as compared with 1904, 1903, 1902 and 1901, the production being 203,849 short tons, as compared with 186,702 short tons in 1904. The value of the zinc production in 1905 was $24,054,182, as compared with $18,670,200 in 1904.

Senator Flint has introduced a bill in Congress for the holding of an exposition near Los Angeles, Cal., to commemorate the opening of the Panama Canal. It would be held in 1915, the year in which it is hoped to open the canal, and would be known as the Universal Peace and Commerce Exposition. A commission having the matter in charge would be incorporated under the laws of California, and would consist of two commissioners of each state and territory of the United States and the District of Columbia, eight commissioners at large and 10 to be appointed by the president. The commission would be expected to raise $5,000,000 by subscription; $5,000,000 to be provided by the government. When the required sum had been raised a further appropriation of $10,000,000 would be forthcoming.

TRADE NEWS.

Sealed proposals will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until January 31st, for the construction of an extension, including heating apparatus, electric conduits and wiring, to the post-office at Crawfordsville, Ind., in accordance with drawings and specifications, copies of which may be had at the above office or at the office of the custodian at Crawfordsville.

The business of Mr. C. H. Thordarson has been taken over by the C. H. Thordarson Electric Manufacturing Company, incorporated under the laws of the state of Illinois with a capital of $100,000. The company is located at 153, 155, 157 and 159 South Jefferson Street, Chicago. Officers and directors are: President, C. H. Thordarson; vice-president, Joseph W. Watkins; secretary-treasurer, John A. Brennan. Mr. Watkins was formerly vice-president of the Raymond Brothers Impact Pulverizer Company, and Mr. Brennan has been for many years associated with Mr. Thordarson.

Succeeding the firm of F. B. Badt & Co., a company bearing the same name has been incorporated under the laws of the state of Illinois with authorized capital of $25,000. The directors are F. B. Badt, Paul A. Westburg and Otis H. Waldo. They have elected Mr. Badt as president and treasurer and Mr. Westburg as secretary. The engineering business of the concern will be carried on as formerly. Mr. Badt is one of the best-known electrical engineers of Chicago, and with increased facilities for doing business the interests of his company should advance in corresponding degree.

Mr. George V. W. Ingham has been transferred from the main office of Pass & Seymour to Chicago as western sales agent, in charge of the territory controlled from Chicago. Mr. Ingham has been with the company at the factory for some time and is well posted in the line, and in a position to handle all conditions very satisfactorily. Mr. A. S. Merrill remains in Chicago, also, as assistant western sales agent. This change is made necessary by the fact that the volume of business handled from Chicago territory is larger than one man can handle to advantage, and the company desires to have representatives get around to see customers oftener.

BUSINESS.

The capital stock of the American Electrical Supply Company, Chicago, has been increased from $50,000 to $100,000 and the number of directors increased from five to nine.

The Power and Mining Machinery Company of Cudahy (suburb of Milwaukee), Wis., in conjunction with the Snow Steam Pump works of Buffalo, N. Y., has opened a new sales office at 719 White Building, Buffalo, where will be handled the several types of gas-generating apparatus, such as the Loomis-Pettibone system, suction and pressure gas plants, built by the Power and Mining Machinery Company, and the Snow gas engines, built by the Snow Steam Pump works. Mr. Seward Babbitt, sales manager of the first-named concern, will make his headquarters at the Buffalo office, on account of the facility for conducting business from that point.

In a neat little circular C. O. Schneider & Co., 84 Adams Street, Chicago, call attention to the Firefly flasher. Many of these flashers were used this year in Christmas-tree lighting. They are very effective in any electrical decorative lighting. The flasher is an automatic, reliable and safe little instrument with which to light and darken a number of small lamps from 15 to 30 times a minute on direct or alternating 110-volt current.

The Wesco Supply Company of St. Louis, Mo., has purchased the plant of the Davis Electric Manufacturing Company of Springfield, Mass., including all machinery and the finished and unfinished product. The latter is being removed to St. Louis, where the company will continue the manufacture of the famous Davis switches, as well as all of its other specialties. The five-story factory building at the corner of Eighth Street and Clark Avenue, St. Louis, has been leased for a term of years, and is being installed in the latest and most modern machinery and other equipment for the manufacture of these specialties, as well as tablet boards, cut-out cabinets, switchboards, telephones and telephone accessories. It is the purpose to have one of the most complete and modern factories for the production of electrical specialties in the West. The factory will be in complete operation by January 15, 1907.

ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued (United States Patent Office) December 18, 1906.

838,525. Testing System for Telephone Lines. William W. Dean, Chicago, Ill., assignor to the Kellogg Switchboard and Supply Company, Chicago, Ill. Application filed June 29, 1903.

A testing conductor is placed so that it is common to the two cords, being connected to them through contacts of an associated plug-seat switch and disconnected from them through the contacts of a supervisory relay.

838,537. Cross-arm for Electrical Construction. Evlyn S. Hamilton, Adrian, Mich. Application filed April 9, 1906.

The body of the cross arm is of angular form in cross section and has a series of yokes or ribs to resist tortional strain. A series of pin supports project upwardly and a series of line-wire supports with tie wires project downwardly, and are placed opposite the pins.

838,542. Railway Signaling Apparatus. Albert J. Hitch, Ridgetown, Ontario, Canada. Application filed December 4, 1905.

Electrically operated means governed by the passing of a train actuate a shutter which discloses or shuts from view an indicating device.

838,545. Multiple Telegraphy and Telephony. Maurice Hutin and Maurice Leblanc, Paris, France, assignors to the Westinghouse Electric and Manufacturing Company, Pittsburg, Pa. Application filed May 9, 1894.

A number of vibrating currents of different frequencies are maintained on the lines simultaneously. Each line of the system has its static capacity and inductance so related as to render its real reactance zero each for a different one of the frequencies. The transmitters are adapted to alter the vibrations and receivers are in the resonant circuits, which are attuned to the frequency of the current which it is desired to receive.

838,547. Electric Motor and Method of Controlling the Same. Austin Kimble, Chicago, Ill., assignor of one-half to Perkins B. Bass, Chicago, Ill. Application filed May 21, 1906.

A contact pin is placed at the junction of the shunt and series windings and a second contact pin is connected with a conductor which short-circuits the series winding. A contact member is so connected in the circuit that it can be moved into contact with the points to control the direction of the current in the series winding.

838,583. System for Charging Storage Cells. Ira S. Raymer, Beaver, Pa. Application filed August 23, 1905.

In conjunction with a block section of a railway system the battery consists of three sets of storage batteries, and the system is arranged so that the circuit-controlling apparatus shifts the three sets of cells successively into connection with the track and the source of charging current.

838,586. Electric-car Sign and Signal. Charles W. Ryder and Franklin Orth, Burlington, Vt. Application filed April 8, 1905.

The signs are transparent and on different sides of a box containing electric lights. The sign can be rotated so as to expose the different signs on the different sides and can be locked in position.

838,605. Dynamo-electric Machine. Bernard A. Behrend, Norwood, Ohio, assignor to the Allis-Chalmers Company, Milwaukee, Wis., and the Bullock Electric Manufacturing Company. Application filed March 26, 1906.

A design for an alternating-current dynamo in which the means for retaining the coils in the slots in the core consists of wedges having portions engaging the grooves in the teeth in the laminated armature. The portions of the wedges bridge ventilating spaces having a width not greater than the width of the slots.

838,613. Lamp-socket Adapter. Frederick J. Forbes and Robert E. York, Portage, Wis. Application filed June 19, 1905.

The adapter is for screw-base lamps and the principal feature is that a jam nut engages with the thread of the receptacle to hold the adapter in place.

838,617. Means for Effecting and Controlling the Storage of Water in Hydraulic-power Systems. Fritz Golwig, Vienna, Austria-Hungary. Application filed May 5, 1906.

Means are provided for registering the flow of water into an upper reservoir and out of a lower reservoir. The means also control the flow and are governed for this purpose by the difference in the rates of flow.

838,647. Pyro-electric Furnace. Finis E. Roach, Chicago, Ill. Application filed October 11, 1905.

A shell of insulating material open at each end has resistance wire wound around it. Means are provided for closing the ends.

838,652. Electric Brander. George J. Schneider, Detroit, Mich. Application filed July 10, 1905.

The conductor forming the heating resistance has portions in relief and is backed by electrically insulating heat-resisting material.

838,681. Limit Switch for Electric Motors. Sidney Burrowes, Falls View, Ontario, Canada. Application filed February 19, 1906.

A nut on a journaled screw is held from revolving without interfering with its longitudinal movement. The nut can engage with a detent to cause it to release a motion piece which operates an electric switch.

838,716. Electroplating Apparatus. William S. Hutchinson, Boston, Mass. Application filed July 29, 1905.

For recovering gold from plating solutions a tank has several compartments joined together and interconnected and a series of zinc boxes communicate with the outlet.

838,717. Process of Electroplating. William S. Hutchinson, Boston, Mass. Application filed July 29, 1905.

Similar to the preceding patent.

838,729. Wire Terminal. Fred T. Lockwood, Jackson, Mich. Application filed October 26, 1905.

A single piece of metal is formed with a hole in one end and a radial slot. The shank is provided with a pair of large and a pair of small clamping wings for the wire.

838,742. Trolley Catch. William A. Oates, Los Angeles, Cal. Application filed April 5, 1904.

A bell-shaped thimble secured to the trolley cord is adapted to engage a stop in the trolley-catch casing. Trolley levers are journaled in the casing and automatically return to position after being operated upon by the trolley cord.

838,749. Telephone System. Henry L. Reber, St. Louis, Mo. Application filed March 29, 1905.

A trunk-telephone exchange system has order wires having multiple terminals in the A board and means are provided to enable the A operators to instantly pick out idle B operators. (See cut on next page.)

838,764. Means for Insulating Electric Conductors. Stanislaus Berger, Trier, Germany. Application filed May 9, 1905.

A series of tubular cases having guiding rods inside of insulating material, receive the conducting wires. The cases are filled with insulating material and are surrounded by a protecting pipe.

838,780. Railway Signal. George P. Finnigan, Greene, N. Y. Application filed August 19, 1905.

A semaphore arm is weighted so as to automatically come to "danger" position when released. A magnetic clutch holds the arm and is energized by a battery.

838,784. Wattmeter. Lorin E. Imlay, Niagara Falls, N. Y. Application filed February 16, 1905.

A secondary element carrying an indicator is acted upon by primary and shunt coils. A stylus records its movement on a drum which is driven by a separate source of energy. The car carrying the stylus is mounted so as to be moved by a screw and the screw is driven by a friction pulley. The friction pulley is engaged by one of two other friction pulleys. The engagement of the friction pulleys is governed by electromagnets, which cause one or the other to come in contact with the driving pulley according to the direction of the current through it.

838,787. Telephony. Isidor Kitsee, Philadelphia, Pa. Application filed June 8, 1901.

The connecting plug of a telephone switchboard is provided with a core and helix which is actuated by the circuit of the calling subscriber. Means on the switchboard attract and hold the plug as long as the magnet is energized. These means form part of the called circuit.

838,788. Electric Transmission of Intelligence. Isidor Kitsee, Philadelphia, Pa. Application filed August 11, 1906.

To reduce the effect of a power wire on a series of lines of transmission a coil is placed in the region of the power wire and is connected to another coil around all of the lines of transmission.

838,800. Automatic Voltage Regulator for Dynamos. George S. Neeley, St. Louis, Mo. Application filed July 31, 1905.

A variable resistance and a shunt resistance are interposed in the field circuit of the exciter. One main artificial magnet is connected in series with the field of the exciter and another is in series with the working circuit of the alternator. The two are so connected mechanically that they operate the variable resistance in response to varying intensities of the exciter-field current and the working current of the alternator.

838,801. Method of Regulating the Field Density of Electric Generators. George S. Neeley, St. Louis, Mo. Application filed August 21, 1905.

The excitation of the field of the generator is controlled by different electromagnetic forces resulting from placing the intensity of the field current in magnetic opposition to the current output of the machine.

838,802. Automatic Regulator for Direct-current Dynamos. George S. Neeley, St. Louis, Mo. Application filed September 29, 1905.

A magnet having a plurality of windings has one winding inshunt with the shunt field of the dynamo and a variable resistance so that the incremental action of the field current flowing through the winding tends to increase the variable resistance. The other winding of the magnet is in multiple with the work circuit so that the incremental action of the voltage of the machine increases the saturation of the magnet which assists the action of the field current to increase the variable resistance. Means are also provided to operate the two windings, in opposition so as to decrease the variable resistance. (See cut on next page.)

838,809. Telephone System with Central Battery. Gottlieb M. T. Piltz, Stockholm, Sweden, assignor to Stockholms Allmänna, Telefon Aktiebolag, Stockholm, Sweden. Application filed August 4, 1903.

Two relays—one energized when the subscriber calls and the other energized when the plug is inserted in the answering jack, are connected by the latter operation so that they act as an inductive resistance. Another inductive resistance is so arranged that when the plug is inserted in the jack the resistance is interposed between the central battery and the other line branch. The second resistance is in the form of two relays, one of which serves to cut out the calling signal and the other the clearing-out signal.

838,811. Electrical Receptacle. Bert E. Salisbury, Syracuse, N. Y., assignor to Pass & Seymour, Solvay, N. Y. Application filed July 20, 1904.

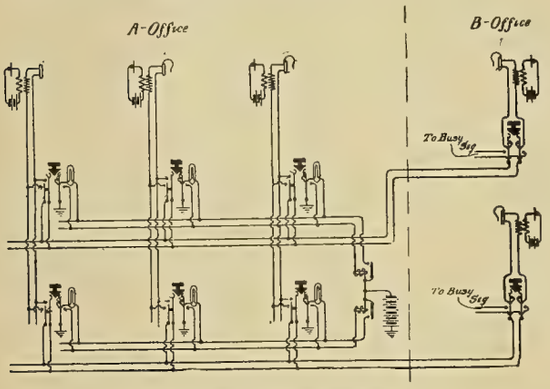
For incandescent lamps the receptacle has a round porcelain base and is evidently of the wall type.

838,820. Interlocking Machine for Railway Purposes. Jacob B. Struble, Wilkinsburg, Pa., assignor to the Union Switch and Signal Company, Swissvale, Pa. Application filed October 6, 1906.

A bar is movable in one direction to effect the interlocking and in the opposite direction to effect its release. Magnetic means permit a slow movement in the said opposite direction.

838,822. Battery-charging System. William I. Thomson, Newark, N. J., assignor to the Safety Car Heating and Lighting Company, New York, N. Y. Application filed August 17, 1904.

The external circuit leading from the generator comprises two paths in parallel, and means are provided to open the circuit of one of the paths and divert the external output of the generator through the other path if the voltage of the generator exceeds a certain point.



NO. 838,749.—TELEPHONE SYSTEM.

838,823. Low-water Alarm. William I. Thomson, Newark, N. J., assignor to the Safety Car Heating and Lighting Company. Application filed October 22, 1904.

A circuit is connected through the water so that if the water falls below a certain point the circuit is broken. Means are provided to cause an alarm to ring when the circuit is broken.

838,848. Signal Device. James S. Cunningham, Allegheny, Pa. Application filed October 26, 1905.

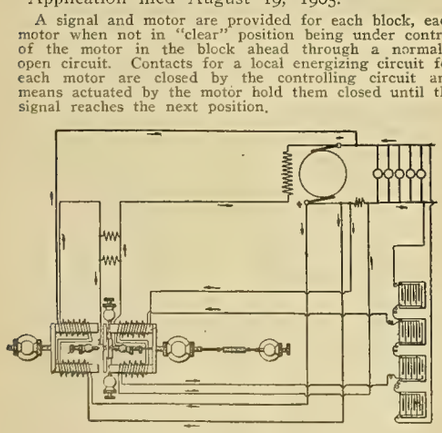
Wheels carried by the locomotive engage telephone and signal rails, which are elevated above the railway rails. A telephone is carried by the locomotive and electromagnets are energized by the wheels engaging the signal rail to release the operating levers of the locomotive. Means are provided to normally establish communication between the different blocks of the system and the locomotives in the blocks.

838,850. Automatic Call Indicator for Telephones. Earl P. Denton and Arthur W. Nazor, Frankfort, Ky. Application filed January 13, 1906.

A point movable by the clapper indicates a call. The point is connected by a flexible connector to the receiver hook and pulls the point to normal position when the receiver is taken off the hook.

838,854. Electric Block-signal System for Railways. George P. Finnigan, Greene, N. Y. Application filed August 19, 1905.

A signal and motor are provided for each block, each motor when not in "clear" position being under control of the motor in the block ahead through a normally open circuit. Contacts for a local energizing circuit for each motor are closed by the controlling circuit and means actuated by the motor hold them closed until the signal reaches the next position.



NO. 838,802.—AUTOMATIC REGULATOR FOR DIRECT-CURRENT DYNAMOS.

838,860. Incandescent-lamp Guard. Harvey Hubbell, Bridgeport, Conn. Application filed August 18, 1906.

A metallic wire lamp guard has a coating substance on the wire which secures the wires together at the points of contact.

838,884. Plural-coil Electric Heater. James F. McElroy, Albany, N. Y., assignor to the Consolidated Car Heating Company, Albany, N. Y. Application filed April 9, 1906.

A plurality of resistance elements are mounted side by side on an insulating support and have coextensive longitudinal spaces. The elements have means for their respective connection with a plurality of heating circuits so that one or more elements may be operative.

838,885. Alternating-current Heater. James F. McElroy, Albany, N. Y., assignor to the Consolidated Car Heating Company, Albany, N. Y. Application filed September 6, 1906.

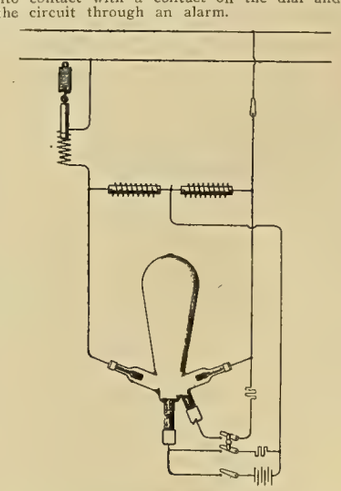
Heating coils are distributed in the apartment to be heated and are located on the respective sides of the circuit. The coils are grouped into divisions of substantially equal resistance, to balance the circuit.

838,916. Inductive Bond. Louis H. Thullen, Edgewood, Pa. Application filed February 27, 1906.

The core of the bond has several arms and on one of the arms there is a winding, all the turns of which are in the same direction and are in close inductive relation. A conductor leads from the middle point of the winding. (See cut.)

838,918. Electric Alarm Clock. Louis Trede, Durant, Iowa. Application filed June 15, 1906.

A contact on the hand of the clock is arranged to come into contact with a contact on the dial and completes the circuit through an alarm.



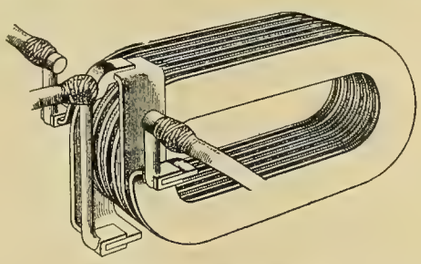
NO. 838,949.—VAPOR RECTIFIER.

838,949. Vapor Rectifier. Alexander Churchward, New York, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed April 19, 1905.

A vapor rectifier having a number of anodes and a cathode is connected to a source of alternating current. Means are provided for impressing the normal voltage across the rectifier anodes before the rectifier starts and automatic means decrease the voltage on the rectifier when the current begins to flow through it. (See cut.)

838,950. Therapeutic Lamp. Harley E. Coger, Minneapolis, Minn., and John B. Marshall, Chicago, Ill., assignors to the Spear-Marshall Company, Chicago, Ill. Application filed August 31, 1905.

The lamp is placed inside of a combined directing and reflecting device and heating means are also included within the director. (See cut.)



NO. 838,916.—INDUCTIVE BOND.

838,977. Solution for Use in Art of Electrotyping. August Gerstner, New York, N. Y. Application filed April 20, 1906.

The solution comprises nitrate of silver, chloride of sodium and graphite.

838,994. Spark Plug. Ralph O. Hood, Danvers, Mass., assignor of one-half to Warren D. King, Peabody, Mass. Application filed March 9, 1904.

A stem is provided with a head at both ends. A sleeve about the stem has insulation between one end of it and the corresponding head of the stem. A casing is about the insulation and forms a gastight joint with it.

839,000. Vibrator. Edward B. Jacobson, Pittsfield, Mass., assignor to the Pittsfield Spark Coil Company, Pittsfield, Mass. Application filed December 19, 1905.

An armature overlies the free end of the main spring and is secured to it. An auxiliary spring engages the main spring and an adjustable contact point is opposite a contact point on the main spring.

839,023. Incandescent Electric Lamp. George A. Nellis, Allegheny, Pa. Application filed September 25, 1905.

A portion of the leading-in wire within the seal is helically wound.

839,027. Electric Contact Device. Peder O. Pedersen, Copenhagen, Denmark. Application filed April 15, 1904.

For alternating currents, the conducting body is capable of vibrating with definite periodicity. A magnet is provided and the current flows through the conducting body which is held to the magnet when its vibrations have increased to a predetermined amount.

839,029. Receiving System for Wireless Transmission of Signals. Valdemar Poulsen, Copenhagen, Denmark. Application filed October 2, 1905.

A condenser is arranged to be charged by the received wireless impulses and a local source of power is connected to the condenser to change its capacity so that the energy of the electric charge is multiplied.

839,048. Automatic Cut-out Device for Electric Circuits. William O. Taylor, Limerick Square, Pa. Application filed January 3, 1905.

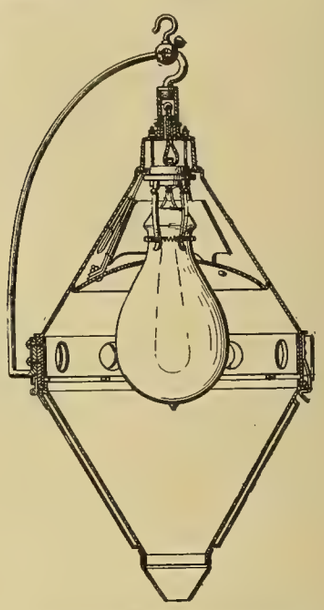
A circuit-breaker having a movable element, and an electromagnet consisting of a single coil having oppositely facing pole-pieces, are interposed in the line and are combined with a pair of armatures. One armature is located at each end of the coil and each is connected to the movable element of the circuit-breaker.

839,049. Spark-producing Device. Fredus A. Thurston, Chicago, Ill. Application filed February 7, 1905.

A device encloses the armature of an electromagnet and is provided with a supporting edge. The armature has a groove adapted to receive the edge and located at one side of the center of gravity.

839,072. Rail Bond. Frank D. Masterson, Boston, Mass., assignor to the Chase-Shawmut Company, Boston, Mass. Application filed October 2, 1905.

An extensible intermediate portion is composed of several strips. A band embraces them and is attached to one strip, permitting a sliding movement of the several strips relative to each other, but preventing their undue separation.



NO. 838,950.—THERAPEUTIC LAMP.

839,079. Time-limit Circuit-breaker. William M. Scott, Philadelphia, Pa., assignor to the Cutter Electrical and Manufacturing Company. Application filed February 17, 1903.

A movable mass within a chamber is retarded in its movements in one direction, but is permitted to return quickly. The movements of the mass are controlled by electro-magnetic means and control the main circuit.

REISSUES.

12,581. Electromagnetic Friction Clutch. Wenzel Schuster and Heinrich Ast, Vienna, Austria-Hungary. Application filed November 22, 1906. Original No. 736,789, dated August 18, 1903.

The driving member constitutes a magnet and the driven member constitutes an armature. Non-magnetic friction rings are carried by each of the members and are so proportioned as to maintain an air-gap between them.

PATENTS THAT HAVE EXPIRED.

Following is a list of electrical patents (issued by the United States Patent Office) that expired December 24, 1906:

417,742. Electric Cam. H. S. Prentiss, New York, N. Y.
417,747. Device for Suspending Electric Conductors. S. H. Short, Cleveland, Ohio.
417,753. Time Distributer for Electric Clocks. L. H. Spellier, Philadelphia, Pa.
417,787 and 417,788. Incandescent Lamp Socket. J. W. Packard, New York, N. Y.
417,789. Incandescent Electric Lamp. J. W. Packard, New York, N. Y.
417,794. Armature for Electric Machines. A. Schmid, Allegheny, and N. Tesla, Pittsburg, assignors to the Westinghouse Electric Company, Pittsburg, Pa.
417,814. Galvanic Battery. P. B. Delany, New York, N. Y.
417,842. Device for an Electric Car Signal. J. P. Runkel, Milwaukee, Wis.
417,920. Electric Heating Apparatus for Electric Railways. R. M. Hunter, Philadelphia, Pa.
417,923. Electric Therapeutic Apparatus. F. J. Kneuper, New York, N. Y.
417,926. Electric Circuit Controller. F. A. Lane, New Haven, Conn.
417,927. Automatic Electric Clock-winding Device. F. A. Lane, New Haven, Conn.
417,928. Electric Winding Clock. F. A. Lane, New Haven, Conn.
417,974. Electric Railway Contact. F. O. Blackwell, New York, N. Y.
417,992. Underground Electric Conduit. J. Dell, St. Louis, Mo.
418,069. Electrical Toy. H. G. Rogers, Washington, D. C.
418,070. Electrical Toy. H. G. Rogers and A. M. Coyle, Washington, D. C.
418,120. Magneto-electric Machine. W. Gillett, New York, N. Y.
418,125. Electric Synchronizing Device for Clock Pendulums. J. Hamblet, Brooklyn, N. Y.
418,140. Electrode for Secondary Batteries. H. G. Osburn, Chicago, Ill.

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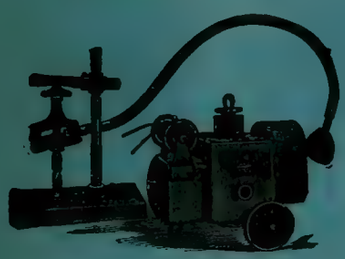
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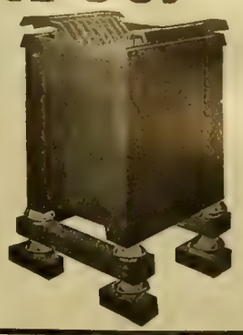

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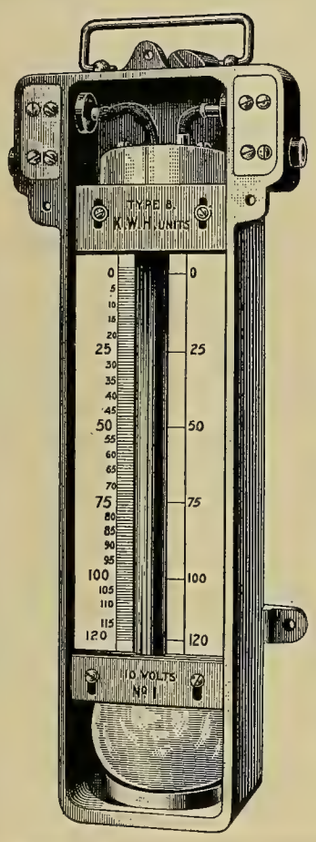

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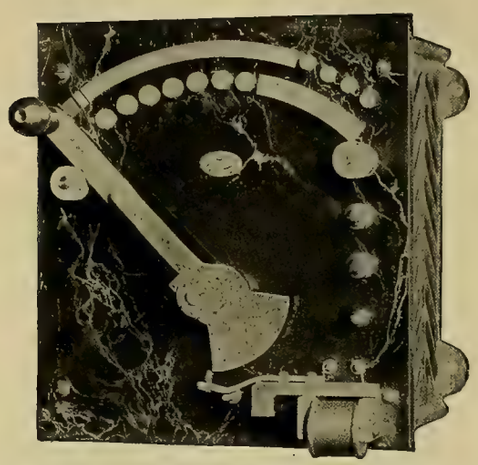

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Simplex Electrical Co.
Standard Underground Cable Co.
Wesco Supply Co.
Western Electric Company.

For Alphabetical Index of Advertisements See Page 3.

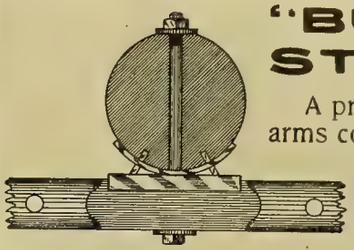
"Diamond H" Switches

Trade H Mark

This Trade-Mark guarantees quality.

The Hart Mfg. Co., Hartford, Conn.

New York Boston Chicago Toronto, Ont.



"BULL DOG" STEEL GAIN

A pressed steel support for cross arms consisting of two plates, one engaging the arm and the other the pole. It provides a means of mounting arms without cutting gains. It strengthens the arm and pole. It facilitates the placing and alignment of cross arms. It saves braces on four and six pin arms. It can be purchased at a cost slightly exceeding the cost of cutting a gain. It is made for telephone and standard arms and will fit any pole.

WRITE FOR PRICES AND DESCRIPTIVE CIRCULAR

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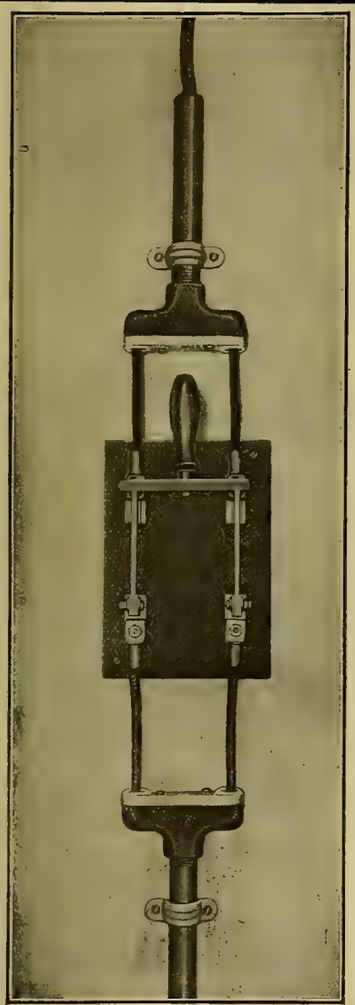
10 South Clinton St. Chicago, Ill.



THE **SENSIBLE** AND **CHEAP** way of getting your wires **OUT OF OR INTO CONDUIT** is to use

CONDULETS

CATALOGUE DESCRIBES SEVERAL HUNDRED KINDS

GET IT

CROUSE-HINDS CO.

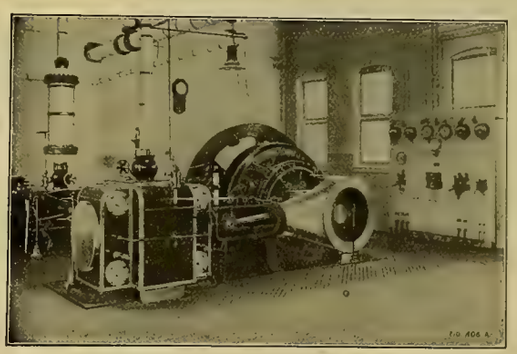
MANUFACTURERS

70 W. Jackson Blvd., CHICAGO.

GENERATORS

CAPABLE OF HEAVY

OVERLOADS



125 K. W. Crocker-Wheeler Generator

represents a clear profit for the central station. **C-W** machines are celebrated for their great overload capacity. Bulletin No. 53 T gives reasons.

CROCKER-WHEELER

COMPANY

AMPERE, NEW JERSEY

RELIABLE

"Unit Accumulator"

National Battery Company

ELECTRIC STORAGE BATTERIES

BUFFALO, N. Y.

Branch Offices: NEW YORK, CHICAGO

THE ELECTRO-CHEMICAL TRAY BATTERY

Important point— **no "choking" gas.**
Made up in "tray form," hence for a battery of a voltage of 110, one stack would only stand **about 30 inches high.** Many other **good novel points—investigate it.**

SMITH STORAGE BATTERY CO., - - Zoar, O.

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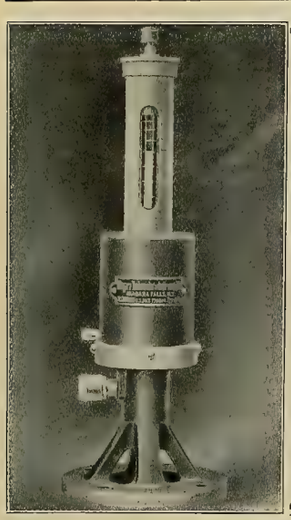
BARE AND INSULATED WIRES AND CABLES.
Chicago Insulated Wire & Mfg. Co.
CHICAGO, ILL.



NIAGARA TACHOMETERS

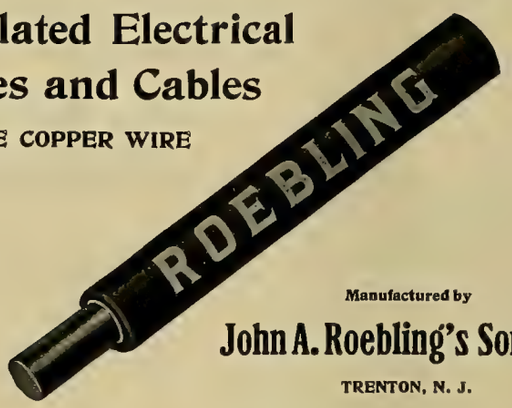
represent the acme of perfection in high-speed indicating devices: simplicity in construction, absolute accuracy, and require minimum attention.

The type "C" instrument shown is for direct connection to vertical shafts adapted to apparatus having high rotary speed where belt drive is not practical. We make instruments that will exactly meet your requirements. Write for catalogue

NIAGARA TACHOMETER AND INSTRUMENT CO.
NIAGARA FALLS, N. Y.

Insulated Electrical Wires and Cables

BARE COPPER WIRE



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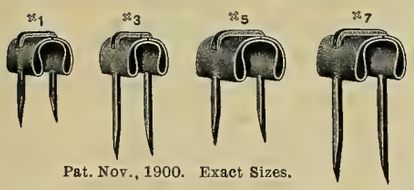
TRENTON, N. J.



Pat. Nov., 1900. Exact Sizes.

BLAKE INSULATED STAPLES
BLAKE COMPRESSED CLEATS

Exact size. Pat. App. for.

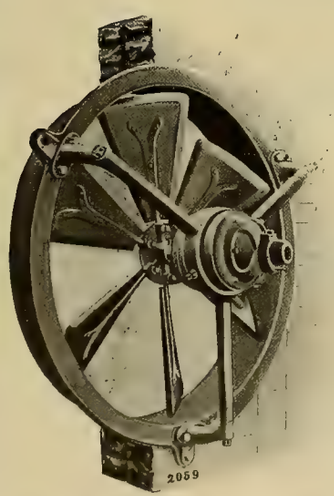
Manufactured and For Sale by

BLAKE SIGNAL & MANUFACTURING CO., 256 Summer St., Boston, Mass.

CHICAGO: American Electrical Supply Co. Western Electric Co.
ST. LOUIS: Wesco Supply Co. Western Electric Co.

Wagner Electric Mfg. Co.

ST. LOUIS, U. S. A.



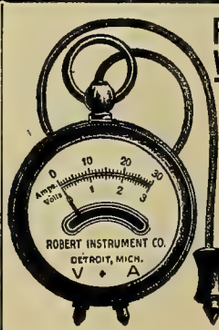
Our Variable Speed Single Phase Ventilating fans will push or pull the air out of your place. We fit them with an Auto Transformer Control and make them reversible. They are great, good sellers, and perfect in action. Your customers would buy if they knew of them. It's up to you, Mr. Station Man, to get them on your lines. Are your solicitors posted? Bulletin No. 75 H will tell you more.

DISTRICT OFFICES IN ALL THE PRINCIPAL CITIES

SPOT THE SPOT
SAMSON SPOT CORD
FOR
ARC LAMP AND TROLLEY CORD
SAMSON CORDAGE WORKS, BOSTON, MASS.

We are the real manufacturers of 75 per cent. of the Enameled Rings used in this country. Try us and see.

STAR EXPANSION BOLT CO.
147-149 CEDAR ST.,
N. Y. CITY



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Dead Beat
Accurate, Durable
Guaranteed

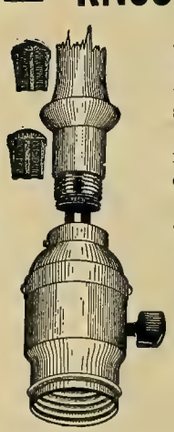
List Price, $6.00 including leather case.

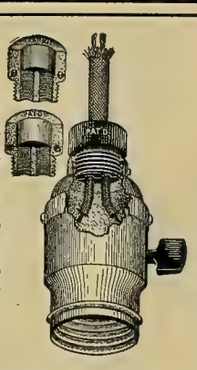
Send for Catalogue

3 Volts
30 Amperes

THE ROBERT INSTRUMENT CO.
26 Shelby Street
DETROIT, MICH.

The "KNOSTRAIN" BUSHINGS





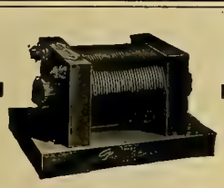
are made in two styles: One of them fits ⅜-inch socket caps, and the other is made for rosette or ⅜-inch socket handle.

Why tie knots in cords which increase the dangers of short circuits?

The "Knostrain" Bushings fit either No. 16 or No. 18 lamp or show window cords.

Samples and Prices on Request

FRANK H. STEWART ELECTRIC CO.
35 NORTH SEVENTH STREET
PHILADELPHIA, PA.



Edison Spark Coil

Reduced from $3.25 to $2.50

The hardest service for a spark coil is firing the compressed charge of air and gas in a gas or gasoline engine. A large volume of energy must appear in the arc when the contacts are separated, but without requiring a high voltage or large number of battery cells, since the latter make weight, occupy space and cost money.

Again the battery energy should not be used up in the coil's internal resistance, since only the electrical energy turned into heat in the spark fires the charge.

The coil should build up its magnetic field quickly, which calls for a low electrical resistance and a short path for the magnetic lines of force.

These and other facts point to a spark coil wound with thick heavy wire and shorter than the ordinary, "pudgy" in fact.

When we collected a number of gasoline engines and began to experiment we found that such a coil gave much the best results and with the least waste of batteries.

We therefore put it on the market, although, as it contained twice as much copper as other coils, we were compelled to ask a higher price. Still, we have sold larger and larger numbers each season as users of gas engines and others have learned that the Edison Coil is cheapest in the long run. It can be used anywhere that a fat, hot make-and-break spark is wanted.

Our large volume of business now enables us to cut the price from $3.25 to $2.50 and for the saving in batteries and trouble you can afford to throw away any ordinary long coil and get an Edison.

Remember that the Edison Cell is the cheapest form of battery energy and ask for BOOK "W. E." on Battery Sparks.

The Edison Mfg. Co.

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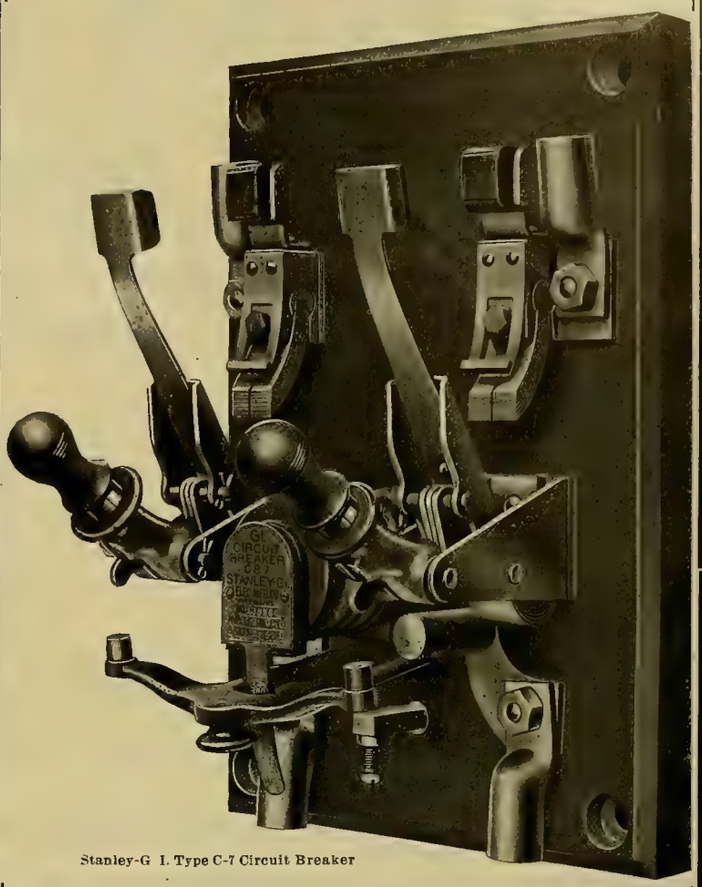
25 Clerkenwell Road, London

Stanley-G.I.

Circuit Breakers



Stanley-G I. Type C-7 Circuit Breaker

Every Motor

in Electrically Driven Shops

should be connected through a circuit breaker rather than through an ordinary switch with fuses.

Besides affording superior protection, circuit breakers are economical. The GREAT economy is in TIME saved —of men and equipment.

With a circuit breaker it is not necessary to send for and wait for the "electrician" every time a circuit opens. Then there is the saving in renewal of fuses, which ALONE soon offsets the increased first cost.

The brushes of C-7 Breakers, of 3 to 300 ampere capacity, are of the laminated form, and are opened by flat springs which carry the carbon contacts.

The latch for holding the breaker closed is so constructed that the breaker cannot be jarred open.

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MINNEAPOLIS, Guaranty Bldg.
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OMAHA, New York Life Building
INDIANAPOLIS, State Life Building

Stanley-G.I. Electric M'F'G. Company Pittsfield MASS.

KNOWLEDGE IS POWER

Let Us Help You To Learn More

An Excellent Opportunity to Obtain PRACTICAL Information on

ELECTRIC LIGHT PLANTS

THE pithy old adage, "Knowledge is Power," is so true as to be self-evident. We must know things to do things. For practical men, practical information is wanted. To supply this need, constantly arising as new men enter the electrical field, the Western Electrician, beginning with this issue, the first of the new volume, will enter upon the publication of a valuable and notable series of articles (constituting, when finished, a complete treatise on the subject) on

The Small Central Station

Practical Hints on Its Construction and Operation

The scope of this eminently practical work, written by experienced authorities on the subject, is well indicated by the list of chapter headings:

I. General Observations.
II. Building and Foundations.
III. Fuel and Waterpower.
IV. Boilers and Setting.
V. Operation of Boilers.
VI. Engines.
VII. Steam Turbines.
VIII. Belting and Shafting.
IX. Electrical Equipment—Generators—Switchboard.
X. Arc and Incandescent Lamps.
XI. Instruments.
XII. Transformers.
XIII. Line Construction.
XIV. Distribution.
XV. Cost of Plants.
XVI. General Data.

The articles supply data relating to small and medium-sized stations using overhead construction, and are especially adapted for intending purchasers of electric-light plants and practical men. Within this field the ground is thoroughly covered in view of the requirements of the best modern practice. Operations and construction are dealt with at length, and the information given has been compiled from the experiences reported by central station managers operating in all parts of the United States, handling various types and sizes of machinery. The series will be enriched with **numerous illustrations, diagrams and tables.**

These articles will be of much value to all readers of the Western Electrician, new and old, interested in the practical operation of electric-light plants.

REMEMBER that this noteworthy series on **Electric Light Plants** begins in this week's issue of the Western Electrician, and will run for from four to six months.

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Western Electrician

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for Morning Service

Electric Coffee Percolator. Capacity 6 cups. Made of heavy copper highly polished and nickel plated.

This electric heating device used in the morning will influence the introduction of others that will extend the service through the day.

Save Time

Coffee can be prepared in a few minutes.

Connection can be made to an ordinary lamp socket.

Easy to use and wash.

Increase your day load by advocating Electric Heating Devices.

No Annoyance

No alcohol to spoil polished table tops.

No difficulty in controlling heat.

No flame.

Order early and secure prompt shipments.

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Direct Current

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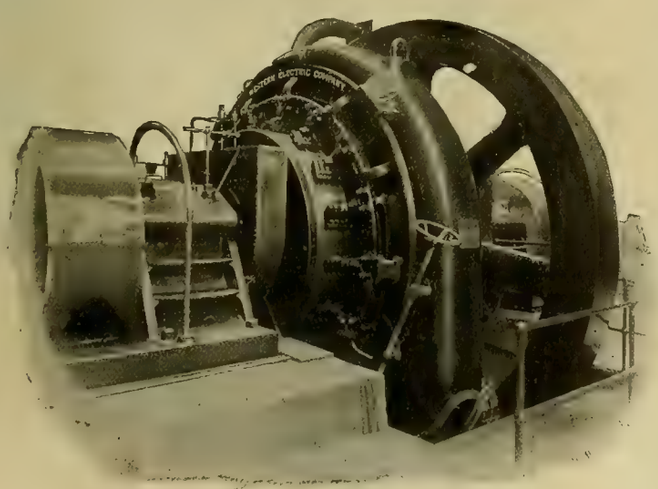
For Sparkless Operation, High Efficiency and Low Temperature Rise, Type L generators are unexcelled. This we can prove by referring you to our customers. Installation in all parts of the country.



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For Stringing Cables

Do the work in the simple natural way. They are of the best quality of material and effectiveness of action.

The frame is so large that the cable does not scrape it. The wheel is malleable iron, nine inches in diameter so as to roll easy, with a deep two-inch groove. Wood rollers if you prefer at the same price.

We should like to tell you more about SECURITY TROLLEYS. Write us.

TOLEDO, OHIO · THE F. BISSELL COMPANY

THE F. BISSELL COMPANY · TOLEDO, O.

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IN YOUR SOCKETS

And secure the maximum of Good Lighting Service.

Miniature Lamps. Street Series Lamps.
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(508)

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MICABOND will save you money in your repair work as well as in your new machines. It is good insulation—made out of the best materials and is sold at reasonable prices.
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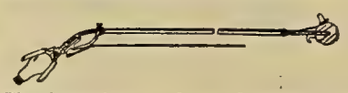

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Measure low and high voltages, besides amperes and ordinary resistances. They are inexpensive and reliable. Send for catalog of portable and switchboard voltmeters and ammeters.
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INDICATING-WATTMETERS OF PRECISION

Scales 10 inches long with 300 well spaced equal divisions.

Accurate on both Direct and Alternating Currents and on varying Power Factors and Frequency.

Prices reasonable. Write us.

Whitney Electrical Instrument Co.
MACHADO & ROLLER, Gen'l Sales Agents.
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YOU NEED IT!

Gale's Commutator Compound.
The Only Article That Will Prevent Sparking.
Will keep the Commutator in good condition and prevent cutting. Absolutely will not gum the brushes.
50c. per stick. $5.00 per dozen. Send 50c. for trial stick.
FOR SALE BY ALL SUPPLY HOUSES OR
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SPEER HIGH-GRADE CARBON BRUSHES
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BELDEN MAGNET WIRE

Our stock of copper and German silver magnet wire is the most complete in the west.

Try us on a rush order

Belden Mfg. Co.
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DOES THE WORK

Convenient—Non-Corrosive—Effective

We also make the famous Crolius Commutator Compound; eliminates sparking and all commutator troubles.

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DAVIS ELECTRIC MANUFACTURING COMPANY
MANUFACTURERS OF
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Tablet Boards, Incandescent and Arc Switch Boards
SEND FOR OUR ATTRACTIVE PRICE LIST
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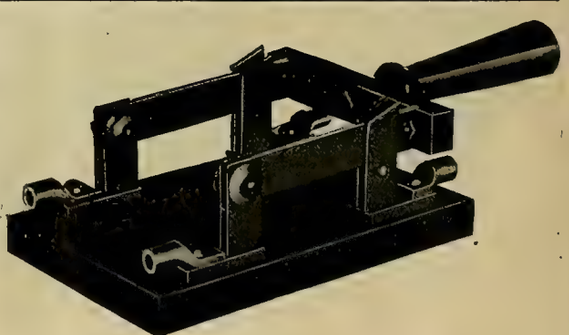

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of the
NEW TYPE B ANCHOR AND WRENCH.

The upper part shows the new malleable eye.
The middle shows the square wrench and sliding handles locked to the anchor by the eye.
The lower part shows the square malleable key and the square shank of the anchor.

THE RODS OF
Stombaugh Guy Anchors

Are not weakened by welds or holes for pins and rivets.

They are made of one piece.

The threading of the eyes on the Type B Anchors equals the strength of the rod.

STOMBAUGH GUY ANCHORS SCREW INTO THE GROUND

When in at the proper depth they are set. The strain can then be put on without fear of any back give. You are sure.

An anchor is as strong as its weakest part.
Stombaugh Guy Anchors have no weak parts.

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Eastern Office: 203 Taylor Bldg., Cortlandt St., New York

NATIONAL CODE STANDARD

WEATHER-PROOF TRADE MARK "O.K." LINE AND HOUSE WIRES

"O. K." Weatherproof Wire.
Slow-Burning Weatherproof and Ideal Wire.

Prices and Samples on Application.

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Office and Factory: PAWTUCKET, R. I.

SNAPPER Sounder, with which good Morse can be "sent." We make telegraph apparatus of every description.

Catalogue No. 21 is a 700 page encyclopaedia of "Something Electrical for Everybody"

Manhattan Electrical Supply Co.
32 Cortlandt Street, NEW YORK — 188 Fifth Avenue, CHICAGO

Sold by electrical supply houses

THE "BABY" TORCH

Burns Without Air Pressure

THE "Baby" Gasoline Torch is the smallest torch made which gives perfect results, and fills the long-felt want for a torch which fits the hand and can be used in contracted places and corners. It can be turned in any position, as it burns equally well in all positions. It is perfectly automatic; has no cocks or valves to get out of order; lights with a match; self-feeding; requires no pumping of air and is always ready for use. It is indispensable to the Telephone and Telegraph linemen and ELECTRICIANS. It burns about two hours from one filling.

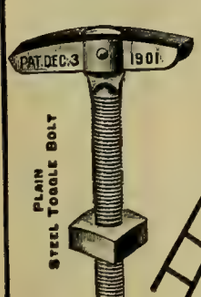
ZEIDLER LAMP & BRASS CO., LOMIRA, WISCONSIN

In 1905

The Western Electrician published 1042 LARGE pages of reading matter and 1575 illustrations. This is 3126 columns or about 3,000,000 words. Equivalent in amount to 23 average $2 technical Books. On the book basis $46 worth given for $3. If you are not a subscriber, send in your order now.

Western Electrician
507 Marquette Building, Chicago

SAVED BY A WRIGLEY TOGGLE BOLT



Write for particulars, sample and prices of this bolt.
The Thos. Wrigley Co.
300-6 Dearborn St., CHICAGO.

TRADE SE MARK

CIRCUIT BREAKERS

ALL STANDARD TYPES AND BUILT TO SPECIAL DESIGNS

The Switchboard Equipment Company
BETHLEHEM, PA.

CLEVELAND: Crosby, Craft & Co. CHICAGO: Francis Raymond

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POSITION WANTED.

Competent engineer and electrician desires po ition as operator of central station in country. Single. Address O. M. AARVIG, care Guarantee Elect. Co., Chicago, Ill.

POSITION WANTED

By two young men with three years' experience in installations of electric light and telephone plants. Do not use tobacco or liquors. A1 references. G. A. Frogner, E. M. Williams, Iola, Wis.

POSITION WANTED

As assistant electrician in electric light or power plant by single young man twenty years of age, strictly temperate and steady worker. Have had two and one half years' experience in electric lighting, motor and switchboard work. A. C. and D. C. Technical graduate. Location preferred Colorado or Wyoming. Salary desired, $18.00. References furnished. Address Box 616, care Western Electrician, 507 Marquette Bldg., Chicago.

WANTED

Capable young men for work in drafting room. Apply NATIONAL BRAKE & ELECTRIC CO., Milwaukee, Wis.

WANTED

Electrical machinists and inside wiremen. Permanent employment, good wages. Apply 117 Widdicomb Bldg., Grand Rapids, Mich.

WANTED

A first class salesman to represent established manufacturing house in Chicago, well acquainted with contracting and jobbing trade. State age, married or single, experience, former and present employer and salary expected. Reply Box 614, care Western Electrician, 507 Marquette Bldg., Chicago.

WANTED

A first class salesman to represent established manufacturing company. Rapid advancement to the right man. State age, experience, former and present employer and salary expected; married or single. Address Box 615, care Western Electrician, 507 Marquette Bldg., Chicago.

WANTED

200 or 300 light dynamo. Must be in first class condition. Bonnet-Nance Stove Co., 172 Washington St., Chicago Heights, Ill.

FOR SALE

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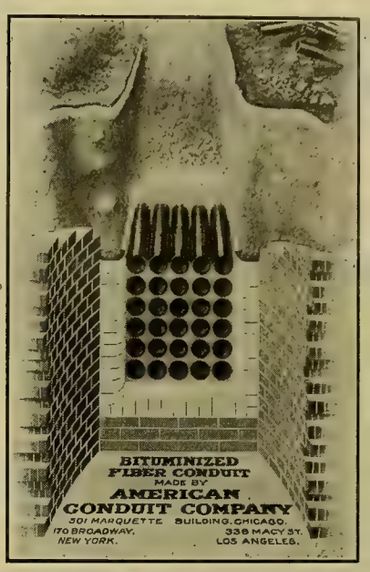

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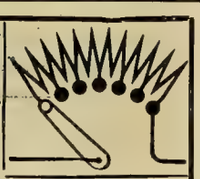

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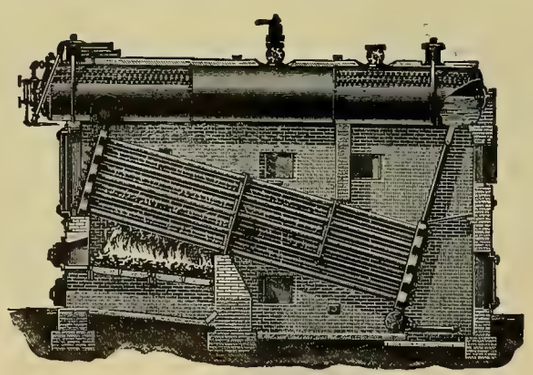

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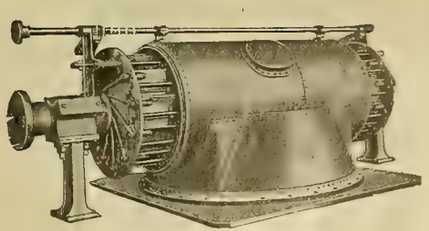

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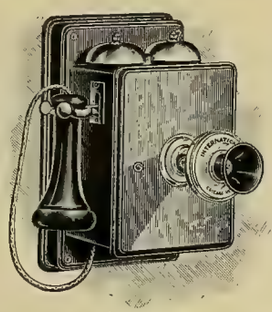

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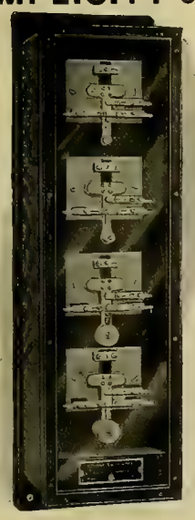

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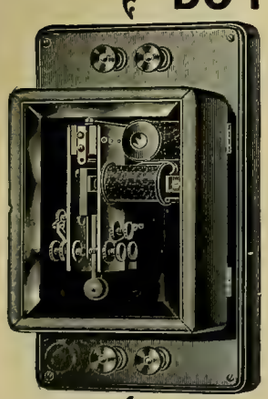

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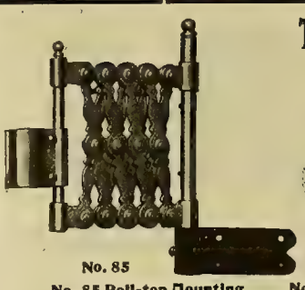

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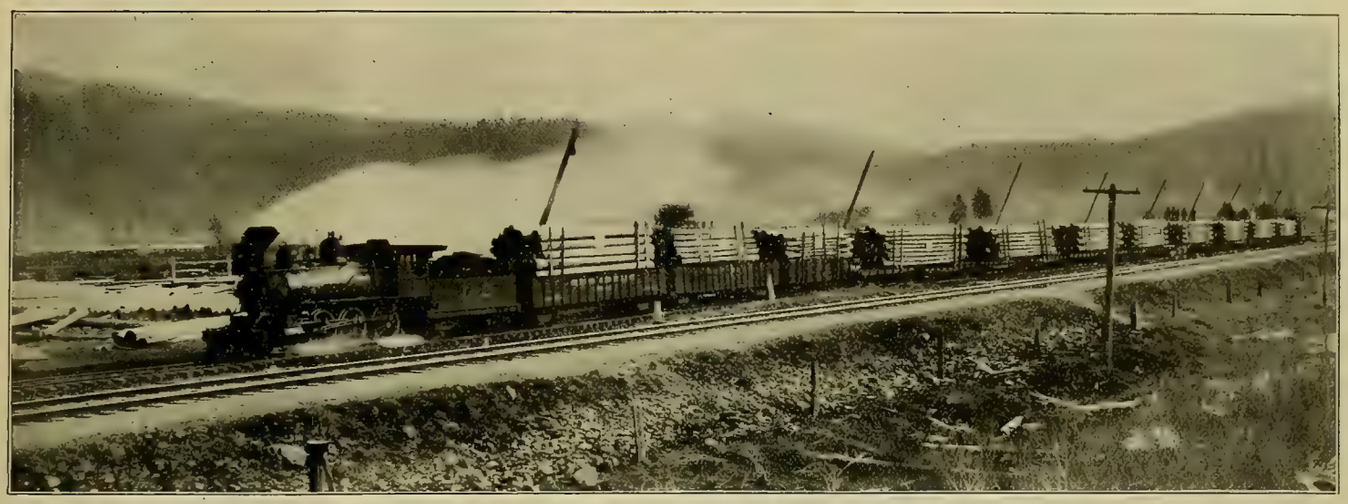

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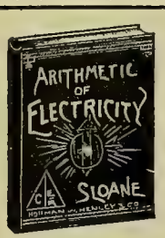

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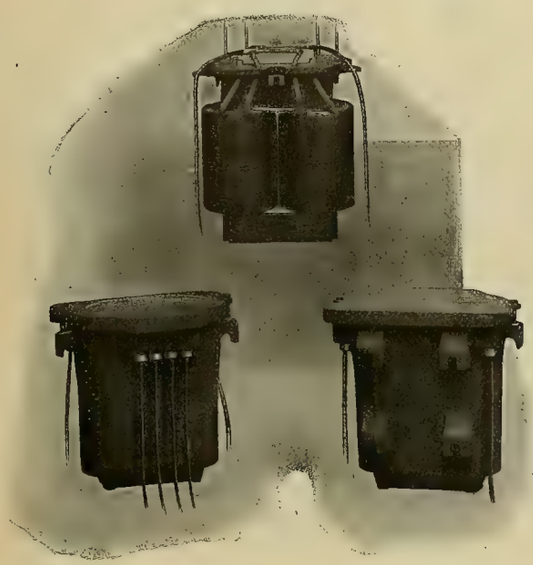

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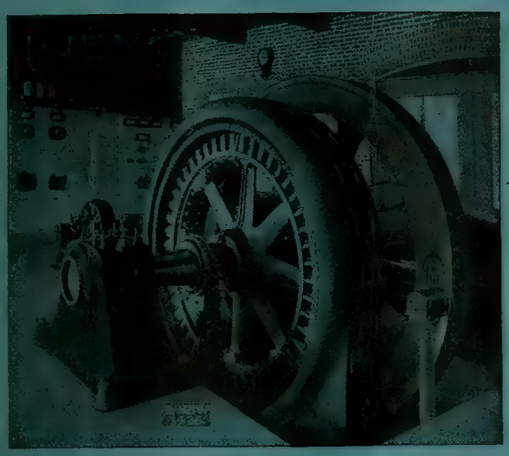

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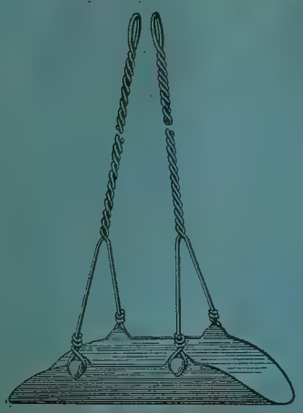

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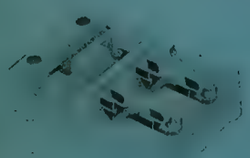

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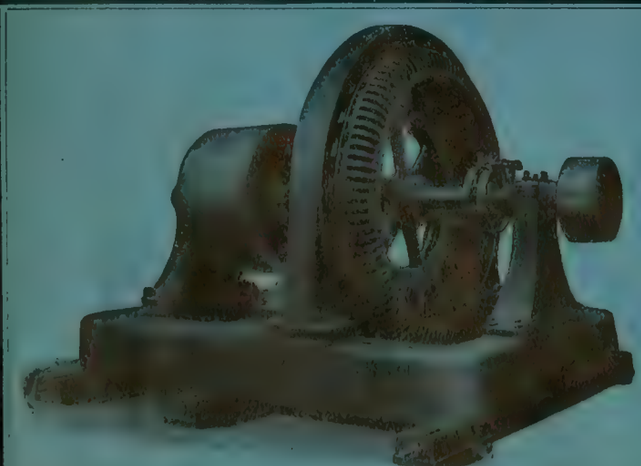

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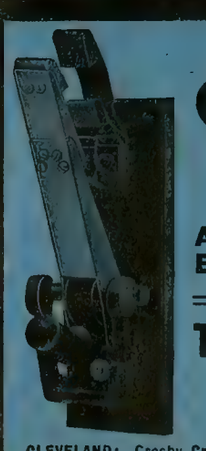
BERLIN—European Weston Electrical Instrument Co., Ritterstrasse No. 88.
New York Office—74 Cortlandt St.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ALL STANDARD TYPES AND BUILT TO SPECIAL DESIGNS
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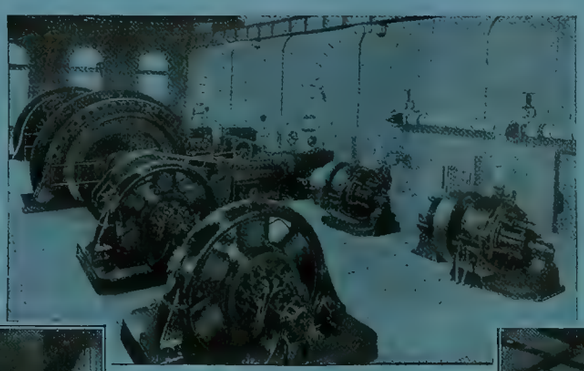

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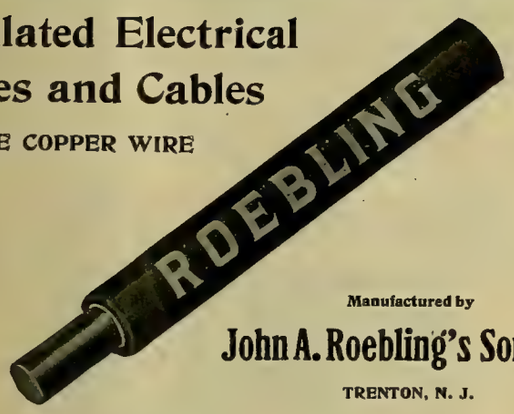

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Universal Exposition

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ALL SIZES

GENERATORS

CAPABLE OF HEAVY

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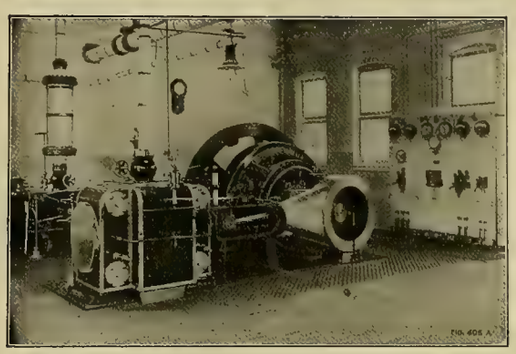

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represents a clear profit for the central station. **C-W** machines are celebrated for their great overload capacity. Bulletin No. 53 T gives reasons.

CROCKER-WHEELER
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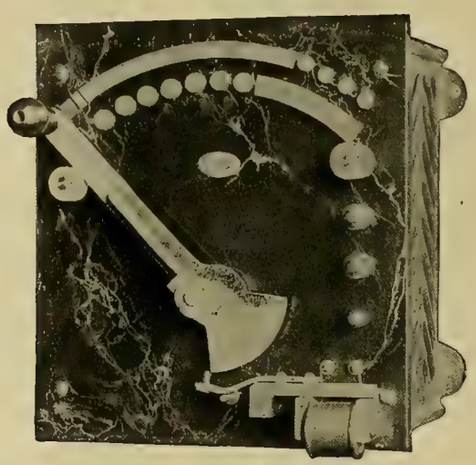

This type of controller is for use with shunt or compound motors, where it is desired to obtain speeds above normal by the insertion of resistance in the shunt field circuit, and also provides for decreasing the motor speed below normal by several steps of armature resistance This method of speed control is particularly well adapted for controlling motor driven fans, as it provides a wide-range of speed control with motors of standard design.
Bulletin No. 44 gives full description and prices.

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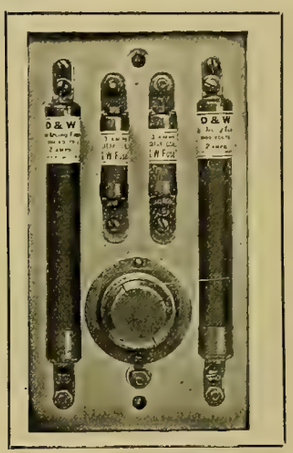
A sure protection against lightning and crosses with high tension lines. Insures safety against destruction and burn-out. Arrester enclosed in metal case and fuse, sneak coil and arrester mounted on one porcelain. Write for descriptive circular.



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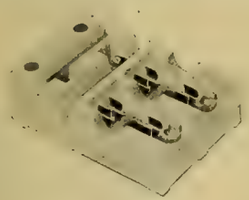
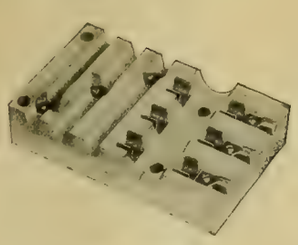


0-30 Amp., 250 V.

31-60 Amp., 250 V.



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RESISTANCE WIRE

Has the highest specific resistance of any wire on the market.

Does not become brittle by repeated heating and cooling.

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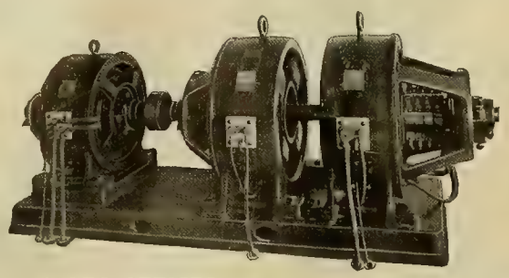

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Five years of severe test under service conditions has established the Gould Counter E. M. F. Regulating Booster as the most eminently successful Storage Battery Regulator on the market.

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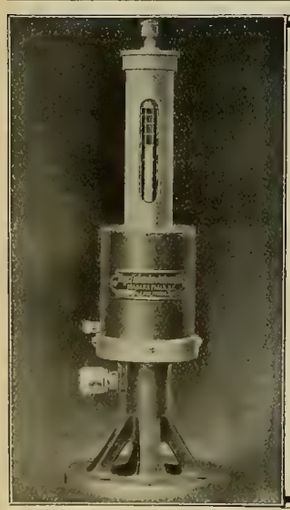

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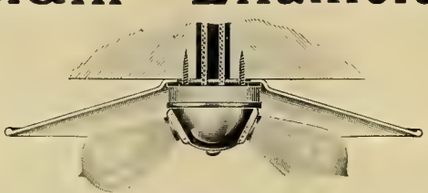

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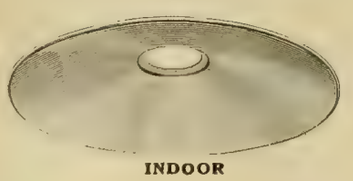

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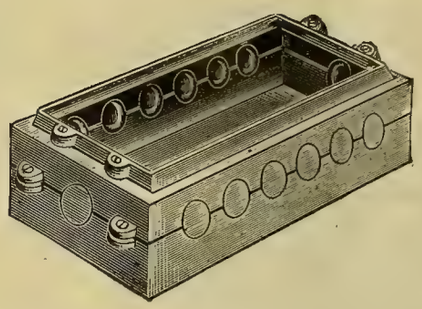

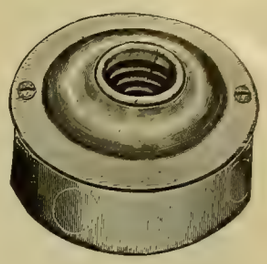

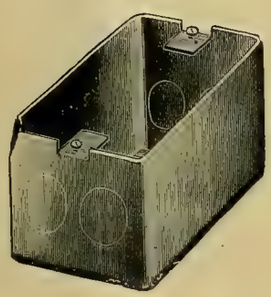

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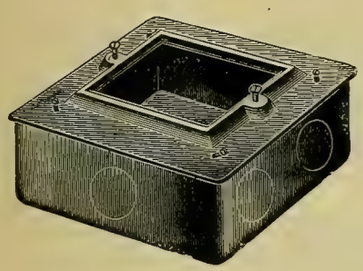

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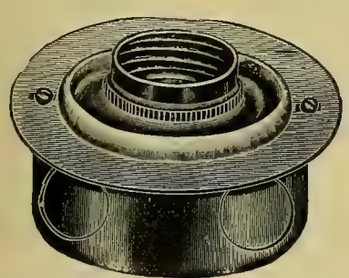

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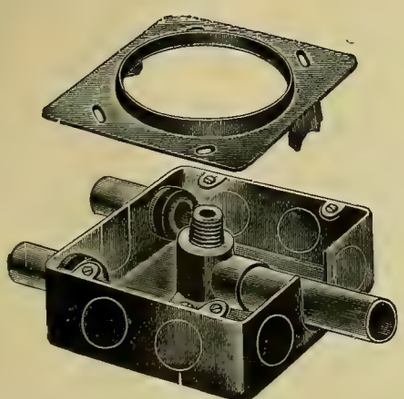

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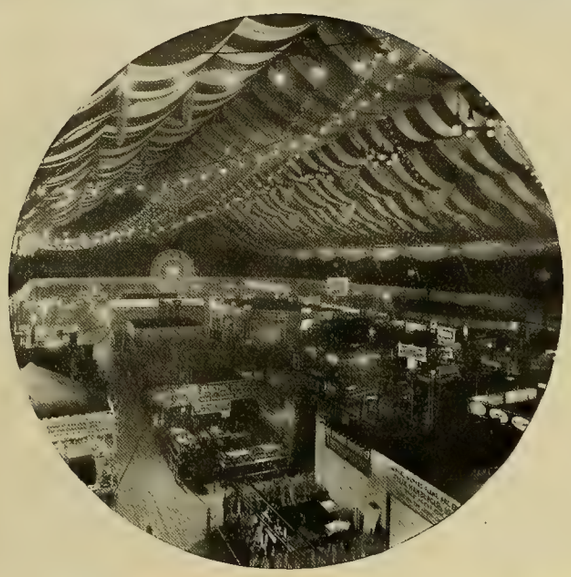

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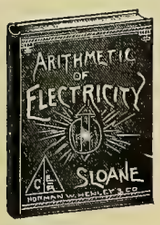

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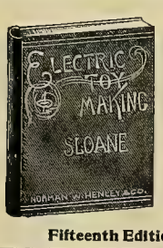

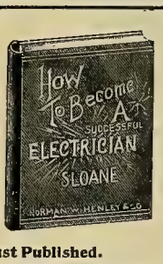

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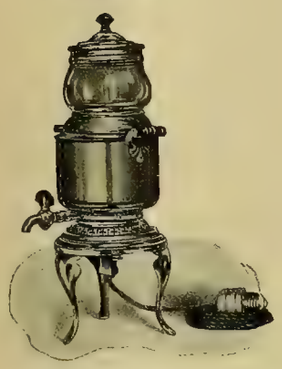

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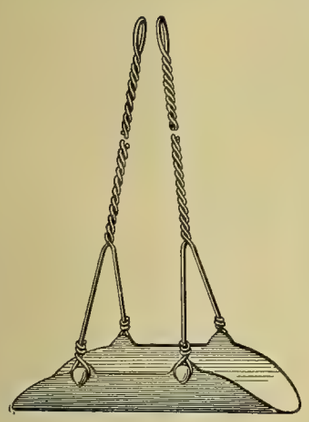

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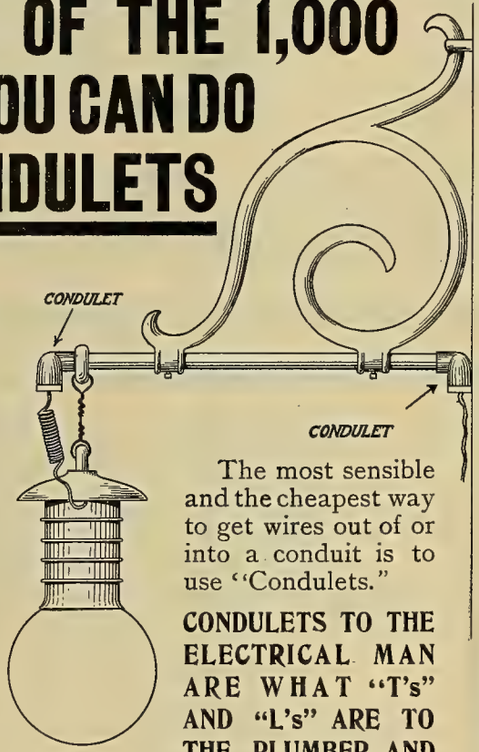

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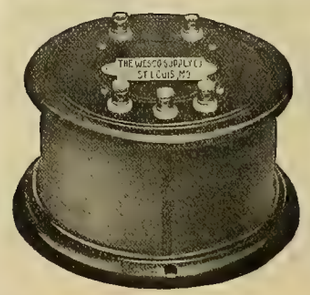

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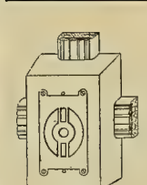

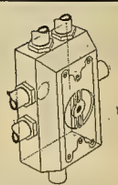

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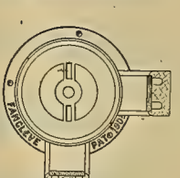

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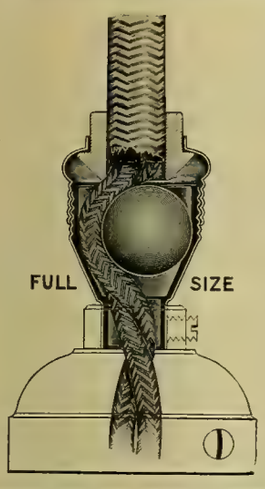

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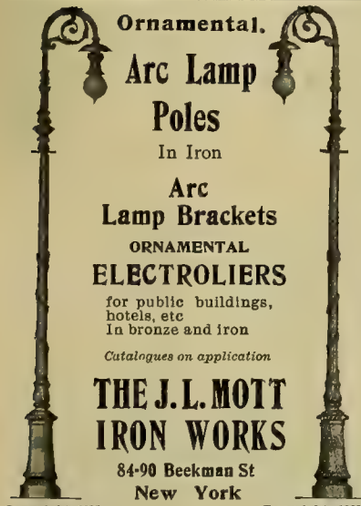

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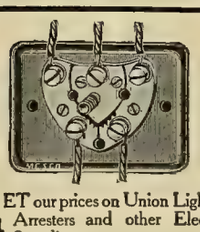

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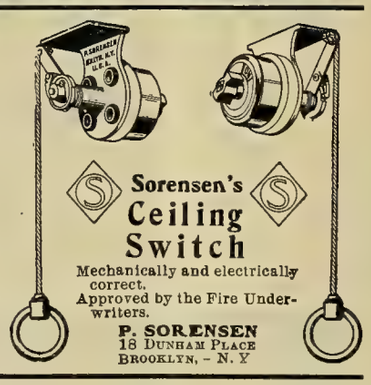

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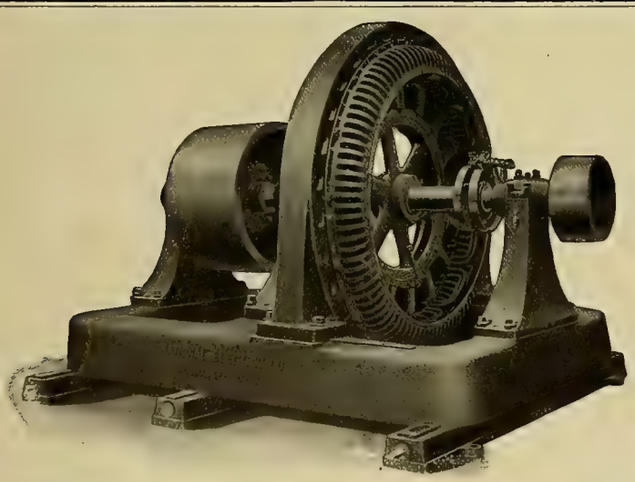

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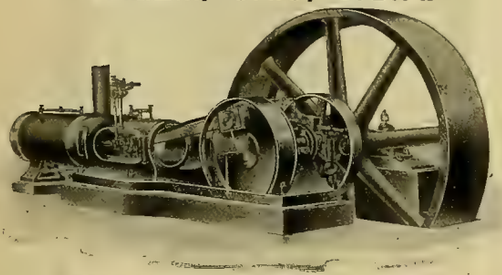

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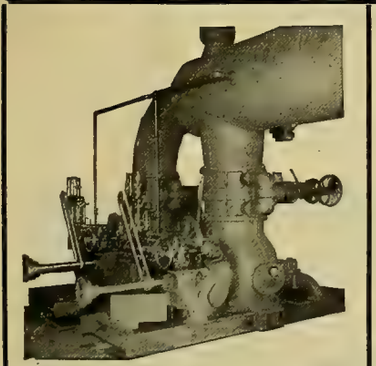

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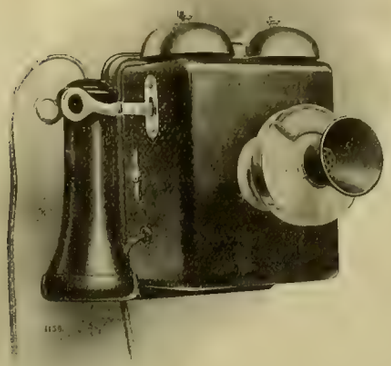

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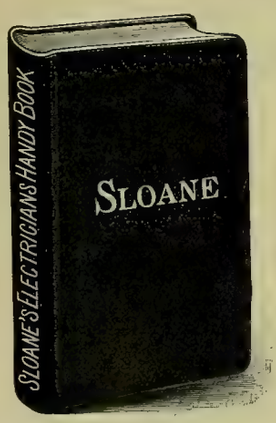

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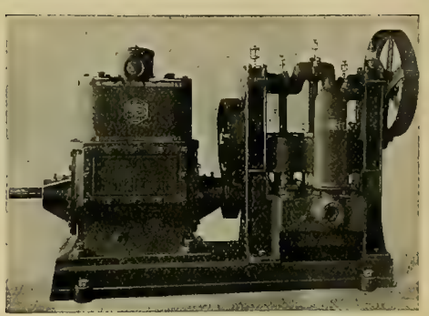

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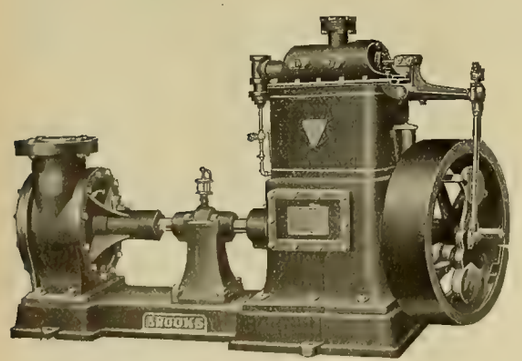

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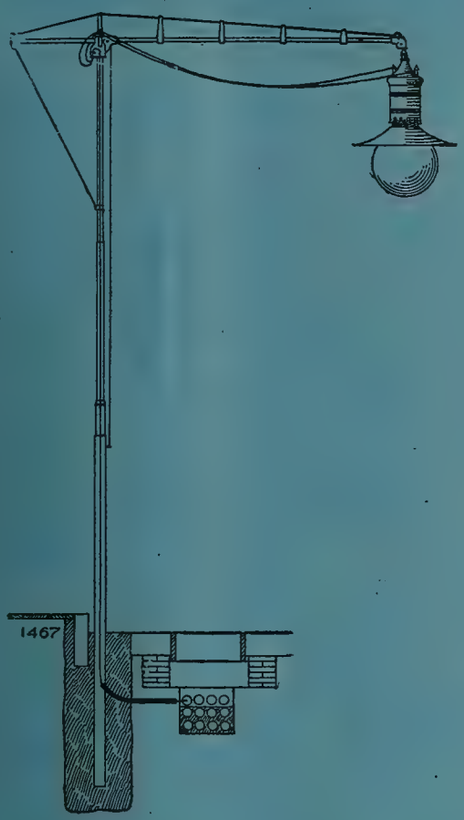

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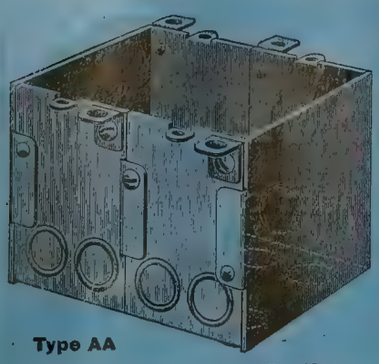

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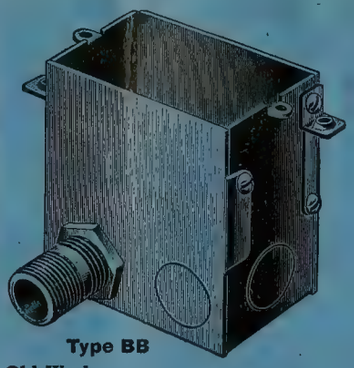

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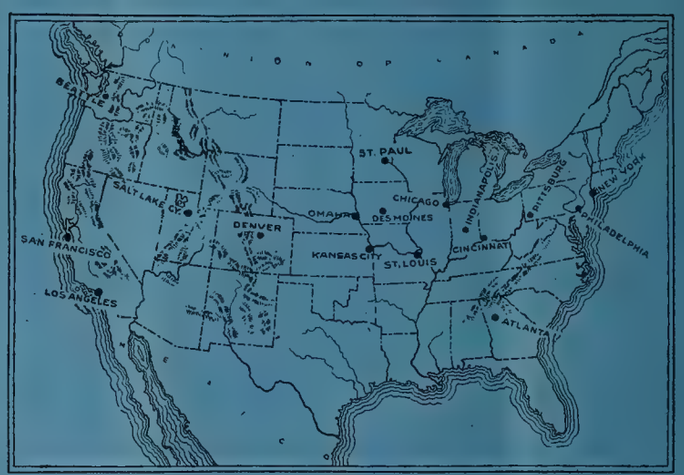

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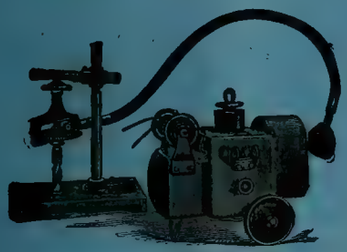

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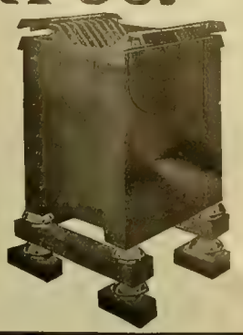

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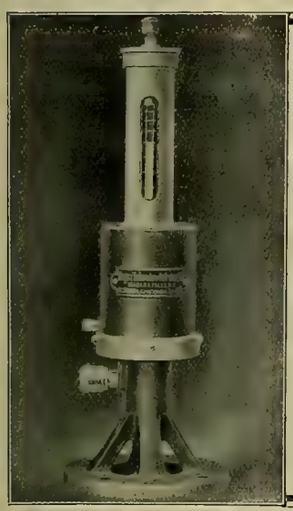

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OUR STOCK OF BRIGHT, NEW, IMPROVED MODELS

1906 FAN MOTORS

FOR DIRECT AND ALTERNATING CURRENT

AWAITS YOUR INSPECTION AND APPROVAL

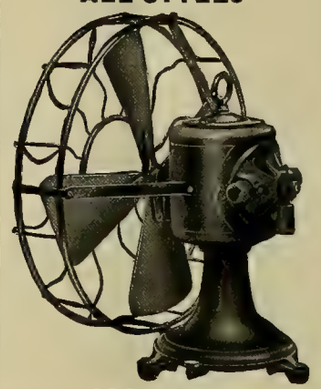
Call and See Them or Write for Prices

CHICAGO EDISON COMPANY

TELEPHONE MAIN 1280

139 ADAMS STREET, CHICAGO

ALL STYLES



ALL SIZES

A. C. CENTRAL STATIONS

INCREASE THEIR CAPACITY WITH

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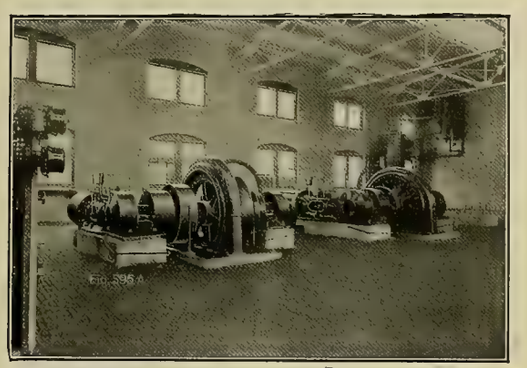

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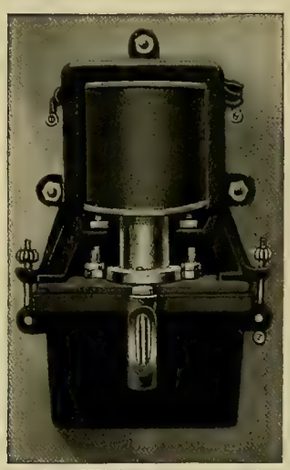
Self Starters for Small Alternating Current Motors



These self starters may be used with single, two or three phase motors of small capacity, designed to be thrown directly across the line. The device comprises a double pole, oil-immersed, solenoid operated switch controlled by either a pressure regulator or float switch, depending on the system used. With a compression tank system the pressure regulator is used, the motor being stopped and started automatically between the two limits for which the regulator is adjusted. With an open tank system the same duty is performed by a float switch.

Bulletin No. 33 gives a complete description of these self starters, which are also made for squirrel cage and slip-ring type motors.

The Cutler-Hammer Mfg. Co.

Milwaukee

New York Boston Chicago Pittsburg

NEVER FAIL TO MAKE A GOOD IMPRESSION — ONE THAT LASTS

COLUMBIA CARBONS COLUMBIA CARBONS

NATIONAL CARBON COMPANY, CLEVELAND, OHIO.

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INSULATING, CABLING, RUBBER AND HYDRAULIC MACHINERY.

OFFICE:
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Protect Your System Against Electrical Storms by Using

D&W TELEPHONE PROTECTORS

A sure protection against lightning and crosses with high tension lines. Insures safety against destruction and burn-out. Arrester enclosed in metal case and fuse, sneak coil and arrester mounted on one porcelain. ☐ Write for descriptive circular.

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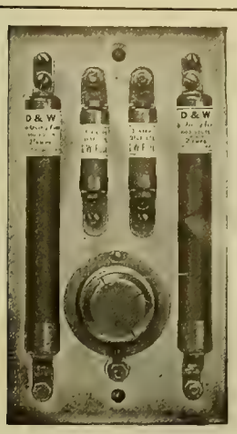

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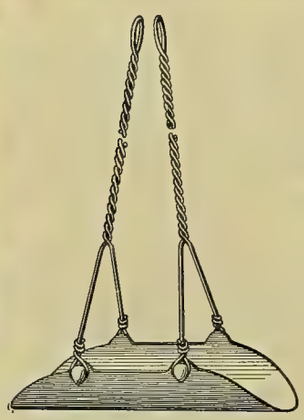

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It always pulls square in the earth and never pulls out.
We make Anchors 5¾x10 in. to 10x30 in.
One man can install the anchors in 20 to 30 minutes.
Write us for prices.

The Holden Anchor Co.

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ANOTHER OF THE 1,000 THINGS YOU CAN DO WITH

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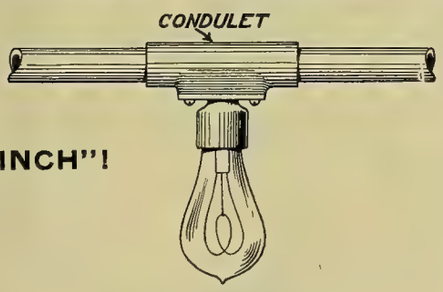
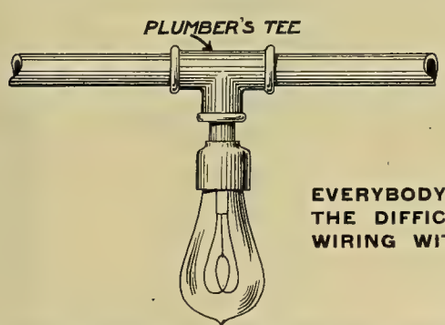


A "CINCH"!



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THE MOST SENSIBLE AND CHEAPEST WAY TO GET WIRES OUT OF OR INTO A CONDUIT IS TO USE CONDULETS.

Condulets to the electrical man are what "T's" and "L's" are to the plumbers and steamfitters.

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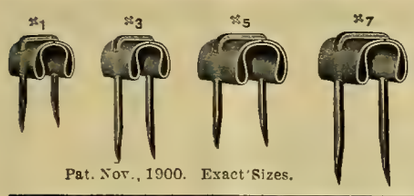

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BLAKE COMPRESSED CLEATS

Exact size. Pat. App. for.

Manufactured and For Sale by

BLAKE SIGNAL & MANUFACTURING CO., 256 Summer St., Boston, Mass.

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THE LIFE OF A BATTERY

Telephone Manufacturers and Telephone Companies, Manufacturers of Gas and Gasoline Engines, *know* that in a

Rock Island New Patent Dry Cell Battery

The carbon used is placed in a chemically prepared cloth and not wrapped in blotting paper, found in *other* cells. *Set* in a wall of chemical instead of the bare can, the method used by others, this treatment so

HOLDS THE MOISTURE CAPTIVE

that neither heat nor cold can possibly affect it. That is the reason a *hand-constructed* Rock Island lasts *nearly one-third* longer than a *machine-made* battery. The *heart* of the Rock Island is sound. There is *less* internal resistance, *more* constant tension and *better* recuperative power than are possessed by any *other* battery made. Our Standard No. 8, cheaper in the long run, does highest class work and is larger than Standard No. 6, the regular size for general purposes. Department A will send prices. Order a barrel. You'll find immediate dividends in improved service.

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A little booklet on the care and the locating and remedying of troubles in dynamos and motors.
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Made in various sizes up to 7½ horse power. Very compact and efficient.
Free radiation and consequent low internal temperature is insured by the entire periphery of the laminations or field punchings being directly exposed to the air.
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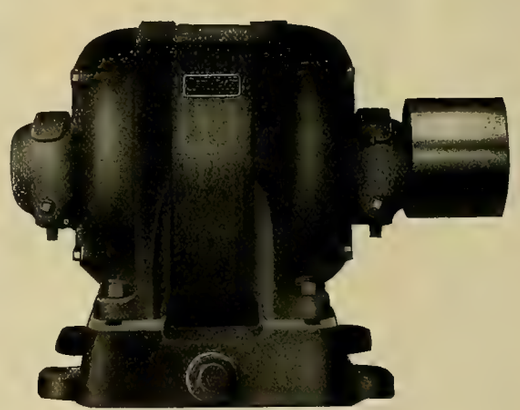

Atlanta: Empire Building
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Chicago: Monadnock Block
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Easy to use and wash.

Increase your day load by advocating Electric Heating Devices.

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So thoroughly that should **VOLTMETER OR AMMETER** be mentioned in your presence, its impression will be the first to flash accross your "mind's eye" as representative of the **"BEST."**

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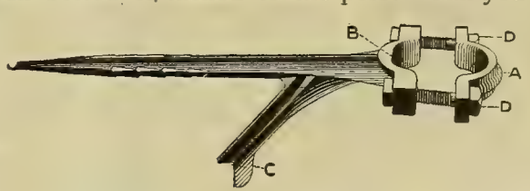

Write for bulletin 189.

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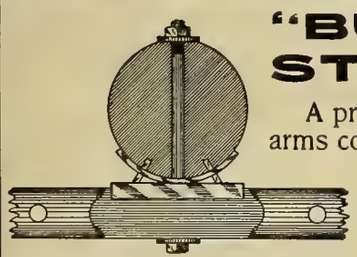

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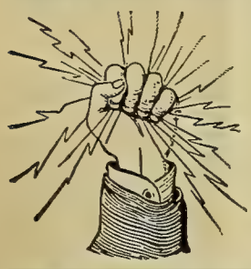

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The upper part shows the new malleable eye.
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Are not weakened by welds or holes for pins and rivets.

They are made of one piece.
The threading of the eyes on the Type B Anchors equals the strength of the rod.

STOMBAUGH GUY ANCHORS SCREW INTO THE GROUND

When in at the proper depth they are set. The strain can then be put on without fear of any back give. You are sure.

An anchor is as strong as its weakest part.
Stombaugh Guy Anchors have no weak parts.

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"O. K." Weatherproof Wire.
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Prices and Samples on Application.

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10-inch scale, 300 equal divisions, accurate on both alternating and direct currents and on varying power factors and frequency.

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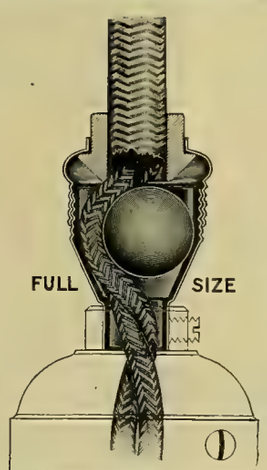

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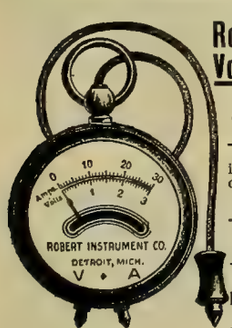

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List Price, $6.00 including leather case.

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3 Volts
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THE PLUME & ATWOOD MFG. CO.
New York Chicago

WANTED, FOR SALE *and similar* **WANT COLUMN** *advertisements (50 words or less), $1.50 an insertion; additional words 3c each.* **POSITION WANTED** *advertisements (50 words or less), $1.00 an insertion; additional words 2c each.*

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FOR SALE

One second hand electrical outfit, complete, with one Atlas boiler, 60 inches x 16 feet; 52 4-inch tubes, with 36-inch smokestack, 50 feet long. 1 Jno. Noye Automatic Engine, 14x16, 126 horsepower. 1 General Electric Alternator, 125 cycle, 120 K. W., single phase, 1,100 volts, with exciter and switchboard instruments. Price $1,800.

HUNTSVILLE LIGHT & POWER CO.,
Huntsville, Mo.

FOR SALE — Bargains

125 VOLT DYNAMOS

	Lights.	
1	16	Crocker-Wheeler.
1	50	Roth, M. P.
2	60	Hobart, M. P.
1	80	Crocker-Wheeler.
1	86	Hobart, M. P., new.
2	100	Hobart, M. P., comp.
3	110	New England, M. P.
1	110	Akron, M. P.
2	300	Westinghouse, M. P.
2	340	Western Elec., M. P.
1	400	Westinghouse, M. P., 22½ K. W.
1	450	Sprague-Lundell, M. P.
1	450	Gen. elec., M. P., comp.
1	450	Western Elec., M. P., comp.
1	510	C. & C., M. P., 30 K. W.
1	540	Westinghouse, M. P., 30 K. W.
2	700	Commercial, M. P., comp.
2	800	Gen. Elec., M. P., comp.
1	900	Wagner M. P., comp.
1	1100	Triumph, M. P., comp.
1	1300	Card, M. P., comp., 72 K. W.
2	1300	W. Elec., M. P., 75 K. W.
2	1350	Gen. Elec. M. P., 75 K. W., 6 pole, direct connected to Ames tandem comp., 11x17x12 automatic engine.
1	1450	General Electric, M. P., comp., form H, 85 K. W.
1	1800	Western Electric, M. P., comp., 6 pole, 100 K. W.
1	2500	Western Electric, M. P., 150 K. W., comp., direct connected to Ball and Wood, tandem comp: engine.

We are now located in our **new shops**, the largest repair shops in this country. Send for our **Monthly Bargain Sheet**, showing complete stock with net prices

GREGORY ELECTRIC CO.
Cor. 16th and Lincoln Streets, :: Chicago

SANITARY DISTRICT OF CHICAGO

NOTICE TO POWER USERS

Sealed proposals indorsed "Proposals for Leasing Electrical Power" will be received by the clerk of the Sanitary District of Chicago at room 1500 American Trust building, Chicago, Ill., until 12 m. (standard time) of September 26, 1906, and will be publicly opened by said board of trustees at a meeting of the board held that day.

The proposals are desired for the leasing of electrical power to be delivered by the Sanitary District at its substation at or near Robey street and the main channel, or at curb line of consumers' premises.

The leasing of power will be made subject to the present and future requirements of the municipalities within the Sanitary District and the approximate quantity of power to be leased and the period of years for which contracts will be made is as follows:

5,000 horse power for five years.
1,000 horse power for four years.
2,000 horse power for three years.
2,000 horse power for two years.

Proposals may be made for any or all of the power for the periods specified, and may cover its use for a 10 or 12 hour period, or a 24-hour period. The price must be made on each horsepower of 746 watts delivered to the lessee at the substation switchboard. If the proposal covers only a 10 or 12 hour service, the hours, day or night, must be specified.

In the event of the municipalities not requiring the power set aside for them at the expiration of the 2, 3 and 4 year periods, the lessee of the power may have the privilege of extending his contract for one year, price and conditions to remain the same.

The electrical power will be delivered in three phase alternating current of sixty cycles at 12,000 volts or will be stepped down at consumers' premises and is suitable for general lighting and power purposes.

Proposals must be made on blanks furnished by the clerk of the Sanitary District.

No proposal will be considered unless the party making it shall furnish evidence satisfactory to the board of trustees of their ability, financially and otherwise, to carry out the terms of the contract should the same be awarded to them.

Bidders are required to state in their proposals their individual names and residences.

The board of trustees reserves the right to reject any and all proposals.

THE SANITARY DISTRICT OF CHICAGO.
By ROBERT R. McCORMICK,
President of Its Board of Trustees.

Attest: I. J. BRYAN, Clerk.
Chicago, July 11, 1906.

ROSSITER, MacGOVERN & CO.

(Incorporated)

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Direct-Connected A. C. Units.

1,500-KW. Westinghouse, 25-cycle, 3-phase, 15,000 volts, 80 RPM, direct-connected to Hamilton-Corliss horizontal cross-compound engine, 30 and 60 by 60 inches.
400-KW. Westinghouse, 1,150 volts, 2-phase, speed 150 RPM, 60-cycle, direct-connected to Williams vertical non-condensing engine, 15 by 25.
75-KW. Westinghouse, 60-cycle, single-phase, 440 volts, 260 RPM, direct-connected to Fischer 125-HP. engine.

Belted A. C. Generators, 60 Cycle, 3 Phase.

700-KW. Westinghouse, 7,200 volts, 220-440-volt, MP, 18-700-400.
150-KW. G. E., 2,300 volts, type AT, class 12-150-600.
75-KW. Westinghouse, 220-440 volt, 720 RPM.

Belted A. C. Generators, 60 Cycle, 2 Phase.

2—250-KW. Westinghouse, 2,200 volts, class 16-250-450.
120-KW. Westinghouse, 2,200 volts, class 10-120-720.
2—60-KW. Westinghouse, 1,100 volts, class 8-60-900.

Belted A. C. Generators, 60 Cycle, Single Phase.

200-KW. G. E., 2,300 volts, type AM, class 6-200-450.
100-KW., 1,050 volts, type AM, class 8-100-900.
2—75-KW. Westinghouse, 2,200 volts, class 10-75-900.
60-KW. Westinghouse, 1,100 volts, type AM, class 8-60-900.
50-KW. G. E., 2,300 volts, type AM, class 8-50-900.
45-KW. Westinghouse, 1,150 volts, class 3-45-900.

Belted A. C. Generators, 125-133 Cycle, Single Phase.

300-KW. Westinghouse, 1,100-2,300 volts.
180-KW. G. E., 1,150 volts, type AS, 750 RPM.
2—120-KW. G. E., 2,300 volts, type AS, 14-120-1,070.
60-KW. G. E., 1,040-1,150 volts, type A, class 10-60-1,500.

A. C. Motors, 25 Cycle, 3 Phase.

200-HP. Westinghouse, 200 volts, type C, 575 RPM.
2—150-HP. Westinghouse, 200 volts, type C, 575 RPM.
100-HP. G. E., 2,200 volts, class G-100-500, Form L.
50-HP. Westinghouse, 220-440 volts, 480 RPM.
20-HP. Westinghouse, 220-440 volts, type C, 720 RPM.
3—5-HP. G. E., 220-440 volt, type I, 750 RPM.

A. C. Motors, 25 Cycle, 2 Phase.

2—200-HP. Westinghouse, 400 volts, type C, 480 RPM.
75-HP. Westinghouse, 400 volts, 480 RPM.
2—30-HP. Westinghouse, 400 volts, 720 RPM.
6—1-HP. Westinghouse, 110 volts, type C, 1,700 RPM.

A. C. Motors, 60 Cycle, 3 Phase.

150-HP. G. E., 550 volts, type I, class 8-150-900.
75-HP. G. E., 2,080 volts, type I, class 12-75-600.
50-HP. G. E., 2,080 volts, class 10-50-720.
30-HP. G. E., type I, class 8-30-900.

A. C. Motors, 60 Cycle, 2 Phase.

300-HP. Westinghouse, 400 volts, type C, 490 RPM.
150-HP. Westinghouse, 200 volts, type C, 580 RPM.
50-HP. Westinghouse, 400 volts, type C, 850 RPM.
30-HP. Westinghouse, 400 volts, type C, 850 RPM.
15-HP. Stanley, 500 volts, 1,152 RPM.
5-HP. G. E., 200 volts, type C, 1,200 RPM.

This is only a PARTIAL LIST. We have the standard sizes of nearly all the larger manufacturing companies. Send us your specifications.

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BOSSERT'S BOXES

Drawn steel. One blow of a hammer gives clean round hole. No filing.

SAVE TIME, BOXES AND MONEY

Be up to date. Use them. Write for bulletin giving full particulars.

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MOTORS DESIGNED FOR YOUR WORK

Northern Motors are built in so many different styles and types that it is almost impossible to have a mechanism to which a Northern Motor could not be readily attached and successfully operate. These different types are all standard.

Northern Motors are Simple and Rugged

BOOKLET No. 2538-A

Northern Electrical Mfg. Co., Engineers, Manufacturers, Madison, Wis., U. S. A.

OFFICES: 425 Monadnock Block, Chicago; Temporary Office, 67 Blake Block, Oakland, Cal.; 21 E. Fifth St., St. Paul, Minn; 1236 Wells Bldg, Milwaukee, Wis.; 801 Land Title Bldg, Philadelphia, Pa.; 200 Equitable Bldg, Boston, Mass; 29 Broadway, New York. 678

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$400 BUYS A FARM IN VIRGINIA Complete.

With comfortable new three-room cottage like Cut. These 25 acre poultry, fruit and vegetable farms are only two miles from Waverly, Va., a modern little town on the N. & W. Ry., midway between Norfolk and Richmond. Climate, water and markets for produce cannot be excelled. Write for further information and for lists and booklets showing farms and plantations from $10 per acre up. **F. H. LaBAUME,** Agrl. & Indl. Agent, Norfolk & Western Ry., Box 316, Roanoke, Va.

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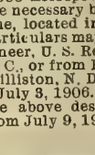
DEPARTMENT OF THE INTERIOR, Washington, D. C., June 4, 1906. Sealed proposals will be received at the office of the United States Reclamation Service, Williston, N. D., until 10 o'clock a. m., July 9, 1906, for the installation of steam and electric pumping plants and electric generating and transmission apparatus, including three pumping stations containing centrifugal pumps of 20 and 30 cubic feet per second capacity under heads of from 30 to 50 feet, driven by steam engines and electric motors aggregating 1,200 horsepower; also two 300 K. W. steam turbine generating units, a 1,000-horsepower boiler plant and accessories, the necessary buildings and 3-mile transmission line, located in the vicinity of Williston, N. D. Particulars may be obtained from the Chief Engineer, U. S. Reclamation Service, Washington, D. C., or from H. A. Storrs, Electrical Engineer, Williston, N. D. E. A. Hitchcock, Secretary.

July 3, 1906. The date of opening bids for the above described work has been changed from July 9, 1906, to August 14, 1906.

Thos. Ryan, Acting Secretary.



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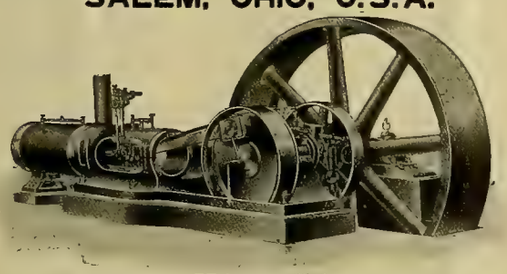

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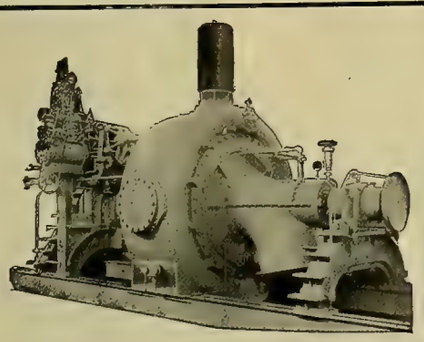

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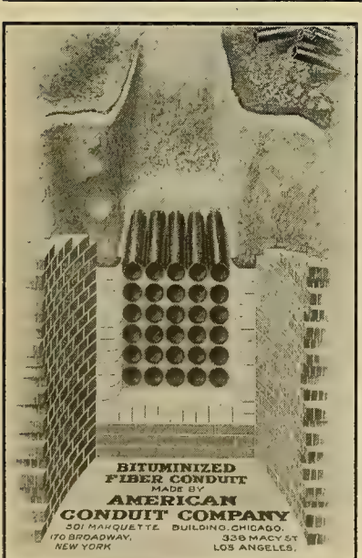

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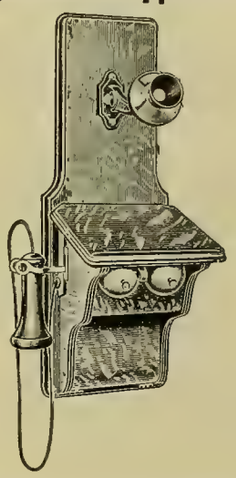

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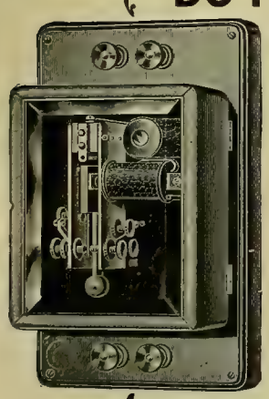

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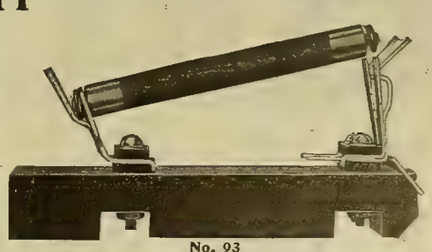

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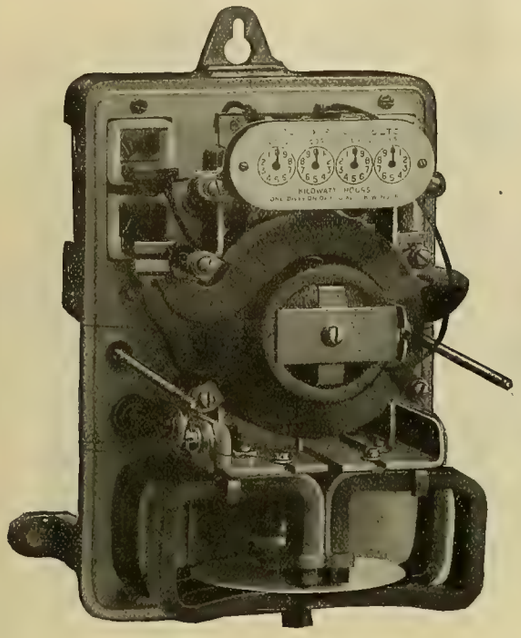

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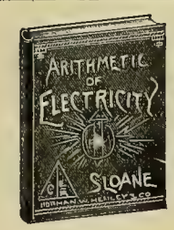

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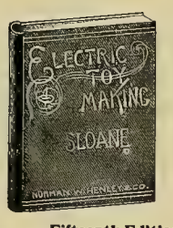

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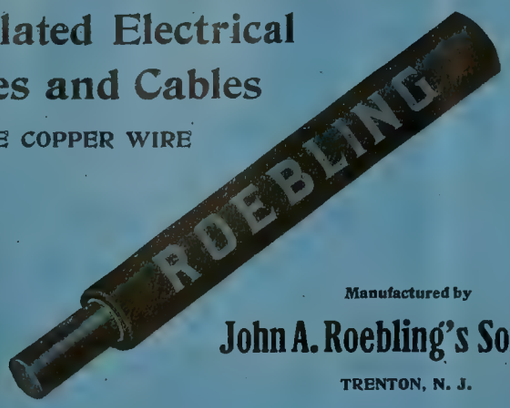

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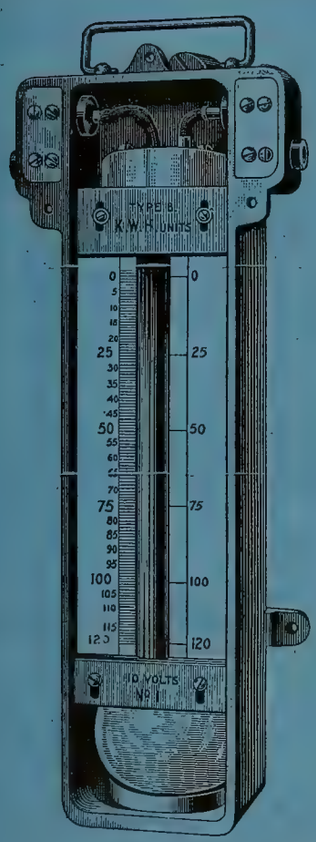

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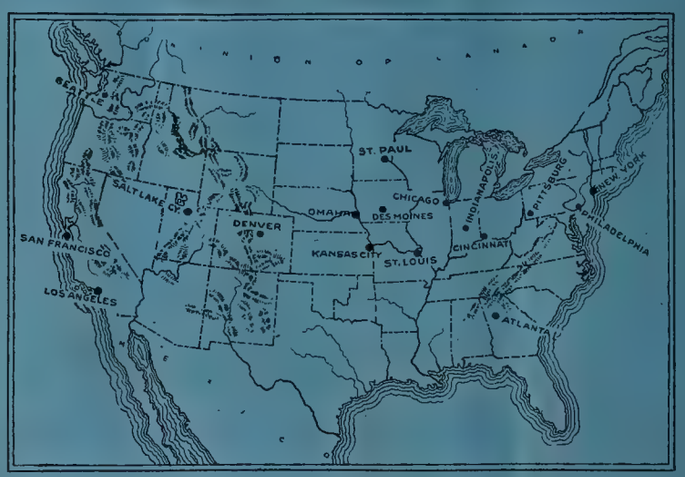

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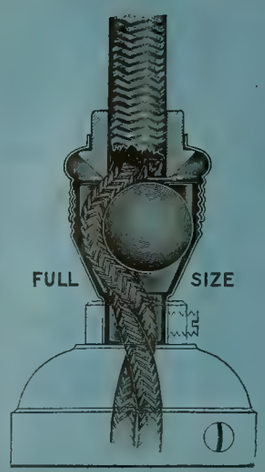

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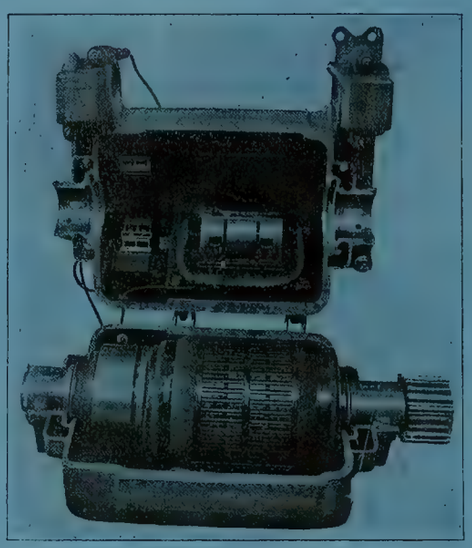

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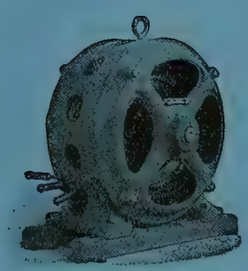

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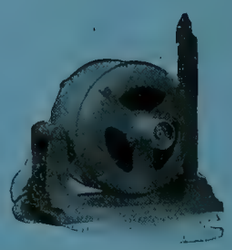

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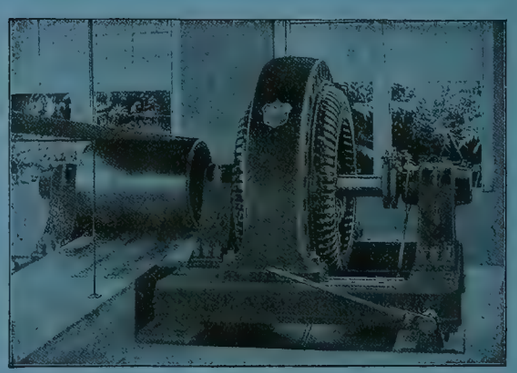

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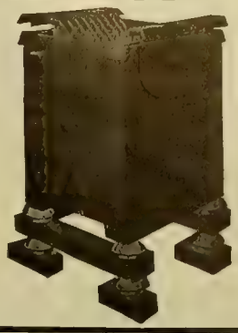

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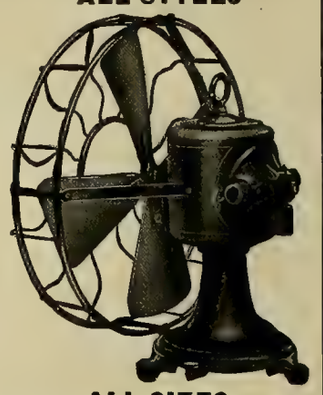

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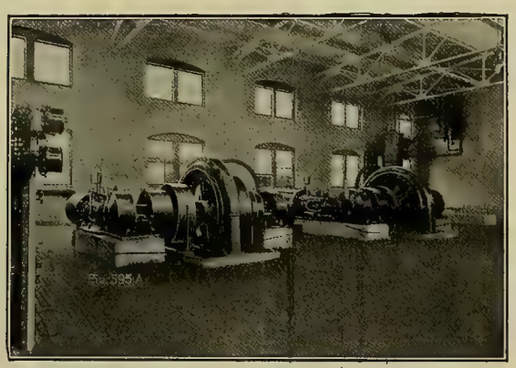

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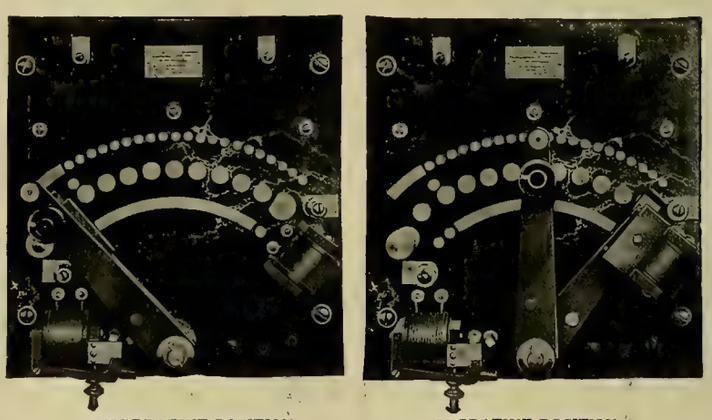
No. 24 C. & H. Controller

FOR MACHINE TOOLS



INOPERATIVE POSITION OPERATIVE POSITION

The above illustrations show the simplicity and compactness of the bulletin 24 and 25 C-H machine tool controller.

One handle both starts and regulates.

The shunt field is short circuited during starting by the curved sector below the large (armature) contact buttons, until all armature resistance is cut out.

At the end of the sector is a round contact which throws the field into circuit when the armature arm is engaged by the retaining magnet and the motor is at normal speed.

Moving the top lever to the left, where it will stay on any contact, controls the motor speed.

Twenty field contacts give a wide speed range.

Retaining magnets return all parts to "off" position in case of interrupted current or overload.

Bulletins 24 and 25 give prices.

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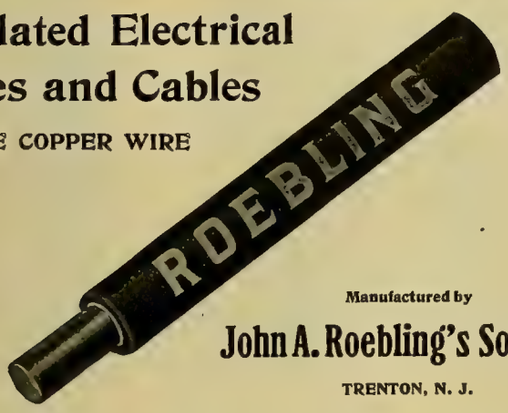

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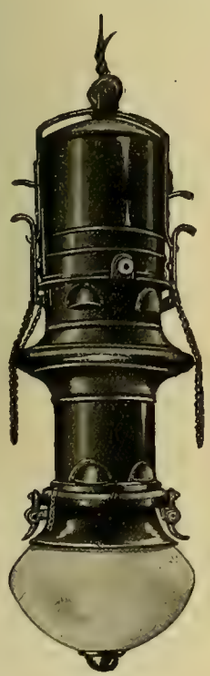

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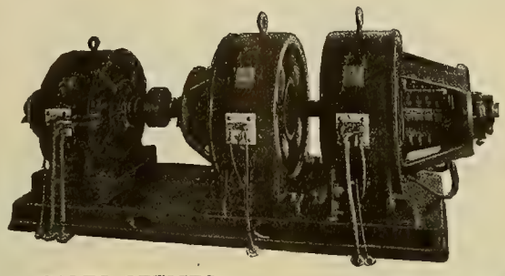

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New York City
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For a long time it has been recognized that the time was ripe for a new lamp manufacturing company to enter the field, **owing to the present high price and dictatorial policy of the association of lamp manufacturers.**

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WE OFFER YOU A STRICTLY FIRST CLASS LAMP AT A REASONABLE PRICE—AND **THAT PRICE IS LESS THAN THE "ASSOCIATION PRICE!"**

As we mean business and want your trade, we urge you to "look us up," to investigate us fully, financially and otherwise, and we, therefore, refer you to the First National Bank of Emporium, Pa., and the Farmers & Merchants Bank of St. Marys, Pa.

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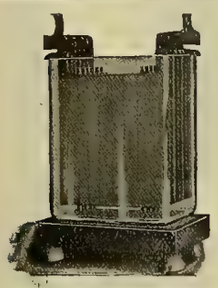

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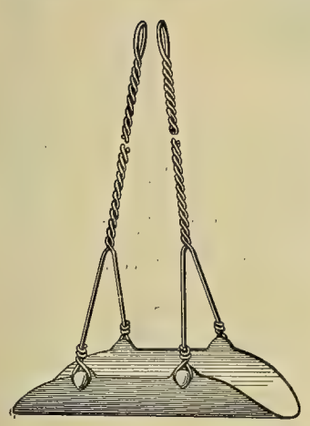

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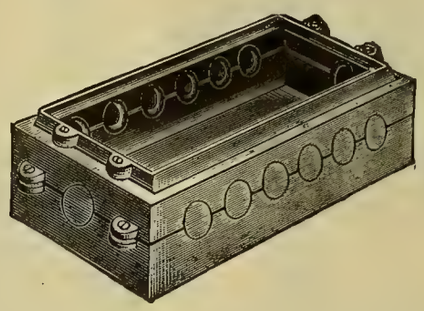
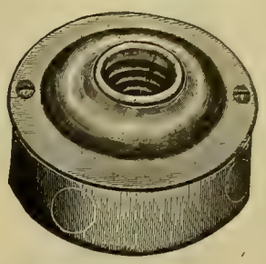
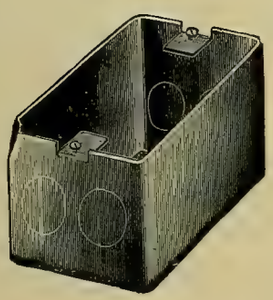
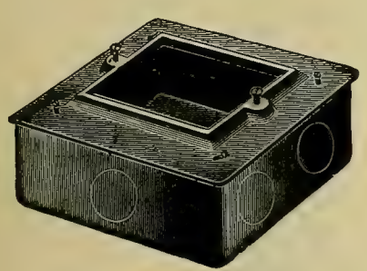






They are made of one piece of drawn steel, plugged with a sufficient number of hermetically sealed outlets from which the plugs may be removed by a sharp blow of the hammer. This leaves a perfectly clean round hole, without the filing or reaming that is always necessary when cast-iron boxes are used.



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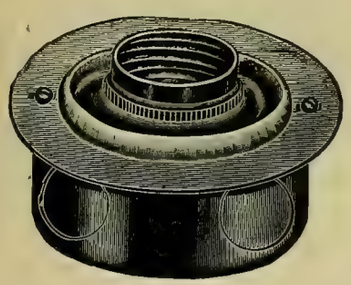

and the saving in breakage resulting from this construction is another item that should render their choice a matter of course.

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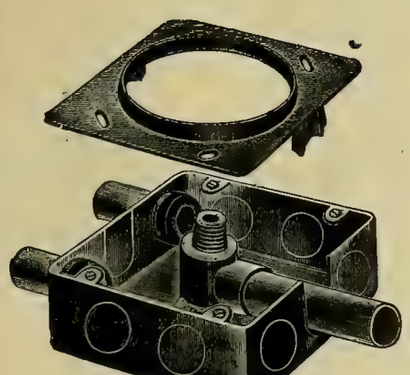

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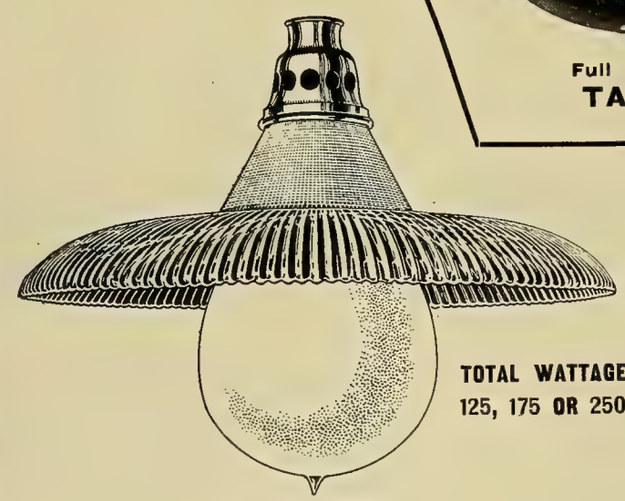

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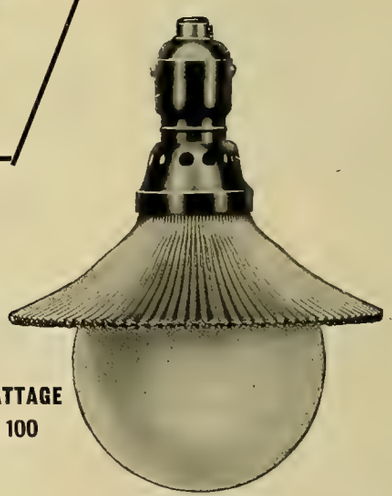

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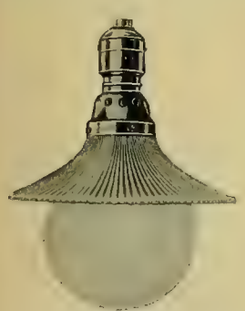

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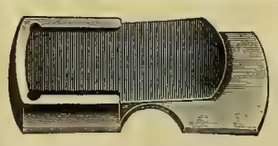

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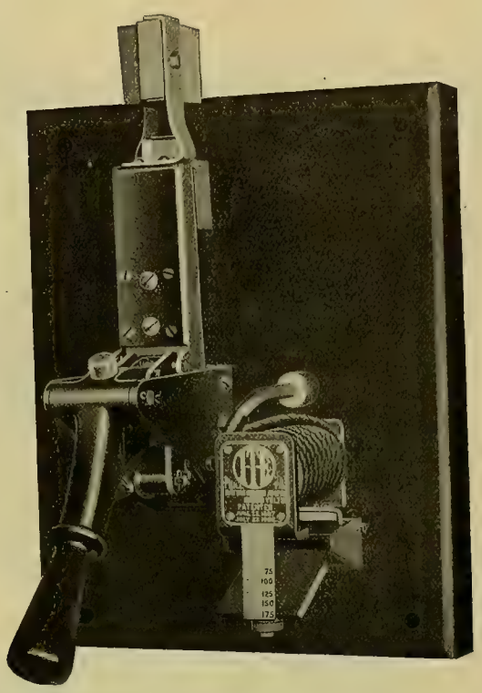

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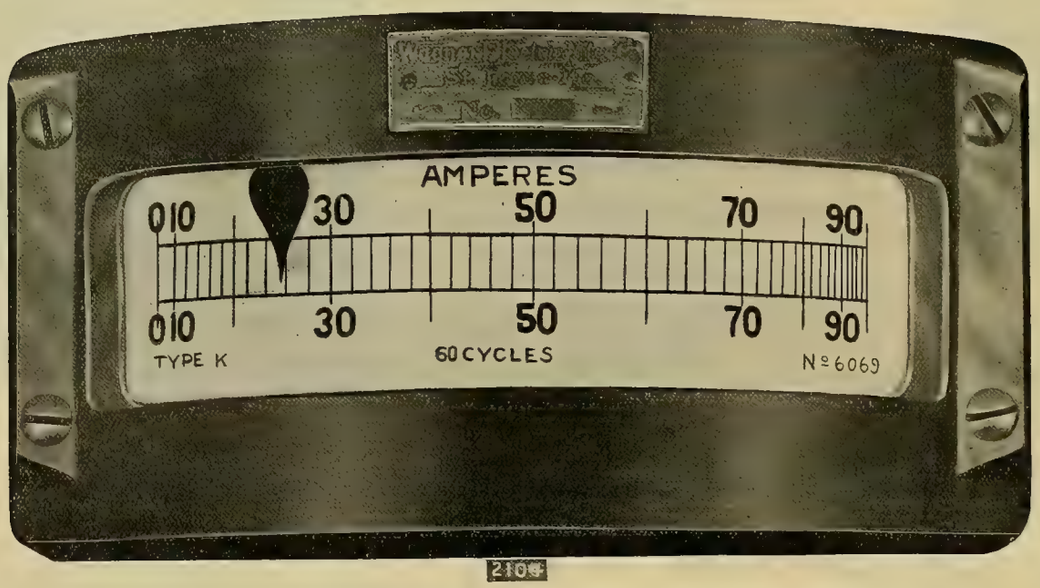

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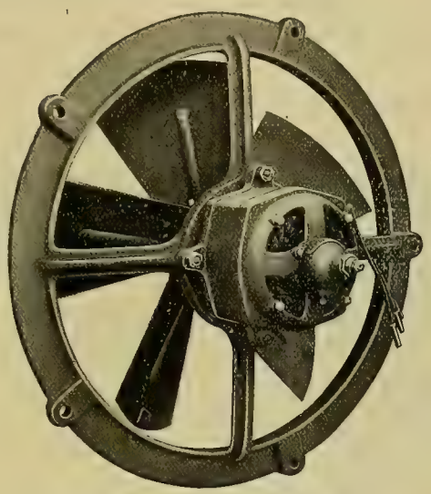

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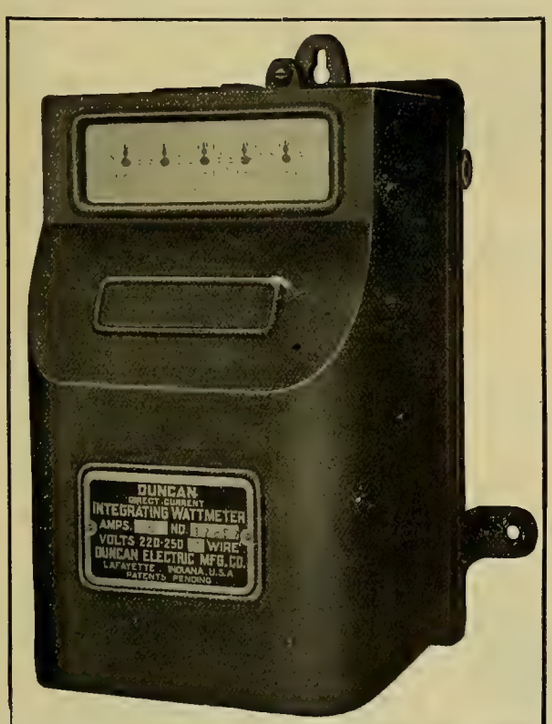

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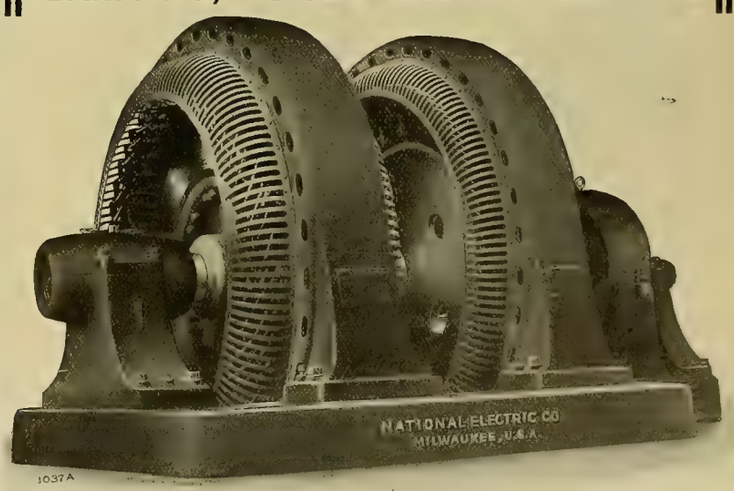

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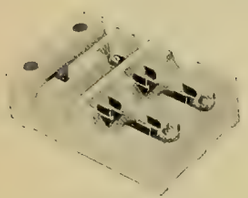

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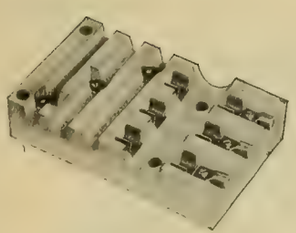

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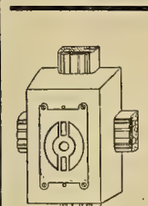

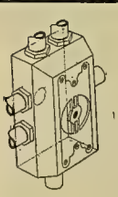

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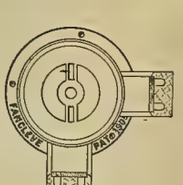

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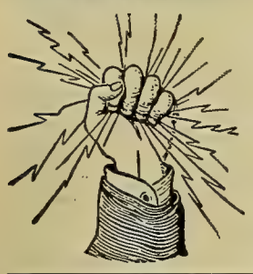

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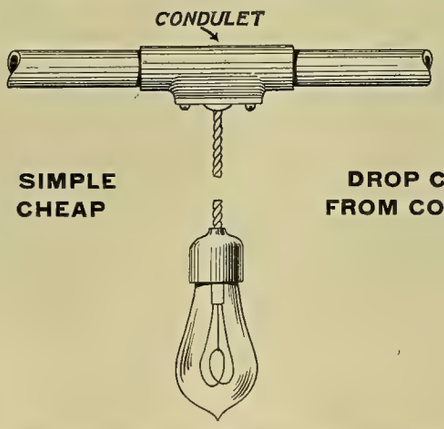

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DEPARTMENT OF THE INTERIOR, Washington, D. C., June 4, 1906. Sealed proposals will be received at the office of the United States Reclamation Service, Williston, N. D., until 10 o'clock a. m., July 9, 1906, for the installation of steam and electric pumping plants and electric generating and transmission apparatus, including three pumping stations containing centrifugal pumps of 20 and 30 cubic feet per second capacity under heads of from 30 to 50 feet, driven by steam engines and electric motors aggregating 1,200 horsepower; also two 300 K. W. steam turbine generating units, a 1,000-horsepower boiler plant and accessories, the necessary buildings and 3-mile transmission line, located in the vicinity of Williston, N.D. Particulars may be obtained from the Chief Engineer, U. S. Reclamation Service, Washington, D. C., or from H. A. Storrs, Electrical Engineer, Williston, N. D. E. A. Hitchcock, Secretary.

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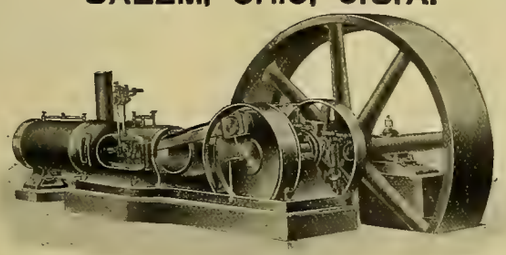

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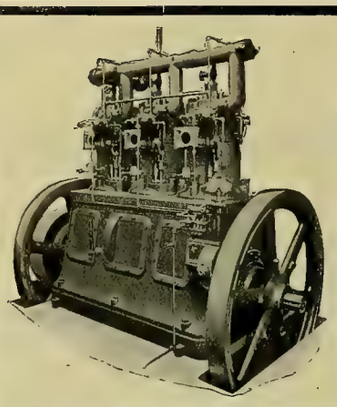

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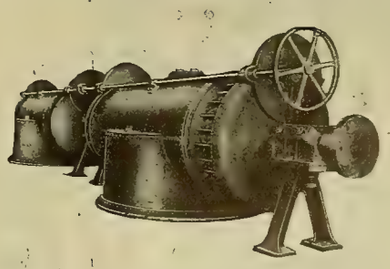

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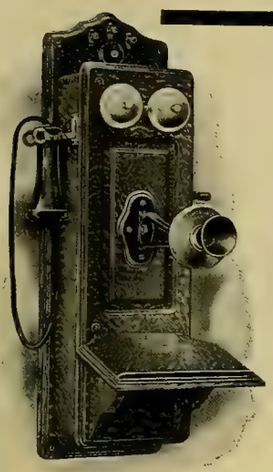

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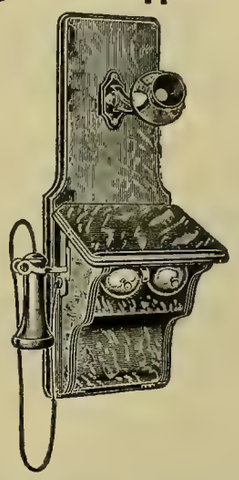

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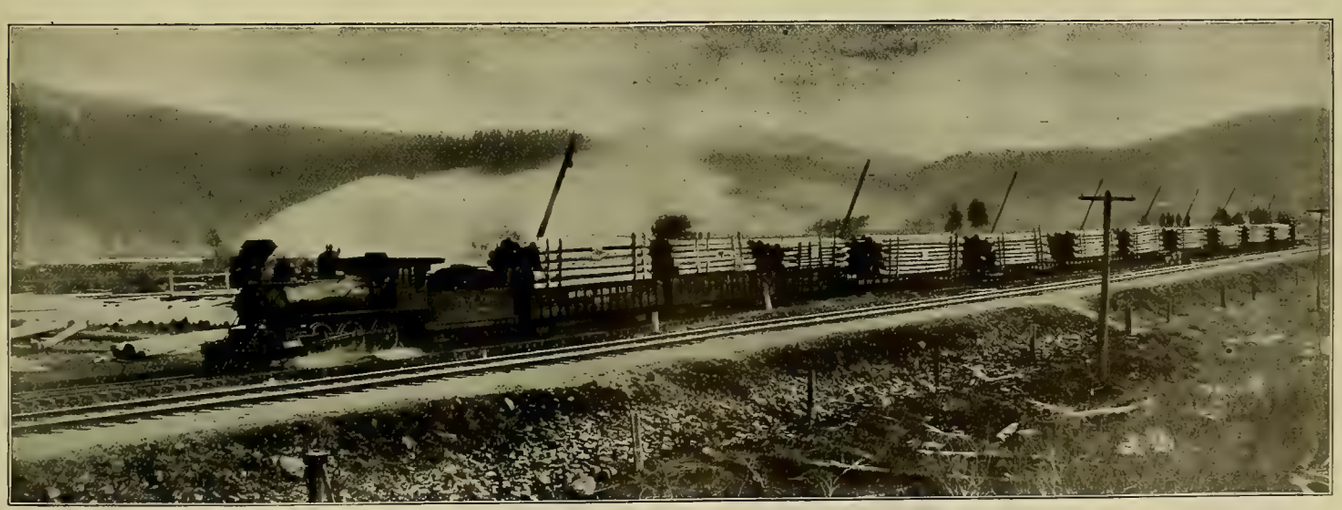

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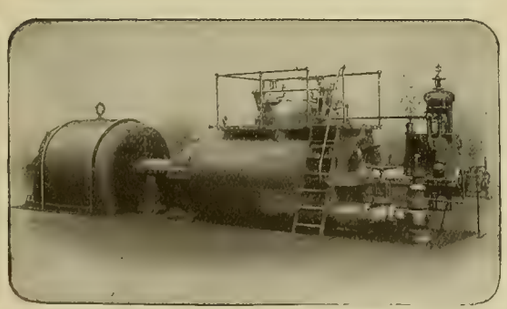

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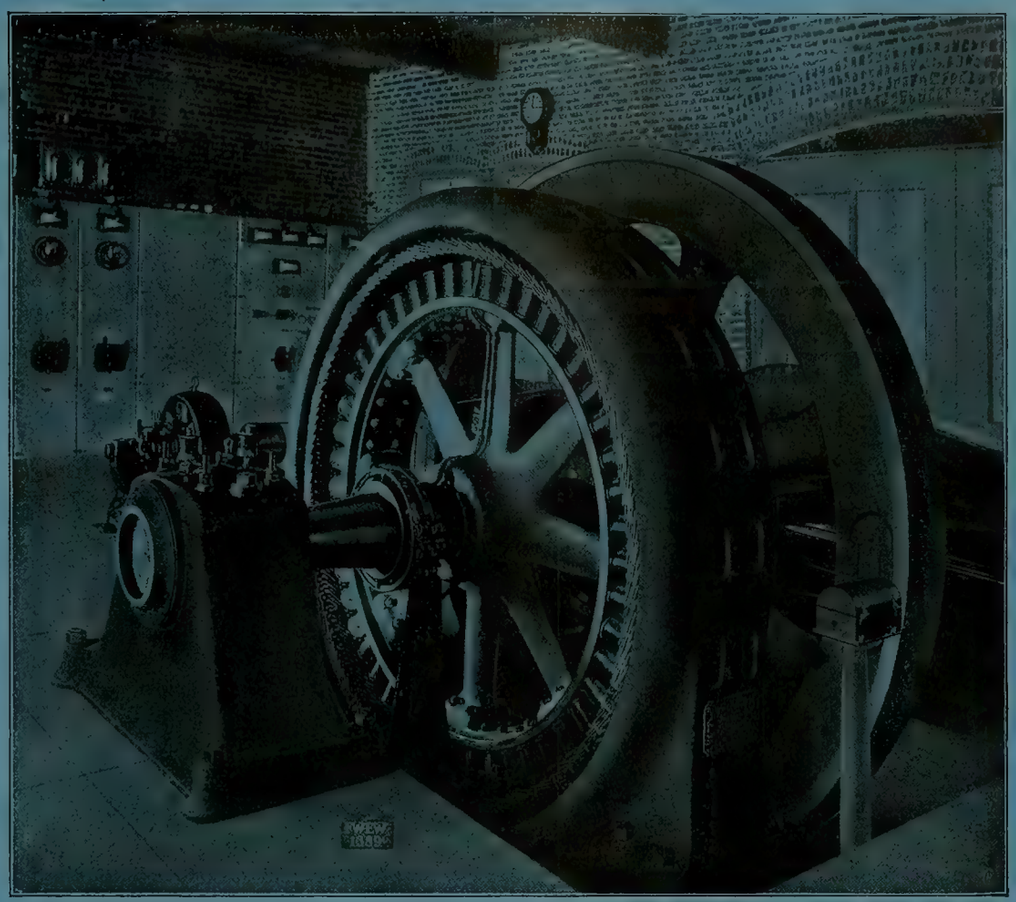

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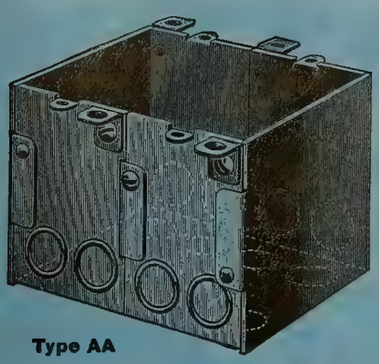

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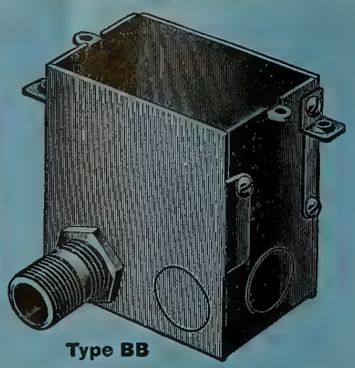

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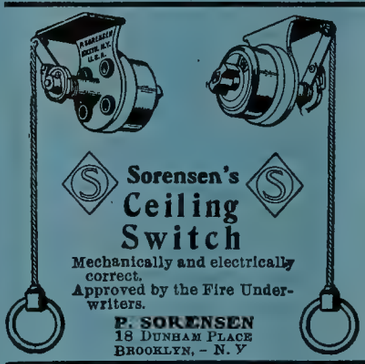

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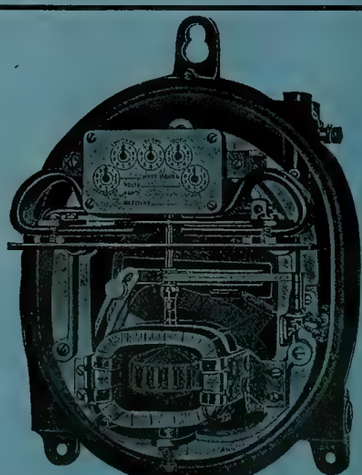

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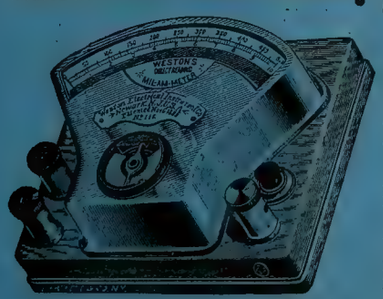

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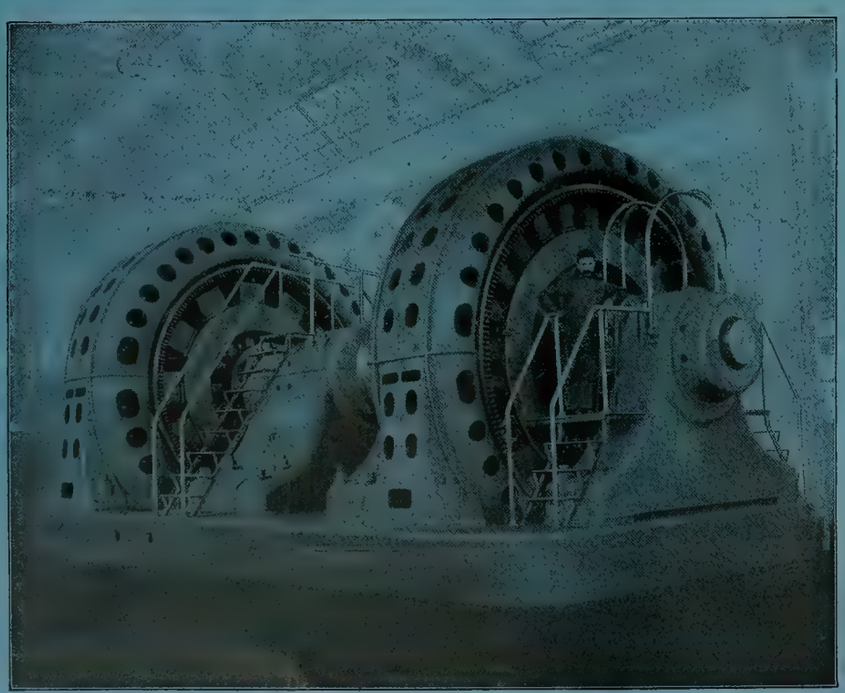

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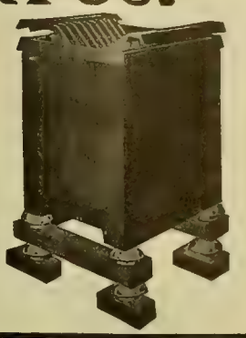

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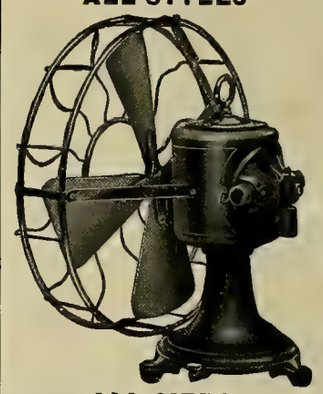

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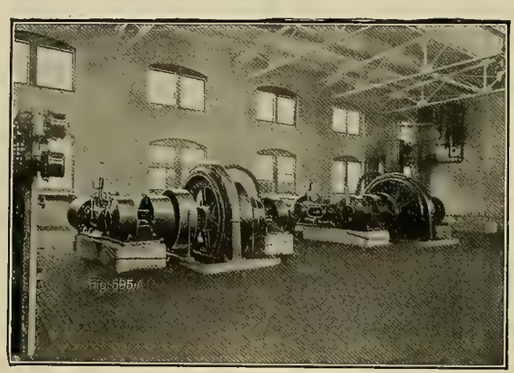

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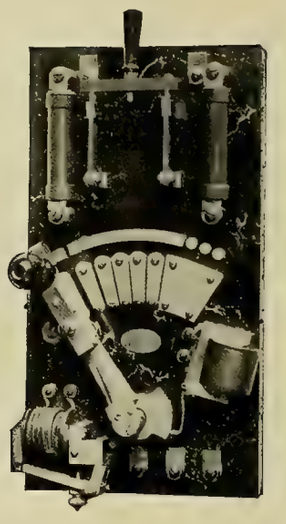

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Allis-Chalmers Co.
General Electric Co.
Westinghouse El. & Mfg. Co.

Electrical and Mechanical Engineers.
Arnold Co., The.
Badt, F. B.
Baker & Co., W. E.
Butterfield Construction Co.
Byllesby & Co., H. M.
Humphrey, Henry H.
Hunt & Co., Robt. W.
Hydro-Elec. Development Co
Jackson, D. C. & W. B.
Kohler Brothers.
Northern Electrical Mfg. Co.
Ruebel & Wells.
Sargent & Lundy.
Schott, W. H.
Stanley—G. I. Elec. Mfg. Co.
Willis, G. M.

Electrical Instruments. (Recording and Testing.)
Bissell Co., The F.
Central Electric Co.
Diamond Meter Co.
Duncan Elec. Mfg. Co.
Ft. Wayne Elec. Wks. Inc.
General Electric Co.
Helios Mfg. Co.
International Elec. Meter Co.
Machado & Roller.
Pignolet, L. M.
Robert Inst. Co., The.
Stanley—G. I. Elec. Mfg. Co.
Wagner Electric Mfg. Co.
Wesco Supply Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.
Weston Electrical Inst. Co.

Electro-Magnets.
Acme Wire Co.

Electro-Plating Mach'y
Crocker-Wheeler Co.
General Electric Co.

Elevators—Conveyors.
Jeffrey Mfg. Co.

Enameled Rings.
Star Expansion Bolt Co.

Engines, Gas, Gasoline and Oil.
Allis-Chalmers Company.
American Diesel Engine Co.
Otto Gas Engine Works.
Westinghouse Machine Co.

Engines, Steam.
Allis-Chalmers Company.
Buckeye Engine Co.
Westinghouse Machine Co.

Fans and Fan Motors.
Central Electric Co.
Century Electric Co.
Crocker-Wheeler Co.
Edison Mfg. Co.
General Electric Co.
Robbins & Myers Co.
Wesco Supply Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.

Fibre.
Bartavert Mfg. Co.
Vulcanized Fibre Co.

Field Coils.
Acme Wire Co.

Fittings.
Plume & Atwood Mfg. Co.

Fixtures, Adjustable,
Morse, Frank W.

Fixtures, Gas and Elec.
Beardslee Chandelier Mfg. Co.
Williamson & Co., R.

Flashers.
Bissell Co., The F.
Haller Machine Co.
Reynolds El. Flasher Mfg. Co.
Wesco Supply Co.

Flexible Shafts.
Stow Mfg. Co.

Fuses and Fuse Wire.
Bissell Co., The F.
Central Electric Co.
Chicago Fuse Wire & Mfg. Co.
D. & W. Fuse Company.
Manhattan Elec. Supply Co.
Wesco Supply Co.
Western Electric Company.

German Silver, Sheet and Wire.
Seymour Mfg. Co.

Globes, Reflectors and Shades.
Haller Machine Co.
Phœnix Glass Co.
Wesco Supply Co.
Western Electric Co.

Governors, Water Wheel and Steam Turbine.
Allis-Chalmers Co.
Ludlow Valve Co.

Graphite Specialties.
Dixon Crucible Co., Jos.
Holmes Fibre-Graphite Co.

Heating (Exhaust Steam).
Amer. District Steam Co.

Holders, Inc. Lamps.
Morse, Frank W.

Hydraulic Machinery.
Alton Machine Co.
Allis-Chalmers Company.

Indicators.
Robertson & Sons, Jas. L.

Induction Coils.
Acme Wire Co.

Inspection & Insurance
Hartford Steam Boiler Inspection & Insurance Co.

Insulating Machinery.
Alton Machine Co.

Insulators and Insulating Materials
American Electrical Works.
Central Electric Co.
Chicago Edison Co.
Indiana Rub. & Ins. Wire Co.
Kartavert Mfg. Co.
Manhattan Elec. Supply Co.
Mica Insulator Co.
Munsell & Co., Eugene.
National India Rubber Co.
New York Insulated Wire Co
Okonite Co., The.
Phillips Insulated Wire Co
Simplex Electrical Co.
Standard Underground C. Co.
Vulcanized Fibre Co.
Wesco Supply Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.

Lamps, Arc.
Bissell Co., The F.
Central Electric Co.
Ft. Wayne Elec. Wks. Inc.
General Electric Co.
Gregory Electric Co.
Manhattan Elec. Supply Co.
Stanley—G. I. Elec. Mfg. Co.
Wesco Supply Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.

Lamp Guards.
Benjamin Elec. Mfg. Co.
Morse, Frank W.

Lamps, Incandescent.
Bissell Co., The F.
Buckeye Electric Company.
Central Electric Co.
Chicago Edison Co.
Columbia Incan. Lamp Co.
Edison Decorative & Miniature Lamp Dept.
General Electric Co.
McCandless, H. W
Monarch Elec. Mfg. Co.
Novelty Incan. Lamp Co
Sawyer-Man Elec. Co.
St. Marys Incand. Lamp Co.
Standard Elect'l. Mfg. Co.
Wesco Supply Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.

Lamps, Incandescent—Replacers & Cleaners.
Morse, Frank W

Letters, Metal, Sign.
Haller Machine Co.

Lightning Arresters.
Central Electric Co.
Ft. Wayne Elec. Wks. Inc.
General Electric Co.
Manhattan Elec. Supply Co.
Stanley—G. I. Elec. Mfg. Co.
Wesco Supply Co.
Western Electric Co.

Line Material.
Ajax Line Material Co.

Linemen's Climbers.
Klein & Sons, Mathias.

Magnets, Autom. Wound
Acme Wire Co.

Magnet Wires.
(See Wires and Cables.)

Mica.
Chicago Mica Co.
Mica Insulator Co.
Munsell & Co., Eugene.

Mining Apparatus, Elec.
Allis-Chalmers Company.
Crocker-Wheeler Co.
General Electric Co.
Jeffrey Mfg. Co.
Wesco Supply Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.

Mining Machinery.
Allis-Chalmers Company.

Model and Machine Shop.
Hoffmann, Emil R.

Motors (See Dynamos and Motors)

Nippers and Pliers.
Klein & Sons, Mathias.

Patent Attorneys.
Bain, Foree & May.

Phosphor Bronze.
Phosphor Bronze Sm. Co. Ltd.
Seymour Mfg Co.

Pipe Bending Machines.
Chicago Pneumatic Tool Co.
Wrigley Co, Thos.

Platinum, Wire and Sheet.
Baker & Co. Inc.

Poles, Arc Lamp.
Mott Iron Works, J. L.

Pole Changers,
Sandwich Pole Changer Co.

Poles and Ties.
Abeles & Taussig.
Berthold & Jennings.
Bruer, Will F.
Fowler & Co., John H.
Kellogg Switch. & Sup. Co.
Lindsley Bros. Co., The
Loud's Sons Co., H. M.
Moss Tie Co.
Mueller Company, William.
Pacific Coast Pole Co.
Perrizo & Sons.
Porter Cedar Company.
Sterling & Son, W. C.
Torrey Cedar Co.
Wilson Co., Jas. I. M.
Worcester Co., C. H.

Polish (Metal).
Hoffman, Geo. W.

Portables.
Plume & Atwood Mfg. Co.

Power Transmission Machinery.
Allis-Chalmers Company.
Jeffrey Mfg. Co.

Rail Joints.
Rail Joint Company, The

Railway Supplies.
Wesco Supply Co.

Re-Winding—Repairs.
Chicago Edison Co.
Gregory Electric Co.

Rheostats.
Cutler-Hammer Mfg. Co.
General Electric Co.
Wesco Supply Co.
Western Electric Co.
Westinghouse El. & Mfg. Co

Rosettes.
Pass & Seymour.

Rubber Machinery.
Alton Machine Co.

Schools and Colleges.
Bliss Electrical School.
Highland Park College.
Michigan College of Mines.
Pratt Institute.

Second-Hand Machin'y.
Bissell Co., The F.
Gregory Electric Co.
Matthews & Bro., W. N.
Rossiter, MacGovern & Co.

Signs, Electric.
Haller Machine Co.

Sleeving, Braided.
Belden Mfg. Co.

Solder, Self Fluxing.
Belden Mfg. Co.

Soldering Sticks, Salt and Paste.
Crollius & Son, E. R.
Western Electric Co.

Solenoids.
Acme Wire Co.
Schureman Co., J. L.

Spark Coils.
Acme Wire Co.

Speaking Tubes.
Central Electric Co.
Manhattan Elec. Supply Co.
Ostrander & Co., W. R.
Wesco Supply Co.
Western Electric Co.

Specialties, Electrical Mfrs. and Designers.
Haller Machine Co.

Speed Indicators.
Niagara Tachometer & Instrument Co.
Weston Electrical Inst. Co.

Speed Recorders.
Niagara Tachometer & Instrument Co.

Springs.
Manross, F. N.

Staples.
Blake Signal & Mfg. Co.

Steel Gains.
Steel Gain Mfg. Co.

Stokers.
Westinghouse Machine Co.

Storage Batteries.
American Battery Co.
Chicago Pneumatic Tool Co
Electric Storage Battery Co.
General Storage Battery Co.
Gould Storage Battery Co.
Hensel & Co., John A.
National Battery Co.
Willard Storage Bat. Co.

Supplies, General Elec.
Amer. Elect'l Supply Co.
Bissell Co., The F.
Central Electric Co.
Century Electric Co.
Chicago Edison Co.
Manhattan Elect'l Supply Co
Wesco Supply Co.
Western Electric Co.

Switches.
(See Cut-outs and Switches.)

Tachometers and Tachographs.
Niagara Tachometer and Instrument Co.

Telephones, Telephone Material and Switchboards.
American El. Telephone Co
Automatic Electric Co.
Bissell Co., The F.
Central Electric Co.
International Tel. Mfg. Co.
Kellogg Switchb. & Sup. Co.
Manhattan Elec. Supply Co.
North Electric Co.
Stromberg-Carlson Tel. M. Co.
Wesco Supply Co.
Western Electric Co.

Telephone Service.
Chicago Telephone Co

Time Switches.
Bissell Co., The F.

Toggle Bolts.
(See Bolts, Toggle.)

Tools.
Klein & Sons, Mathias.

Tools, Pneumatic.
Chicago Pneumatic Tool Co.

Torches.
Zeidler Lamp & Brass Co.

Transformers.
Allis-Chalmers Company.
Central Electric Co.
Crocker-Wheeler Co.
Ft. Wayne Elec. Works, Inc.
General Electric Co.
Kuhlman Electric Co.
La Fayette Elect'l. Mfg. Co.
National Brake & Elec. Co.
Stanley—G. I. Elec. Mfg. Co.
Wagner Electric Mfg. Co.
Wesco Supply Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.

Trucks, Electric Car.
General Electric Co.
Westinghouse El. & Mfg. Co.

Turbines, Steam.
Allis-Chalmers Co.
General Electric Co.
Westinghouse Machine Co.

Turbine Water Wheels.
Allis-Chalmers Co.
Leffel & Co., Jas.

Vacuum Drying.
Devine Co., Joseph P.

Vulcanized Fibre.
Vulcanized Fibre Co.

Wattmeters.
Duncan Elec. Mfg. Co.
Wesco Supply Co.

Wire Rope Machinery.
Alton Machine Co.

Wires and Cables—Magnet Wires.
Acme Wire Co.
American Electrical Works.
Belden Mfg. Co.
Bissell Co., The F.
Central Electric Co.
Chicago Ins. Wire & Mfg. Co.
Crescent Ins. Wire & Cble. Co.
Driver-Harris Wire Co.
General Electric Co.
Hazard Manufacturing Co.
Indiana Rub. & Ins. Wire Co.
India Rubber & Gutta Percha Insulating Co.
Kellogg Switch. & Sup. Co.
Manhattan Elec. Supply Co.
Marion Ins. Wire & Rub. Co.
National India Rubber Co
New York Insulated Wire Co.
Okonite Co., The.
Phillips, Eugene F.
Phillips Insulated Wire Co
Roebling's Sons Co., J. A.
Runzel-Lenz Elec. Mfg. Co.
Safety Ins. Wire & Cable Co.
Simplex Electrical Co.
Standard Underground Cable Co,
Wesco Supply Co.
Western Electric Company.

For Alphabetical Index of Advertisements See Page 3.

The week before your Incandescent Lamp Contract Expires!

Exciting, is it not?

No, not NOW—it once was, tho', in the good old days before the "ORGANIZATION" wove its "meshes" about you!

Now what do you get?

All the excitement you want, but your excitement is akin to that of the man who undergoes the appendicitis operation—you take the ether and go to sleep and when you wake up it is all over; but you've lost something, viz.: The difference between our price and that "16 to 18 cents per."

At the expiration of your present contract, therefore, try us—let us into the game. Make some competition for yourself!

We, too, will gladly give you a wine dinner—two wine dinners if that is all you want!

But remember, while the dinner (and 16 and 18 cents per!) is all you'll get from the "other fellow," we may give you "dessert" on top of the dinner—try us!

St. Mary's Incandescent Lamp Company

Wm. M. Rothschild - Pres
St. Mary's, Pa.

Let us quote you

P.S. 6000 Lamps daily capacity -
We protect buyers against litigation -
Penna. Corporation - Capital Stock $100.000.

THE LIFE OF A BATTERY

Telephone Manufacturers and Telephone Companies, Manufacturers of Gas and Gasoline Engines, *know* that in a

Rock Island New Patent Dry Cell Battery

The carbon used is placed in a chemically prepared cloth and not wrapped in blotting paper, found in *other* cells. *Set* in a wall of chemical instead of the bare can, the method used by others, this treatment so

HOLDS THE MOISTURE CAPTIVE

that neither heat nor cold can possibly affect it. That is the reason a *hand-constructed* Rock Island lasts *nearly one-third* longer than a *machine-made* battery. The *heart* of the Rock Island is sound. There is *less* internal resistance, *more* constant tension and *better* recuperative power than are possessed by any *other* battery made. Our Standard No. 8, cheaper in the long run, does highest class work and is larger than Standard No. 6, the regular size for general purposes. Department A will send prices. Order a barrel. You'll find immediate dividends in improved service.

R·I BAT

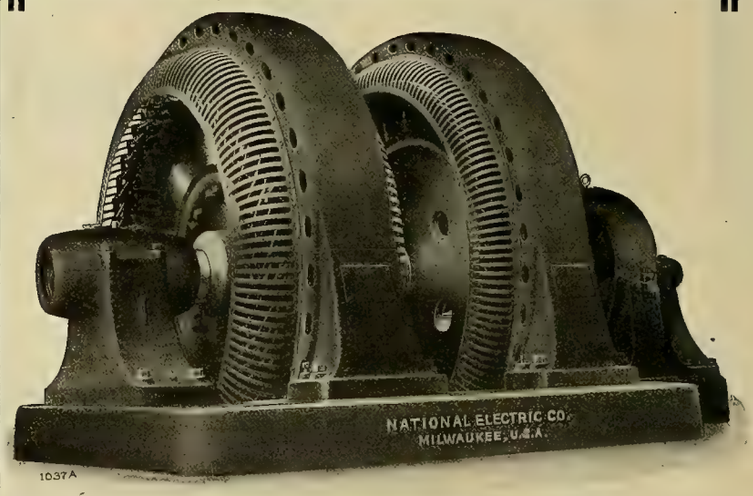
ROCK ISLAND BATTERY CO.
Ninth and Sycamore Streets CINCINNATI, OHIO

DIRECT AND ALTERNATING CURRENT

GENERATORS

FOR

LIGHTING, POWER AND RY. SERVICE



4 FREQUENCY CHANGERS, each 1,000 K. W. capacity, like above, furnished the Union Electric Light & Power Co., St. Louis, Mo.

NATIONAL BRAKE & ELECTRIC COMPANY
MILWAUKEE

General Sales Office, 519 First National Bank Building, Chicag

Stanley-G.I.

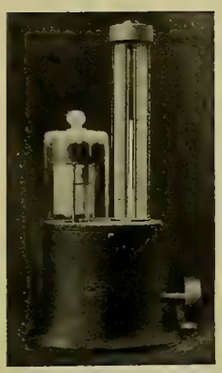
The Stanley-G. I. Electric Manufacturing Company is a consolidation of the Stanley Electric Manufacturing Company of Pittsfield and the General Incandescent Arc Light Company of New York. The Stanley Company's product, marketed under the well-known trade name of the S. K. C. System, comprises generators, transformers, rotary converters, motor generator sets, switchboard apparatus, induction motors, etc. The General Incandescent Arc Light Company have been favorably known as builders of the high grade G. I. arc lamps, incandescent lamps, alternating current and direct current motors and special electrical supplies.

MIDDLE WEST OFFICES:

CHICAGO, Monadnock Block
CINCINNATI, First Nat'l Bank Bldg.
CLEVELAND, Citizens Building
DETROIT, Chamber of Commerce
INDIANAPOLIS, State Life Bldg.
KANSAS CITY, Postal Telegraph Bldg.
MINNEAPOLIS, Guaranty Building
OMAHA, New York Life Building
ST. LOUIS, Century Building

Special Representative for the Southwest, HOBSON ELECTRIC CO., Dallas and Houston, Texas

Stanley-G.I. Electric M'F'G. Company Pittsfield MASS.



This instrument indicates the speed of the machine to which it is attached at any instant and at the same time traces a speed record of the machine for any desired period.

Niagara Tachometers are made in many types. Send for illustrated book—'twill cost you nothing.

NIAGARA TACHOMETER & INSTRUMENT COMPANY.
NIAGARA FALLS, N. Y.

"Diamond H" Switches

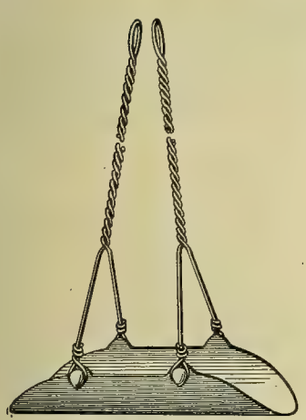
Trade H Mark

This Trade-Mark guarantees quality.

The Hart Mfg. Co., Hartford, Conn.

New York Boston Chicago Toronto, Ont.

SPOT THE SPOT
SAMSON SPOT CORD
FOR
ARC LAMP AND TROLLEY CORD
SAMSON CORDAGE WORKS, BOSTON, MASS.



NOTICE

This is the

Holden Anchor

It always pulls square in the earth and never pulls out.
We make Anchors 5¾x10 in. to 10x30 in.
One man can install the anchors in 20 to 30 minutes.
Write us for prices.

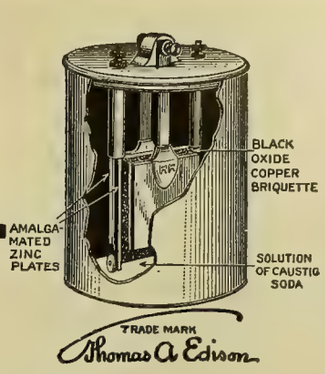
The Holden Anchor Co.
DES MOINES, IOWA

AMERICAN ELECTRICAL SUPPLY CO

ARE YOU SEEKING
Good Material, Good Service, Correct Prices on Electrical Supplies? If you are, let us hear from you.

IF ELECTRICAL AND GOOD WE SELL IT

211-213 LAKE ST. CHICAGO



Mr. Dealer: Why Are There No Kicks On the Edison Battery?

Our Factory Manager remarked the other day that he rarely received a complaint on an Edison cell and that when he did it was usually due to:

(1) Getting oil on the briquettes, which is needless.

(2) Using instead of the mineral oil furnished by us animal vegetable oils, which turn to soft soap.

(3) Using the wrong size of soda can, which makes the solution too strong, or too weak, or

(4) Using commercial crude soda or impure water, which causes local action on the zincs.

A large dealer who does not handle the Edison cell also said recently that he was much bothered lately by people coming in and asking for the Edison cell, insisting on having it and refusing all others.

Now, why do people insist upon getting the Edison cell? For the very reason given above: The Edison cell gives no trouble, it keeps the engine going or does whatever else it has to do by standing up with full voltage and current to the end of its guaranteed life. It does not fag, tire out nor need resting. The scientific reasons why it does not and why others do are fully explained in the Edison Battery Catalogue.

The Edison Primary Battery is the result of extended painstaking investigations made by Mr. Edison, Dr. Kennelly and others with a view to finding the combination of elements that would give the most battery energy, regularly, without fail or bother, for a Dollar. Mr. Edison originally wanted such a battery to operate the Phonograph. As any battery for such a purpose is enough of a nuisance anyway, he went to great expense to find the one that would be most clean, dependable and cheap. The result was the Edison cell. People soon found that it was an excellent cell for other purposes as well, and the result has been an unforeseen demand, like that on the dealer quoted above, which our Factory Manager says is turning his hair gray figuring on how to keep up with orders.

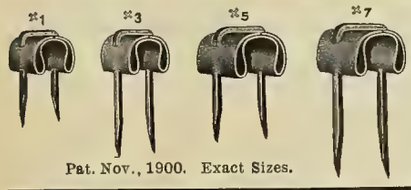
Apply for an Edison agency and profit by the demand for the cell that gives "The most battery energy for a Dollar."

Edison Mfg. Co.

7 Lakeside Avenue ORANGE, N. J.

31 Union Square, New York | **304 Wabash Ave., Chicago**

25 Clerkenwell Road, London, E. C.



Pat. Nov., 1900. Exact Sizes.

BLAKE INSULATED STAPLES
BLAKE COMPRESSED CLEATS

Manufactured and For Sale by

Exact size. Pat. July, 1906

BLAKE SIGNAL & MANUFACTURING CO., 256 Summer St., Boston, Mass.

CHICAGO: American Electrical Supply Co. Western Electric Co. ST. LOUIS: Wesco Supply Co. Western Electric Co.

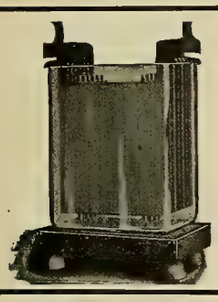
"THE STANDARD"
MOTORS-DYNAMOS-FANS
ARE WELL MADE AND YOU'LL LIKE THEM
FOR ALL DIRECT CURRENT CIRCUITS
THE ROBBINS & MYERS CO.
SPRINGFIELD, OHIO.

BOSSERT'S BOXES
Drawn steel. One blow of a hammer gives clean round hole. No filing.
SAVE TIME, BOXES AND MONEY
Be up to date. Use them. Write for bulletin giving full particulars.
Bossert Electric Construction Co., UTICA, N.Y.

RECO FLASHERS
Are easy to sell. You make a fine profit. Everybody with an electric sign wants one. Write us today for particulars and prices. Also pointers on electric signs.
Reynolds Electric Flasher Mfg. Co.
191 Fifth Ave., CHICAGO

When a man's electrical ideas flow freely; when he discusses electrical subjects intelligently and glibly, you will be pretty safe in assuming that he keeps in touch with electrical progress by perusing the Western Electrician 52 times a year.

IRON ARC LAMP POLES, BRACKETS, ETC.
THE J. L. MOTT IRON WORKS
84-90 BEEKMAN ST.
NEW YORK


RELIABLE **"Unit Accumulator"**
National Battery Company
ELECTRIC STORAGE BATTERIES
BUFFALO, N. Y.
Branch Offices:
NEW YORK, CHICAGO

AS YE SOW SO SHALL YE REAP
SOW AN ADVERTISING APPROPRIATION AND YE SHALL REAP INCREASED BUSINESS

THE NEW INCANDESCENT LAMP!

We offer you a strictly first class lamp at a reasonable price — **and that price is less than the "association price."**

It is "up to you," Mr. Lamp Buyer, to say whether the Czars of the lamp business shall dictate the price you shall pay for lamps.

Ours is a New Lamp, but we know the business. Give us a trial and we will prove our proposition so you will stay with us.

As we mean business and want your trade, we urge you to "look us up," to investigate us fully, financially and otherwise, and we, therefore, refer you to the First National Bank of Emporium, Pa., and the Farmers & Merchants Bank of St. Marys, Pa.

NOVELTY INCANDESCENT LAMP CO.
St. Marys Elk County, Pa.

Reduced Telephone Rates
IN CHICAGO

If the franchise of Chicago Telephone Company in the City of Chicago is extended, the following rates have been proposed for the Chicago Exchange.

SINGLE LINE TELEPHONES:

50 calls per month : :	$5.00
Next additional 50 calls in the month	5 cents each
Third 50 calls in the month : :	4 cents each
All calls in the month beyond 150 :	3 cents each

RESIDENCE RATES WITH UNLIMITED SERVICE:

Single line : : : :	$75.00 per annum
Two-party line : : :	60.00 per annum

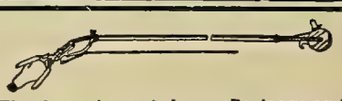
NICKEL SERVICE:

Direct line, 20 cents per day, including 4 calls
Direct line, 15 cents per day, including 2 calls
Two-party line, 15 cents per day, including 3 calls
Two-party line, 10 cents per day, including 1 call
Two-party line, residences only, 10 cents per day
Four-party line, residences only, 5 cents per day
Extension telephones : : : $1.00 per month

CHICAGO TELEPHONE COMPANY,
203 Washington Street, Chicago.

DOES THE WORK

Convenient—Non-Corrosive—Effective
We also make the famous Crolius Commutator Compound; eliminates sparking and all commutator troubles.
E. R. CROLIUS & SON
6419 Peoria Street - CHICAGO, ILL.


The Incandescent Lamp Replacer and Cleaner replaces and cleans any C. P. lamp at any height or angle.
FRANK W. MORSE
Room 301, 116 Bedford St., Boston, Mass.

EMPIRE MINIATURE LAMPS
Send for Circular
H. W. McCANDLESS & CO.
Licensed Manufacturers
67 & 69 Park Place
NEW YORK

BELDEN MAGNET WIRE
Our stock of copper and German silver magnet wire is the most complete in the west.
Try us on a rush order
Belden Mfg. Co.
CHICAGO

General Electric Company

Direct Current Circuit Protection

By Type MD2 Lightning Arresters

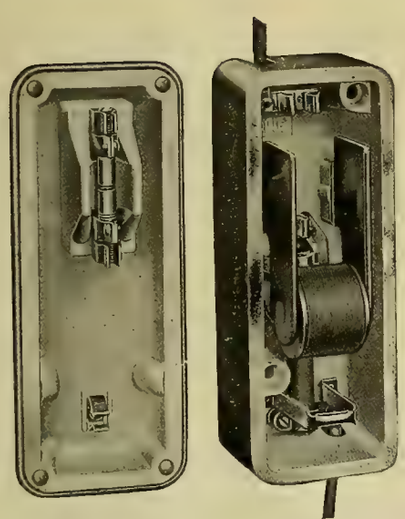
It Allows Free Static Discharge

by a straight path through the arrester to ground—the high voltage discharge cannot short-circuit the arrester.

It Enforces Rupture of Dynamic Arc

by means of a magnetic blow-out coil in shunt with a non-inductive resistance—the surest means known to science.

For years the principles involved in the design of the MD2 arrester have been recognized as the correct basis for proper protection of direct current circuits from lightning.



Cover Interior

OPERATION—Any attempt of the direct current to follow a lightning discharge to ground is at once interrupted at the spark gap by the action of the magnetic blowout, the field of which is produced by the passage of the current through the blowout coil connected in shunt with a portion of the non-inductive resistance. The blowout chute surrounding the spark gap prevents any contact of the arc with other parts of the arrester.

1042

New York Office
44 Broad Street

Principal Office
Schenectady, N. Y.

Sales Offices in
all Large Cities

INSIST ON HAVING

Edison Miniature Lamps

Because they are reliable. Cost less than any other make in the end. . . . . .

LOOK FOR THE LABEL IN THE STEM

Candelabra Lamps
Telephone Lamps
Battery Lamps

Edison Decorative and Miniature Lamp Department

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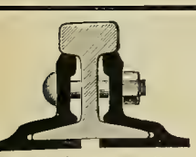

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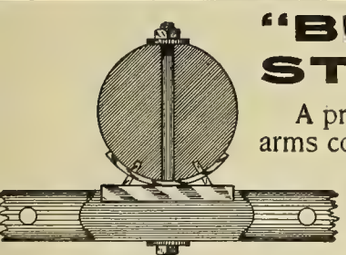

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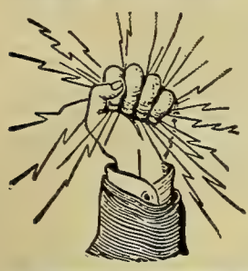

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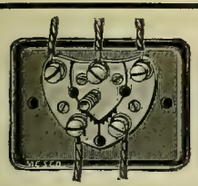

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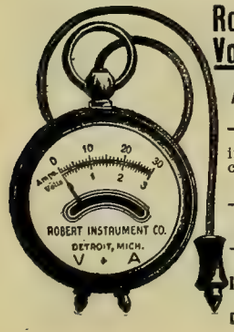

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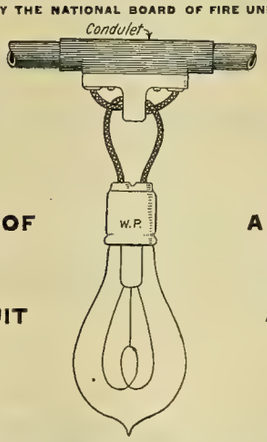

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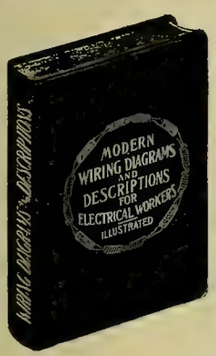

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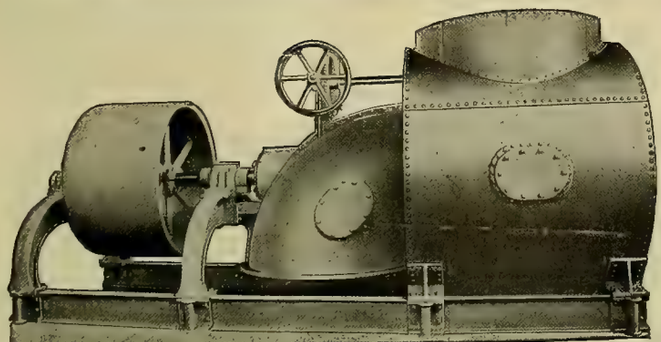

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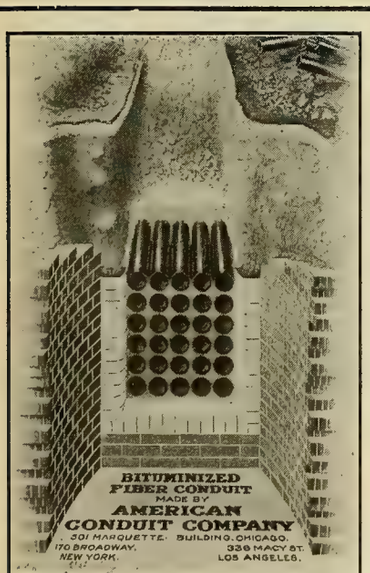

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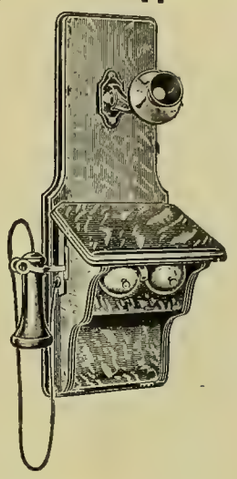

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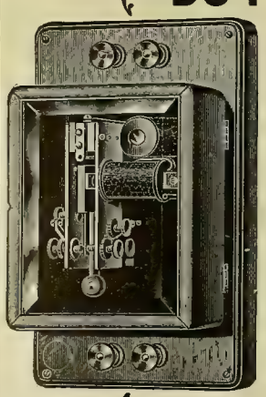

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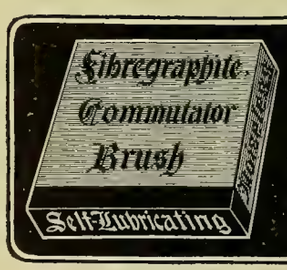

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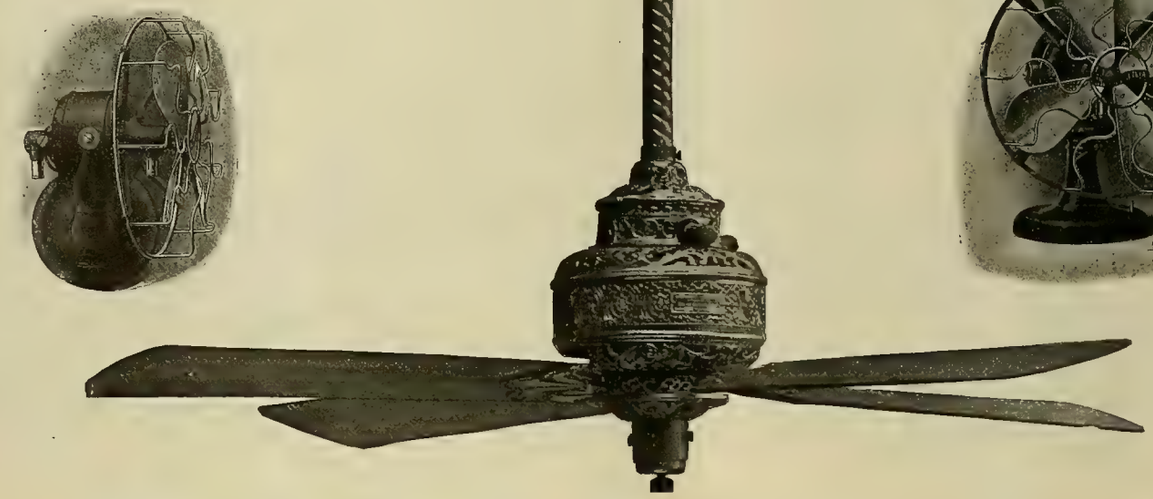

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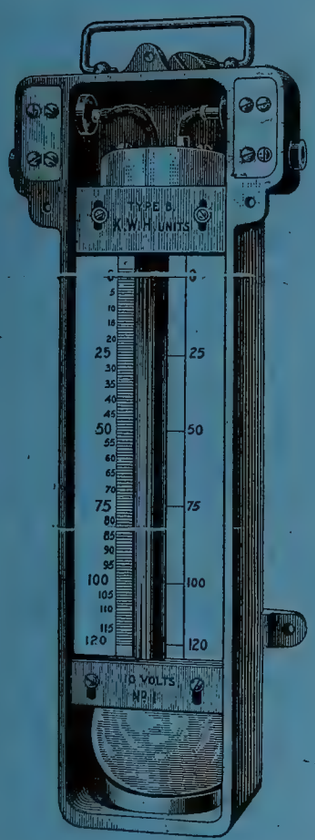

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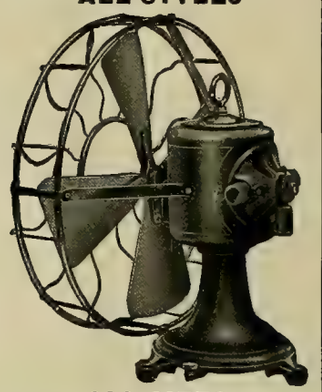

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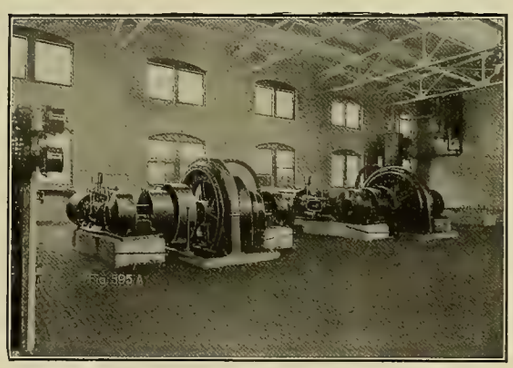

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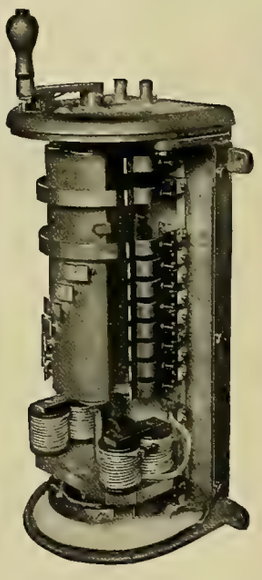

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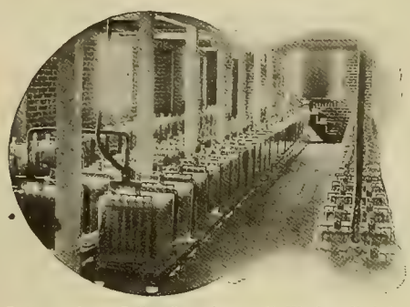

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Chicago Edison Co.
National Carbon Co.
Reisinger, Hugo.
Speer Carbon Co.
Wesco Supply Co.

Castings.
Alton Machine Co.
National Brake & Elec. Co.

Chains.
Jeffrey Mfg. Co.
Plume & Atwood Mfg. Co.

Chains, Galvanized.
Oneida Community, Ltd.

Circuit Breakers.
Cutler-Hammer Mfg. Co.
Cutter Elec. & Mfg. Co.
Ft. Wayne Elec. Wks. Inc.
Wesco Supply Co.
Western Electric Company.
Westinghouse El. & Mfg. Co.

Clamps, Ground.
Yonkers Specialty Co.

Cleats.
Blake Signal & Mfg. Co.

Clusters.
Benjamin Elec. Mfg. Co.
Plume & Atwood Mfg. Co.

Coal and Ashes Handling Machinery.
Jeffrey Mfg. Co.

Coal Mining Machinery.
Allis-Chalmers Company.

Coils and Magnets.
Acme Wire Co.
Western Electric Co.

Commutator Compound.
Crollus & Son, E. R.
McLennan & Co., K.

Condensers, Electric.
Stanley—G. I. Elec. Mfg. Co.

Conduits.
American Circular Loom Co.
American Conduit Company.
Central Electric Co.
Crouse-Hinds Co.
Gest, G. M.
McRoy Clay Works.
Osburn Flexible Conduit Co.
Wesco Supply Co.

Conduit Rods.
Cope, T. J.

Contractor, Electric Subway.
Gest, G. M.

Contractors and Electric Light Plants.
Allis-Chalmers Company.
Crocker-Wheeler Co.
Ft. Wayne Elec. Wks., Inc.
General Electric Co.
National Brake & Elec. Co.
Northern Electrical Mfg. Co.
Wagner Electric Mfg. Co.
Wesco Supply Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.

Controllers.
Cutler-Hammer Mfg. Co.
Schureman Co., J. L.

Cord.
Ajax Line Material Co.
Belden Mfg. Co.
Runzel-Lenz Elec. Mfg. Co.
Samson Cordage Wks.

Cross-Arms, Pins and Brackets.
Berthold & Jennings.
Central Electric Co.
Maine Hub Mfg. Co.
Manhattan Elec. Supply Co.
Wesco Supply Co.
Western Electric Company.

Cut-Outs and Switches.
Bissell Co., The F.
Bossert Elec. Const. Co.
Central Electric Co.
Chicago Edison Co.
Crouse-Hinds Co.
Cutter Elec. & Mfg. Co.
Ft. Wayne Elec. Wks. Inc.
General Electric Co.
Hart Manufacturing Co.
Manhattan Elec. Supply Co.
Sorensen, P.
Switchboard Equipment Co.
Wesco Supply Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.

Drills, Electric.
Chicago Pneumatic Tool Co.

Drying Machinery.
Alton Machine Co.
Devine Co., Joseph P.

Dynamos and Motors.
Allis-Chalmers Company.
Bissell Co., The F.
Central Electric Co.
Century Electric Co.
Crocker-Wheeler Co.
Ft. Wayne Elec. Wks. Inc.
General Elec. Co.
Gregory Electric Co.
National Brake & Elec. Co.
Northern Electrical Mfg. Co.
Robbins & Myers Co.
Stanley—G. I. Elec. Mfg. Co.
Stow Manufacturing Co.
Wagner Electric Mfg. Co.
Wesco Supply Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.

Electric Heating Appl.
Simplex Elec. Heating Co.
Western Electric Co.

Electric Railways.
Allis-Chalmers Co.
General Electric Co.
Westinghouse El. & Mfg. Co.

Electrical and Mechanical Engineers.
Arnold Co., The.
Badt, F. B.
Baker & Co., W. E.
Butterfield Construction Co.
Byllesby & Co., H. M.
Humphrey, Henry H.
Hunt & Co., Robt. W.
Hydro-Elec. Development Co
Jackson, D. C. & W. B.
Kohler Brothers.
Northern Electrical Mfg. Co.
Ruebel & Wells.
Sargent & Lundy.
Schott, W. H.
Stanley—G. I. Elec. Mfg. Co.
Willis, G. M.

Electrical Instruments. (Recording and Testing.)
Bissell Co., The F.
Central Electric Co.
Diamond Meter Co.
Duncan Elec. Mfg. Co.
Ft. Wayne Elec. Wks. Inc.
General Electric Co.
Helios Mfg. Co.
International Elec. Meter Co.
Machado & Roller.
Pignolet, L. M.
Stanley—G. I. Elec. Mfg. Co.
Wagner Electric Mfg. Co.
Wesco Supply Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.
Weston Electrical Inst. Co.

Electro-Magnets.
Acme Wire Co.

Electro-Plating Mach'y
Crocker-Wheeler Co.
General Electric Co.

Elevators—Conveyors.
Jeffrey Mfg. Co.

Enameled Rings.
Star Expansion Bolt Co.

Engines, Gas, Gasoline and Oil.
Allis-Chalmers Company.
American Diesel Engine Co.
Otto Gas Engine Works.
Westinghouse Machine Co.

Engines, Steam.
Allis-Chalmers Company.
Buckeye Engine Co.
Westinghouse Machine Co.

Fans and Fan Motors.
Central Electric Co.
Century Electric Co.
Crocker-Wheeler Co.
Edison Mfg. Co.
General Electric Co.
Robbins & Myers Co.
Wesco Supply Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.

Fibre.
Kartavert Mfg. Co.
Vulcanized Fibre Co.

Field Coils.
Acme Wire Co.

Fittings.
Plume & Atwood Mfg. Co.

Fixtures, Adjustable.
Morse, Frank W.

Fixtures, Gas and Elec.
Beardslee Chandelier Mfg. Co.
Williamson & Co., R.

Flashers.
Bissell Co., The F.
Haller Machine Co.
Reynolds El. Flasher Mfg. Co.
Wesco Supply Co.

Flexible Shafts.
Stow Mfg. Co.

Fuses and Fuse Wire.
Bissell Co., The F.
Central Electric Co.
Chicago Fuse Wire & Mfg. Co.
D. & W. Fuse Company.
Manhattan Elec. Supply Co.
Wesco Supply Co.
Western Electric Company.

German Silver, Sheet and Wire.
Seymour Mfg. Co.

Globes, Reflectors and Shades.
Haller Machine Co.
Phœnix Glass Co.
Wesco Supply Co.
Western Electric Co.

Governors, Water Wheel and Steam Turbine.
Allis-Chalmers Co.
Ludlow Valve Co.

Graphite Specialties.
Dixon Crucible Co., Jos.
Holmes Fibre-Graphite Co.

Heating (Exhaust Steam).
Amer. District Steam Co.

Holders, Inc. Lamps.
Morse, Frank W.

Hydraulic Machinery.
Alton Machine Co.
Allis-Chalmers Company.

Indicators.
Robertson & Sons, Jas. L.

Induction Coils.
Acme Wire Co.

Inspection & Insurance
Hartford Steam Boiler Inspection & Insurance Co.

Insulating Machinery.
Alton Machine Co.

Insulators and Insulating Materials
American Electrical Works.
Central Electric Co.
Chicago Edison Co.
Indiana Rub. & Ins. Wire Co.
Kartavert Mfg. Co.
Manhattan Elec. Supply Co.
Mica Insulator Co.
Munsell & Co., Eugene.
National India Rubber Co.
New York Insulated Wire Co
Okonite Co., The.
Phillips Insulated Wire Co
Simplex Electrical Co.
Standard Underground C. Co.
Vulcanized Fibre Co.
Wesco Supply Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.

Lamps, Arc.
Bissell Co., The F.
Central Electric Co.
Ft. Wayne Elec. Wks. Inc.
General Electric Co.
Gregory Electric Co.
Manhattan Elec. Supply Co.
Stanley—G. I. Elec. Mfg. Co.
Wesco Supply Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.

Lamp Guards.
Benjamin Elec. Mfg. Co.
Morse, Frank W.

Lamps, Incandescent.
Bissell Co., The F.
Buckeye Electric Company.
Central Electric Co.
Chicago Edison Co.
Columbia Incan. Lamp Co.
Edison Decorative & Miniature Lamp Dept.
General Electric Co.
McCandless, H. W
Monarch Elec. Mfg. Co.
Novelty Incan. Lamp Co
Sawyer-Man Elec. Co.
St. Marys Incand. Lamp Co.
Standard Elect'l. Mfg. Co.
Wesco Supply Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.

Lamps, Incandescent—Replacers & Cleaners.
Morse, Frank W

Letters, Metal, Sign.
Haller Machine Co.

Lightning Arresters.
Central Electric Co.
Ft. Wayne Elec. Wks. Inc.
General Electric Co.
Manhattan Elec. Supply Co.
Stanley—G. I. Elec. Mfg. Co.
Wesco Supply Co.
Western Electric Co.

Line Material.
Ajax Line Material Co.

Linemen's Climbers.
Klein & Sons, Mathias.

Magnets, Autom. Wound
Acme Wire Co.

Magnet Wires.
(See Wires and Cables.)

Mica.
Chicago Mica Co.
Mica Insulator Co.
Munsell & Co., Eugene.

Mining Apparatus, Elec.
Allis-Chalmers Company.
Crocker-Wheeler Co.
General Electric Co.
Jeffrey Mfg. Co.
Wesco Supply Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.

Mining Machinery.
Allis-Chalmers Company.

Model and Machine Shop.
Hoffmann, Emil R.

Motors (See Dynamos and Motors)

Nippers and Pliers.
Klein & Sons, Mathias.

Patent Attorneys.
Bain, Foree & May.

Phosphor Bronze.
Phosphor Bronze Sm. Co. Ltd.
Seymour Mfg Co.

Pipe Bending Machines.
Chicago Pneumatic Tool Co.
Wrigley Co., Thos.

Platinum, Wire and Sheet.
Baker & Co. Inc.

Poles, Arc Lamp.
Mott Iron Works, J. L.

Pole Changers,
Sandwich Pole Changer Co.

Poles and Ties.
Abeles & Taussig.
Berthold & Jennings.
Bissell Co., F. The
Bruer, Will F.
Fowler & Co., John H.
Kellogg Switch. & Sup. Co.
Lindsley Bros. Co., The
Loud's Sons Co., H. M.
Moss Tie Co.
Mueller Company, William.
Pacific Coast Pole Co.
Perrizo & Sons.
Porter Cedar Company.
Sterling & Son, W. C.
Torrey Cedar Co.
Western Lumber & Pole Co.
Wilson Co., Jas. I. M.
Worcester Co., C. H.

Polish (Metal).
Hoffman, Geo. W.

Portables.
Plume & Atwood Mfg. Co.

Power Transmission Machinery.
Allis-Chalmers Company.
Jeffrey Mfg. Co.

Rail Joints.
Rail Joint Company, The

Railway Supplies.
Wesco Supply Co.

Re-Winding—Repairs.
Chicago Edison Co.
Gregory Electric Co.

Rheostats.
Cutler-Hammer Mfg. Co.
General Electric Co.
Wesco Supply Co.
Western Electric Co.
Westinghouse El. & Mfg. Co

Rosettes.
Pass & Seymour.

Rubber Machinery.
Alton Machine Co.

Schools and Colleges.
Highland Park College.
Michigan College of Mines
Pratt Institute.

Second-Hand Machin'y.
Bissell Co., The F.
Gregory Electric Co.
Matthews & Bro., W. N.
Rossiter, MacGovern & Co.

Signs, Electric.
Haller Machine Co.

Sleeving, Braided.
Belden Mfg. Co.

Solder, Self Fluxing.
Belden Mfg. Co.

Soldering Sticks, Salt and Paste.
Crollus & Son, E. R.
Western Electric Co.

Solenoids.
Acme Wire Co.
Schureman Co., J. L.

Spark Coils.
Acme Wire Co.

Speaking Tubes.
Central Electric Co.
Manhattan Elec. Supply Co.
Ostrander & Co., W. R.
Wesco Supply Co.
Western Electric Co.

Specialties, Electrical Mfrs. and Designers.
Haller Machine Co.

Speed Indicators.
Niagara Tachometer & Instrument Co.
Weston Electrical Inst. Co.

Speed Recorders.
Niagara Tachometer & Instrument Co.

Springs.
Manross, F. N.

Staples.
Blake Signal & Mfg. Co.

Steel Gains.
Steel Gain Mfg. Co.

Stokers.
Westinghouse Machine Co.

Storage Batteries.
American Battery Co.
Chicago Pneumatic Tool Co
Electric Storage Battery Co.
General Storage Battery Co.
Gould Storage Battery Co.
Hensel & Co., John A.
National Battery Co.
Willard Storage Bat. Co.

Supplies, General Elec.
Amer. Elect'l Supply Co.
Bissell Co., The F.
Central Electric Co.
Century Electric Co.
Chicago Edison Co.
Manhattan Elect'l Supply Co
Wesco Supply Co.
Western Electric Co.

Switches.
(See Cut-outs and Switches.)

Tachometers and Tachographs.
Niagara Tachometer and Instrument Co.

Telephones, Telephone Material and Switchboards.
American El. Telephone Co
Automatic Electric Co.
Bissell Co., The F.
Central Electric Co.
International Tel. Mfg. Co.
Kellogg Switchb. & Sup. Co.
Manhattan Elec. Supply Co.
North Electric Co.
Stromberg-Carlson Tel. M. Co.
Wesco Supply Co.
Western Electric Co.

Telephone Service.
Chicago Telephone Co

Time Switches.
Bissell Co., The F.

Toggle Bolts.
(See Bolts, Toggle.)

Tools.
Klein & Sons, Mathias.

Tools, Pneumatic.
Chicago Pneumatic Tool Co.

Torches.
Zeidler Lamp & Brass Co.

Transformers.
Allis-Chalmers Company.
Central Electric Co.
Crocker-Wheeler Co.
Ft. Wayne Elec. Works, Inc.
General Electric Co.
Kuhlman Electric Co.
La Fayette Elect'l. Mfg. Co.
National Brake & Elec. Co.
Stanley—G. I. Elec. Mfg. Co.
Wagner Electric Mfg. Co.
Wesco Supply Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.

Trucks, Electric Car.
General Electric Co.
Westinghouse El. & Mfg. Co.

Turbines, Steam.
Allis-Chalmers Co.
General Electric Co.
Westinghouse Machine Co.

Turbine Water Wheels.
Allis-Chalmers Co.
Leffel & Co., Jas.

Vacuum Drying.
Devine Co., Joseph P.

Vulcanized Fibre.
Vulcanized Fibre Co.

Wattmeters.
Duncan Elec. Mfg. Co.
Wesco Supply Co.

Wire Rope Machinery.
Alton Machine Co.

Wires and Cables—Magnet Wires.
Acme Wire Co.
American Electrical Works.
Belden Mfg. Co.
Bissell Co., The F.
Central Electric Co.
Chicago Ins. Wire & Mfg. Co.
Crescent Ins. Wire & Cble. Co.
Driver-Harris Wire Co.
General Electric Co.
Hazard Manufacturing Co.
Indiana Rub. & Ins. Wire Co.
India Rubber & Gutta Percha Insulating Co.
Kellogg Switch. & Sup. Co.
Manhattan Elec. Supply Co.
Marion Ins. Wire & Rub. Co.
National India Rubber Co
New York Insulated Wire Co.
Okonite Co., The.
Phillips, Eugene F.
Phillips Insulated Wire Co
Roebling's Sons Co., J. A.
Runzel-Lenz Elec. Mfg. Co.
Safety Ins. Wire & Cable Co.
Simplex Electrical Co.
Standard Underground Cable Co,
Wesco Supply Co.
Western Electric Company.

For Alphabetical Index of Advertisements See Page 8.

WILLARD STORAGE BATTERIES

FOR ALL PURPOSES

Manufactured by

THE WILLARD STORAGE BATTERY CO.

CLEVELAND, OHIO

RELIABLE "Unit Accumulator"

National Battery Company

ELECTRIC STORAGE BATTERIES

BUFFALO, N. Y.

Branch Offices:
NEW YORK, CHICAGO

IF YOU ARE INTERESTED IN STORAGE BATTERIES IT WILL PAY YOU TO

WRITE! WRITE!! WRITE!!!

And Learn the Merits and Details of the MUCH CONTESTED BUT VICTORIOUS

HENSEL STORAGE BATTERY

JOHN A. HENSEL & CO., 11 and 13 ELDREDGE COURT, Near Michigan Avenue CHICAGO

IT IS SAID THAT GLADSTONE SAID:

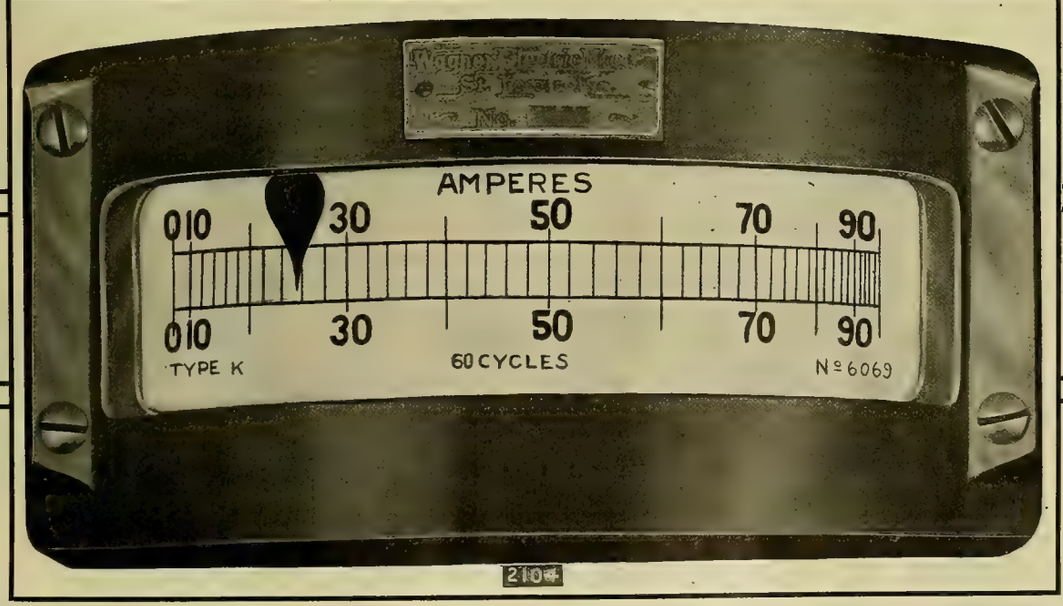
"ONLY A MINT CAN MAKE MONEY WITHOUT ADVERTISING"

IT IS TRUE, WHETHER GLADSTONE SAID IT OR NOT.

Wagner Electric Mfg. Company

Main Office and Factory: ST. LOUIS, U. S. A.

SWITCHBOARD INSTRUMENTS OF PRECISION



TYPES

- Horizontal Edgewise
- Flush or Back of Board Mounting
- Vertical Edgewise
- Illuminated
- Non-Illuminated
- Fan Shape
- Large and Small Round Type

OUR line of Switchboard Instruments is complete. They fill in every respect the requirements of the most exacting engineers. Switchboard builders will find these Instruments handsome in appearance, absolutely accurate. We are carrying a large stock of standard instruments ready for immediate shipment.

EVERY CONTRACTOR SHOULD HAVE A COPY OF OUR BULLETIN 67-D.

The Amusing "Insides" of the Organization

You, Mr. Lamp Buyer, cannot of course see all the comical things that happen on the "other side"---the "inside" ---as has the undersigned.

Stop for a moment and Look! Read!! Think!!!

Have you ever been told of the Herculean struggles of the prime movers of the "Organization," ever since its incep. tion, to keep up "good feeling" and knit the members of the "Organization" closer and closer together, not only in a business sense but in a social sense as well (for there is constant grumbling, you know, around the "Inner Circle," and the "Inner Circle" has no easy job!)?

We have already reminded you in these advertisements of the vast amount of money that the undersigned has seen the Organization spend for junkets, with their accompanying amusements, etc., in efforts to "keep together" the "boys"--- at your expense.

But what would amuse you most, could you appear at a lamp organization meeting (as has been the pleasure of the undersigned), would be to hear the great "Napoleons"---the "Czars of the Lamp Industry,"---making a point of calling each other by their first names, "Tom," "Dick," "Harry," etc.

Think of the King of England addressing the Kaiser of the Empire of Germany with "Hello, Bill, come and have a beer with us!"

Why, the thought is almost tragic in its nature!

Here you naturally ask why we call this to your attention---"What is that to us?" we hear you say.

A very natural query on your part and we take pleasure in answering it: The "Organization" recognizes the enormously important bearing of the "personal equation" in the maintenance of the integrity of the Organization. In a word, it is highly essential that a very close, satisfactory personal relation be maintained and constantly fostered among all the members.

To the outsider it is merely amusing to hear of the "jollying," and the "Tom," "Dick" and "Harry." But to the thinker all this simply means that the lamp "Organization" realizes that it has one of the most difficult propositions in which to maintain harmony that has ever arisen in the electrical business. It has, for a long time, been most successful in maintaining its foundation and in keeping the price of incandescent lamps at a higher figure than should be charged, and this "jollying," strange though it may seem, has played no trifling part in the support of this harmony.

This Organization now has you "down," Mr. Lamp Buyer, it knows it, and it is "rubbing it in" at "16 cents to 18 cents per," and this knitting by "jollying" and otherwise, this "personal welding" of what would likely be warring lamp fac- tions, is one of the several chief elements that go to constitute the present fine "front" or "bluff" of this organization.

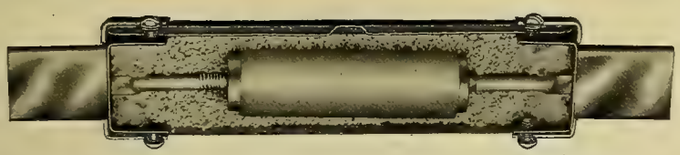
Buy your lamps from us, and you will do more than you ever dreamed to break up that "sweet harmony" for the maintenance of which you "pay the freight."

St. Mary's Incandescent Lamp Company
Wm. M. Rothschild - Pres
St. Mary's, Pa.
— Let us quote you —
P.S. 6000 Lamps daily capacity -
We protect buyers against litigation -
Penna. Corporation — Capital Stock, $100.000.

General Electric Company

G. E. Enclosed Fuses

National Electrical Code Standard



Sectional View of Knife Blade Type, 600 Volts Enclosed Fuse

Sectional View of Knife Blade Type, 250 Volts Enclosed Fuse.

Electrically Accurate

FUSE STRIPS—The fuse strips are die stamped to gauge and always contain just the right amount of metal, which insures accuracy of fusing.

GRANULAR FILLER—This form of filler allows the distribution of the gases throughout the tube, minimizing the pressure exerted on any one point.

VISIBLE INDICATIONS—Evidence of a ruptured fuse is doubly visible in the broken indicator wire on the outside of the tube and the blackened white paper target underneath the wire.

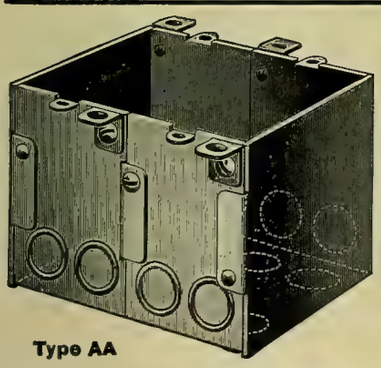
SAFE ALWAYS—Exhaustive tests under the most severe service show quiet rupturing of the arc at the prescribed rating of the fuse, with no fire hazard.

1067

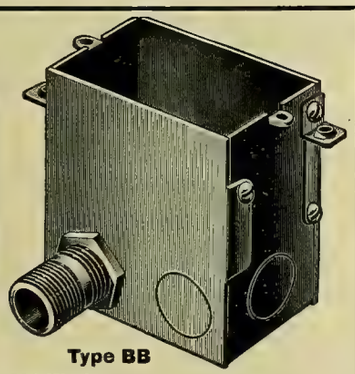
Chicago Office
Monadnock Bldg.

Principal Office
Schenectady, N. Y.

Sales Offices in
All Large Cities



Type AA



Type BB

For New and Old Work

UNION OUTLET SWITCH BOX

PATENTS PENDING

Approved by the Underwriters National Electrical Association. Takes all Standard Switches and Receptacles

Designed so that a **two-gang** box can be converted into any number of gangs by releasing the clamping screws and inserting "Spacers." These gangs are easily assembled with the aid of a screwdriver, and fit together snugly, making a perfect and solid gang box for any required number of switches.

CHICAGO FUSE WIRE & MFG. CO.

NEW YORK CHICAGO BUFFALO

ELECTRO-MAGNETS

WOUND BY AUTOMATIC MACHINE

ACME WIRE CO., NEW HAVEN, CONN.

NEW YORK OFFICE: 26 COURTLANDT ST.

LICENSEES OF THE VARLEY DUPLEX MAGNET CO

THE NIGHT SHIFT

COLUMBIA CARBONS

THEY WILL LIGHTEN YOUR LIGHTING TROUBLES. GIVE THEM A TRIAL. NATIONAL CARBON COMPANY CLEVELAND, O.

LET

EDISON LAMPS

Do Your Lighting

They cost less than all others in the end.

LOOK FOR THE LABEL IN THE STEM

Over 25 Millions Annually Sold

GENERAL ELECTRIC COMPANY

All types and varieties.
Regular Multiple Lamps.
Street Series Lamps.
Miniature Lamps.

Main Lamp Sales Office,
HARRISON, N. J.
(511)

The insulation is the most important part of your machine—be sure you buy only the best. Cheap insulation cannot be good insulation.

IF IT'S MICABOND YOU CAN BE SURE YOU HAVE THE BEST—OUR GUARANTEE IS BEHIND IT

CHICAGO MICA CO. : : : Valparaiso, Ind.

"Diamond H" Switches

Trade H Mark

This Trade-Mark guarantees quality.

The Hart Mfg. Co., Hartford, Conn.

New York Boston Chicago Toronto, Ont.

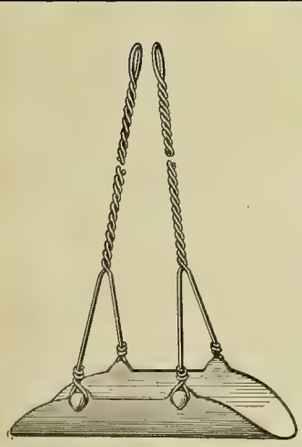
WORKS QUICK AND EASY. KEEPS ITS LUSTER. HOLDS OLD TRADE AND MAKES NEW. DOES NOT DETERIORATE. ESTABLISHED 16 YEARS. SOLD BY AGENTS AND DEALERS ALL OVER THE WORLD.

U.S. METAL POLISH 3 Ounce Box 10 Cents. Samples Sent Free.

GEO. W. HOFFMAN

POLISHES ALL METALS. BRANCHES 115 NASSAU ST., NEW YORK, CHICAGO, SAN FRANCISCO. 295 E. WASHINGTON ST., INDIANAPOLIS, IND.

HIGHEST AWARD, CHICAGO WORLD'S FAIR, 1893. LOUISIANA PURCHASE EXPOSITION 1904.



NOTICE

This is the

Holden Anchor

It always pulls square in the earth and never pulls out.
We make Anchors 5¾x10 in. to 10x30 in.
One man can install the anchors in 20 to 30 minutes.
Write us for prices.

The Holden Anchor Co.
DES MOINES, IOWA

ADAMS SECONDARY GENERATOR

is a money-saver and a practical device for operating annunciator systems, gaslighters and bells of all kinds, absolutely **without expense** after once installed. Wherever an all-day alternating is available this instrument can be employed to immense advantage. Write for bulletin.

"EVERYTHING ELECTRICAL"

WESCO

THE WESCO SUPPLY CO.

Ft. Worth, Texas ST. LOUIS, MO.

MICA INSULATION

Of all Qualities, in any Form at Lowest Prices

That Is.

EUGENE MUNSELL AND CO.
NEW YORK and CHICAGO

Micanite, Linotape, M. I. C. Compound, Empire Cloth and Paper. For Years the Standard.

MICA INSULATOR CO., Originators
NEW YORK and CHICAGO

BIJUR "HIGH-DUTY" BIJUR

General Storage Battery Co.

42 BROADWAY, N. Y.

Electric Heating Apparatus

SEND FOR 82-PAGE CATALOGUE

"UNIT" ENAMELED RHEOSTATS

SIMPLEX ELECTRIC HEATING CO.
Cambridgeport, Mass.

3-in-1 VOLT-AMMETERS

Measure low and high voltages, besides amperes and ordinary resistances. They are inexpensive and reliable. Send for catalog of portable and switchboard voltmeters and ammeters.

L. M. PIGNOLET
78-80 Cortlandt St. New York

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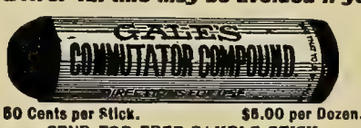
Reduces the working capacity of a motor or dynamo, wears out the commutator, wastes power and may cause a fire. All this may be avoided if you use . . . . . .



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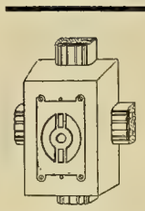

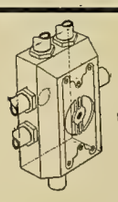

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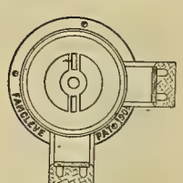

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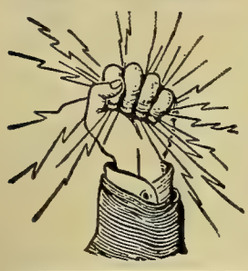

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The proposals are invited on the following divisions of work:

Division A—Switchboards and instruments.
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Each bid must be accompanied by a certified check or cash to the amount of 5 per cent of the total amount of the proposal. All certified checks must be drawn on some responsible bank doing business in the city of Chicago and must be made payable to the clerk of the Sanitary District of Chicago. Said amount of 5 per cent deposited with said bid will be held by the Sanitary District until all of the respective bids for said work have been canvassed and the contract awarded and signed. The return of said check or cash to the bidder to whom the award of said work shall have been made will be conditioned upon his appearing within ten days after receiving notice of such award with bondsmen and executing a contract with the Sanitary District for the work so awarded and giving a bond satisfactory to the board of trustees for the fulfillment of the contract for the work above mentioned in the amount of fifty per cent of the contract price.

All bids must be made in accordance with the plans and specifications of the Sanitary District and upon blank forms furnished by said district.

Bidders are required to state in their bids their individual names and places of residence in full.

The board of trustees reserves the right to reject any and all bids.

THE SANITARY DISTRICT OF CHICAGO.
By ROBERT R. McCORMICK, President.
Attest: I. J. BRYAN, Clerk.
Chicago, July 25, 1906.

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A certified check, or bidder's guarantee bond, of 5 per cent of the amount of the bid, payable to the City Treasurer, must accompany each proposal. Successful bidder must give bond to the amount of 50 per cent of the contract awarded him. The city reserves the right to reject any or all bids or to accept any bid without explanation, or to accept only portions of the bid.

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The Small Central Station

Practical Hints on Its Construction and Operation

The scope of this eminently practical work, written by experienced authorities on the subject, is well indicated by the list of chapter headings:

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XV. Cost of Plants.
XVI. General Data.

The articles supply data relating to small and medium-sized stations using overhead construction, and are especially adapted for intending purchasers of electric-light plants and practical men. Within this field the ground is thoroughly covered in view of the requirements of the best modern practice. Operations and construction are dealt with at length, and the information given has been compiled from the experiences reported by central station managers operating in all parts of the United States, handling various types and sizes of machinery. The series will be enriched with **numerous illustrations, diagrams and tables.**

These articles will be of much value to all readers of the Western Electrician, new and old, interested in the practical operation of electric-light plants.

REMEMBER that this noteworthy series on **Electric Light Plants** began in the July 7th issue of the Western Electrician, and will run for from four to six months.

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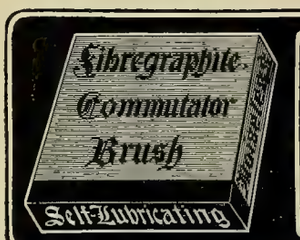

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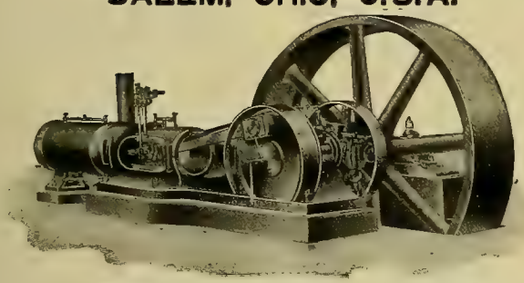

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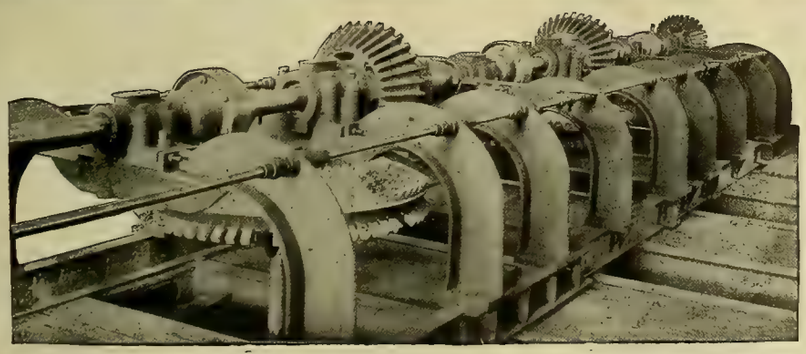

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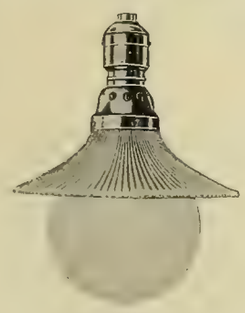

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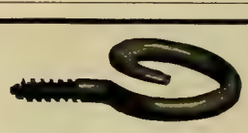

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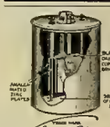

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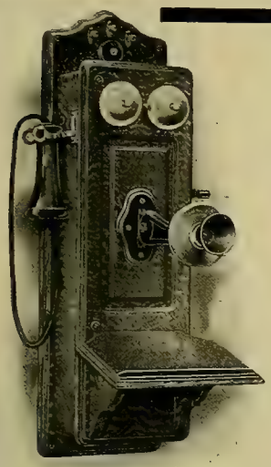

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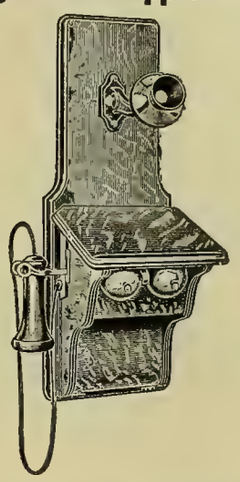

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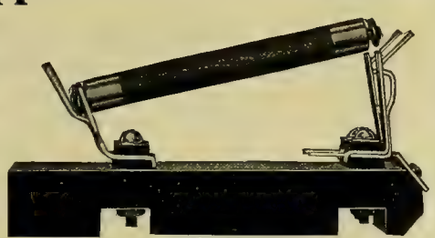

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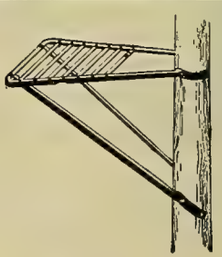
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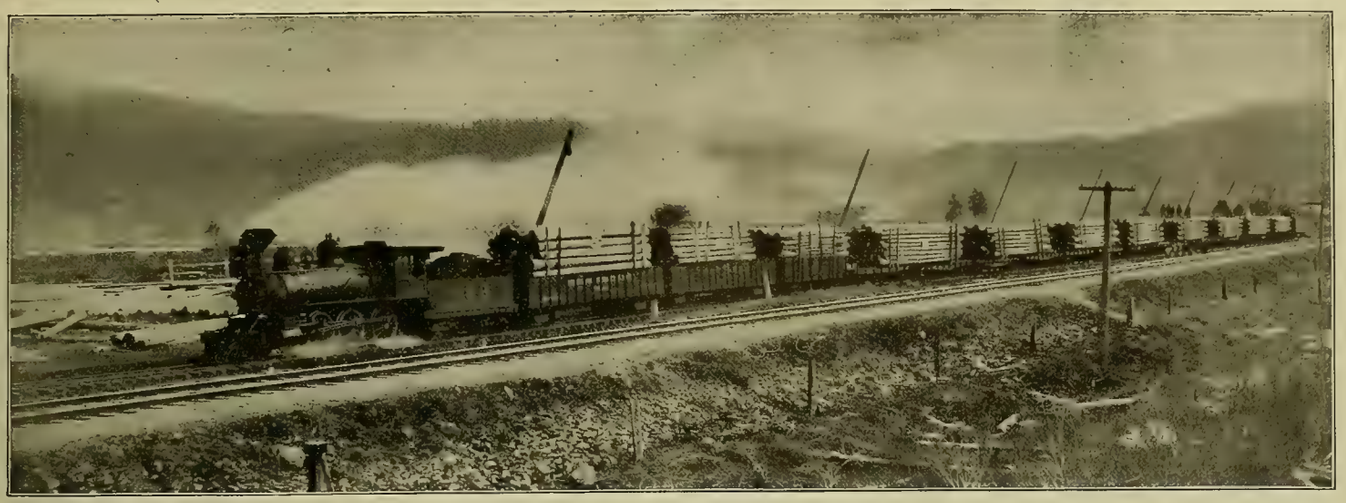

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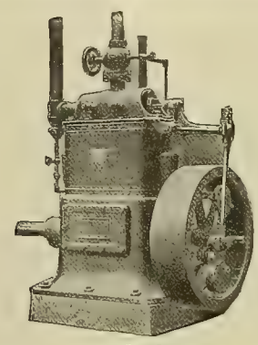
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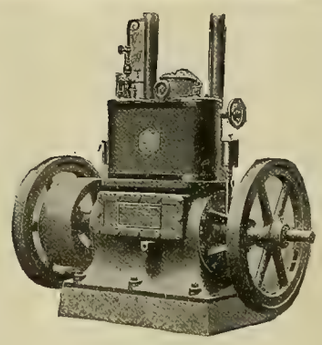
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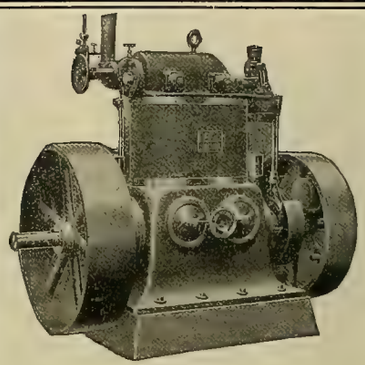
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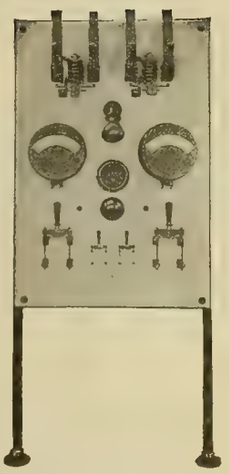
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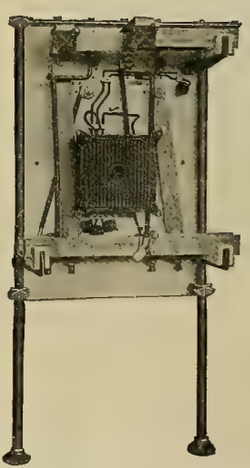
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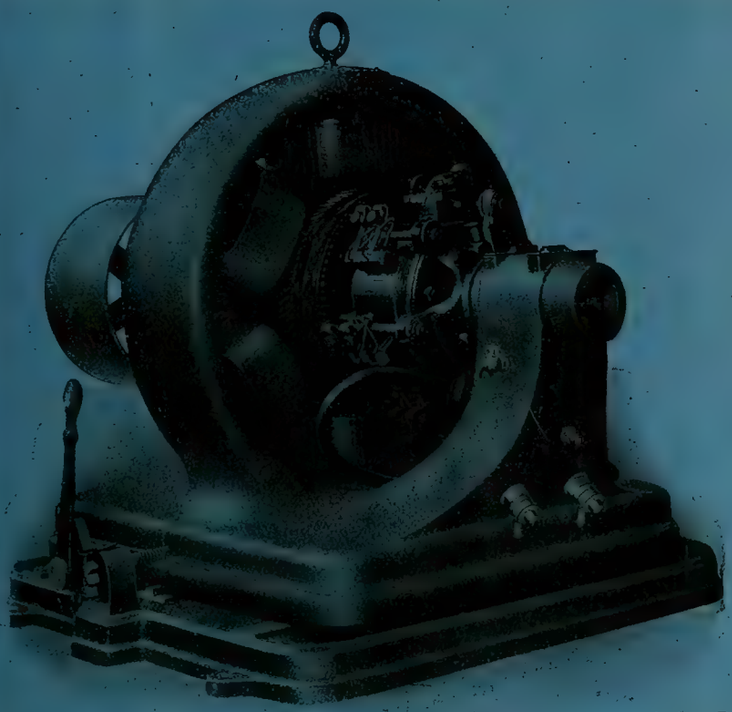

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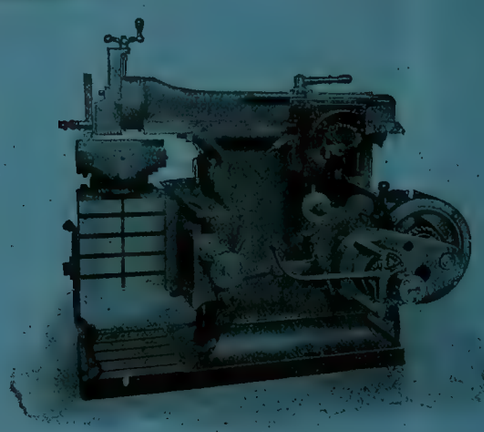

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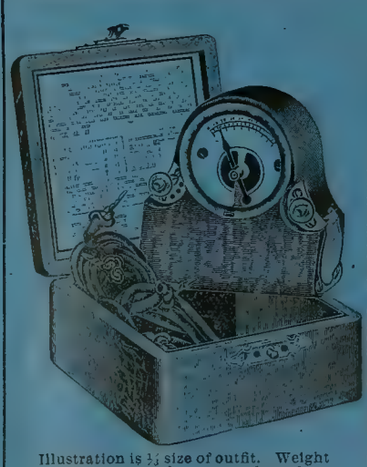

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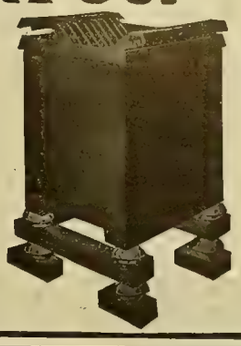

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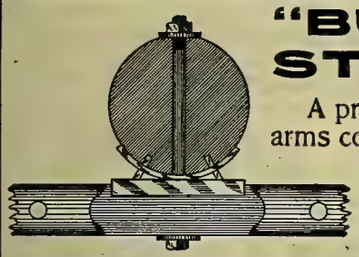

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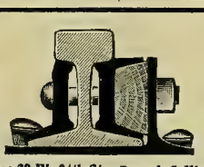

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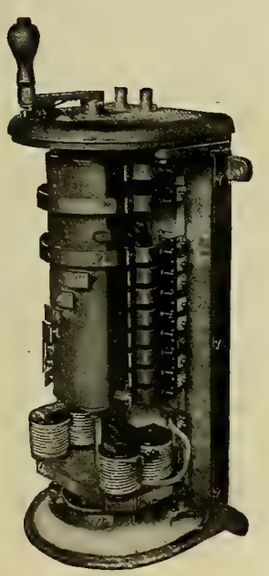

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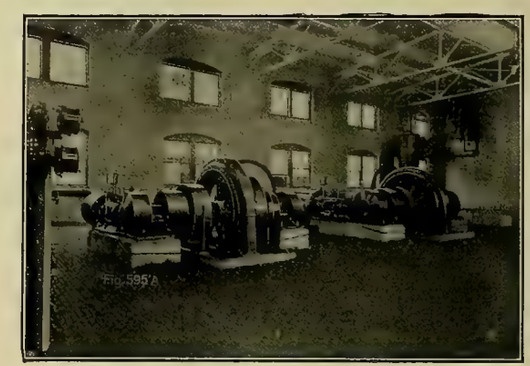

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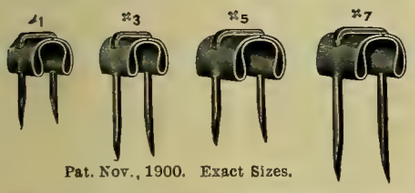

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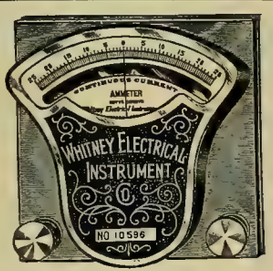

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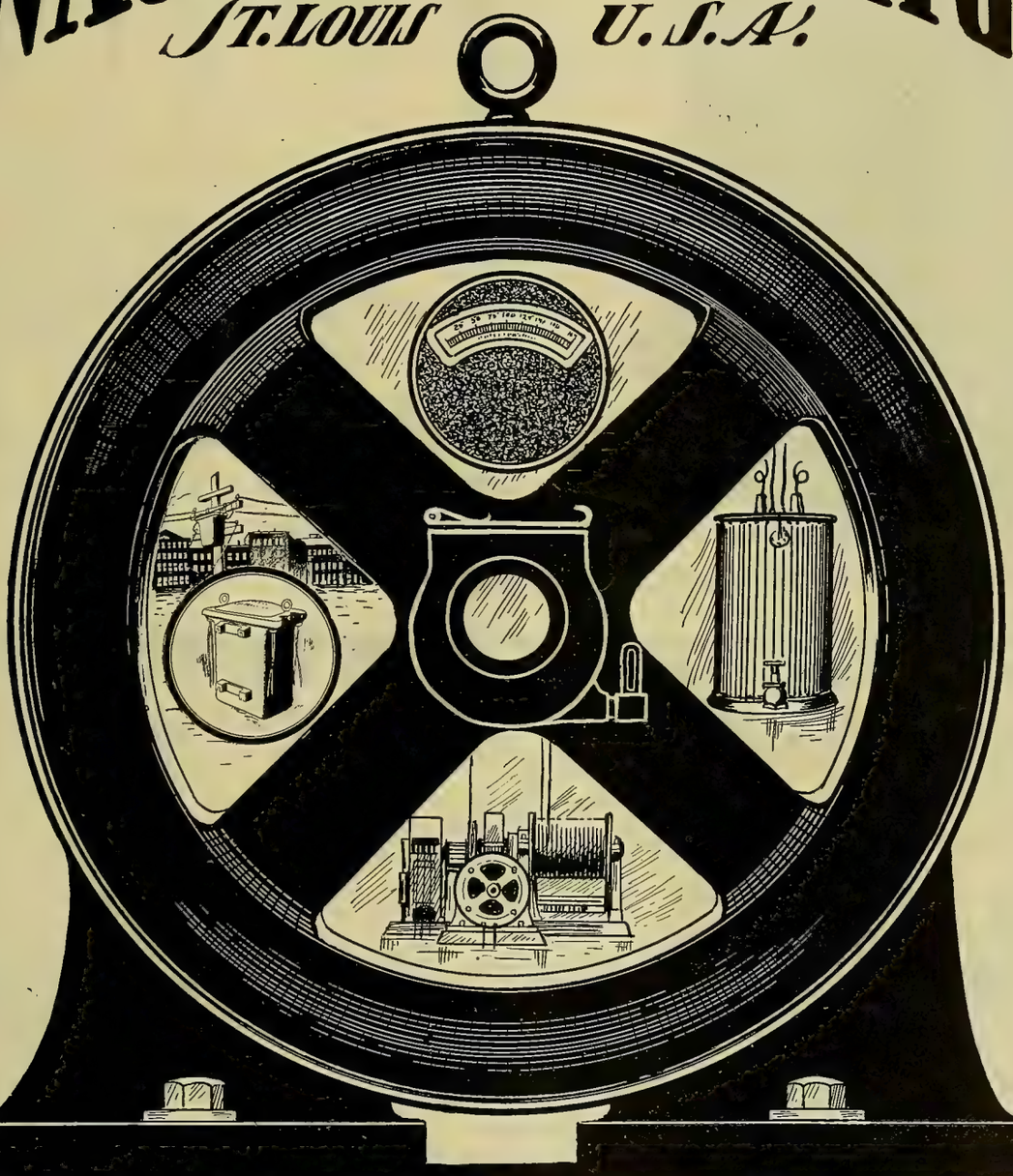

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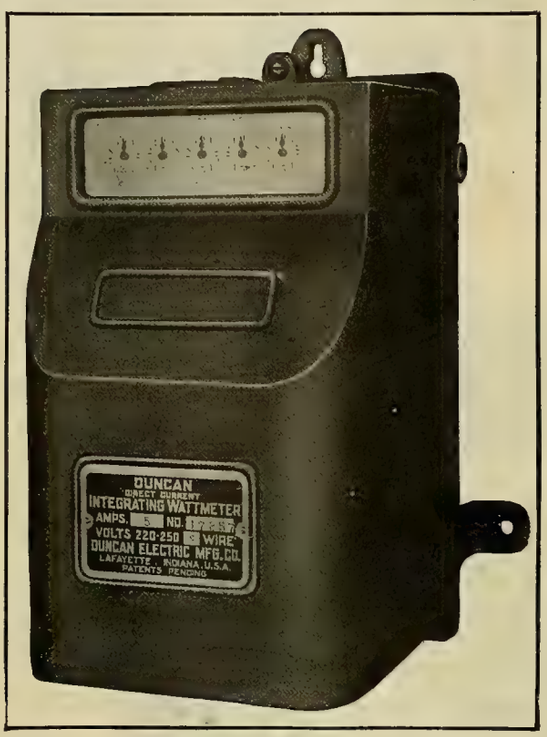

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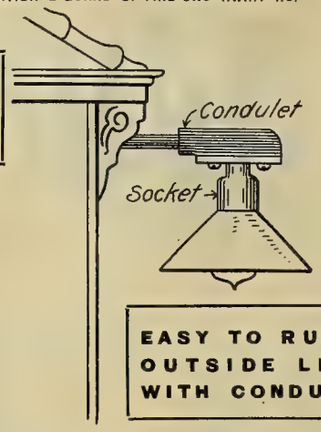

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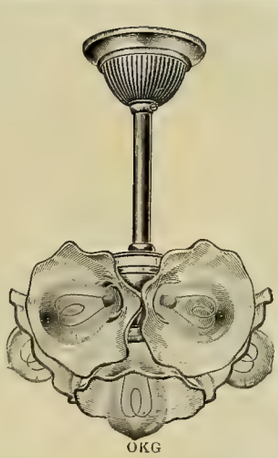
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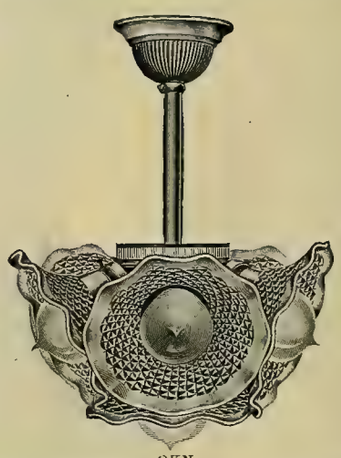
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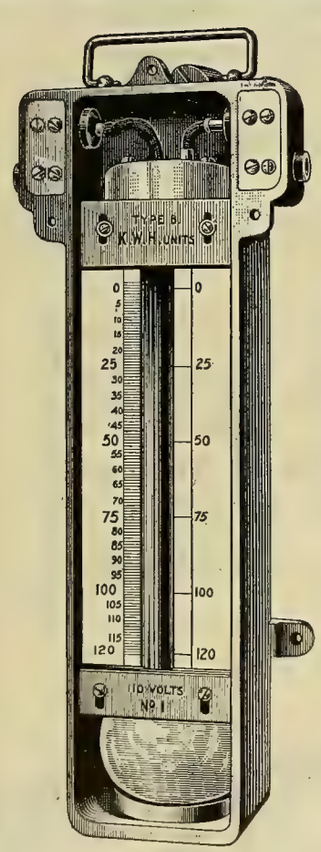

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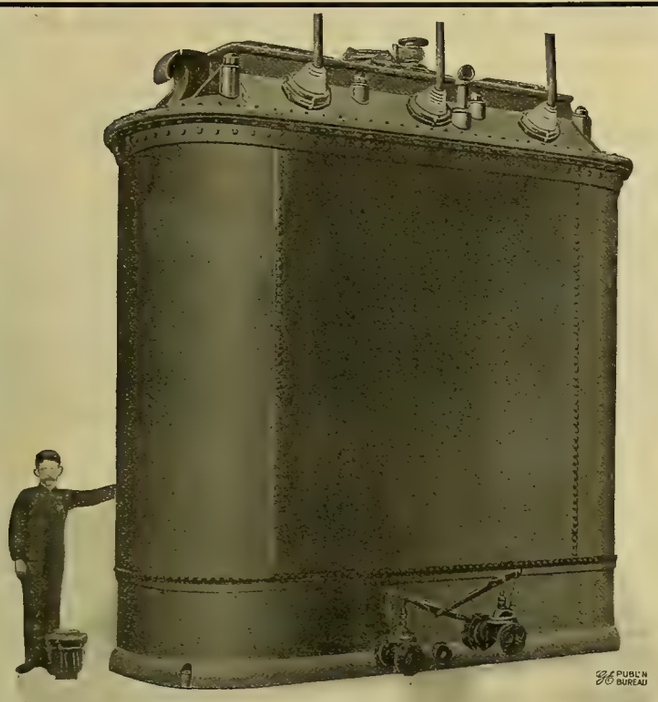

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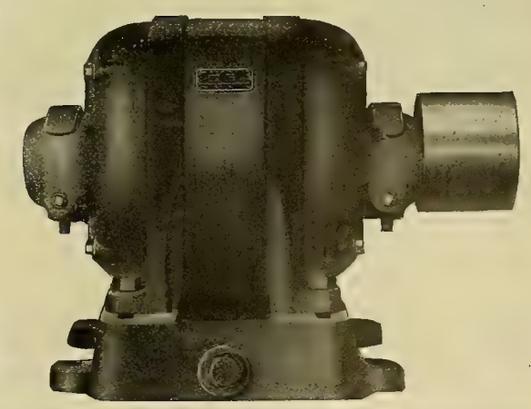

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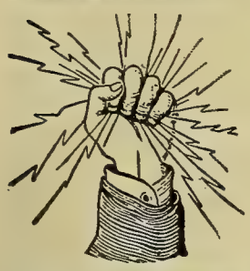

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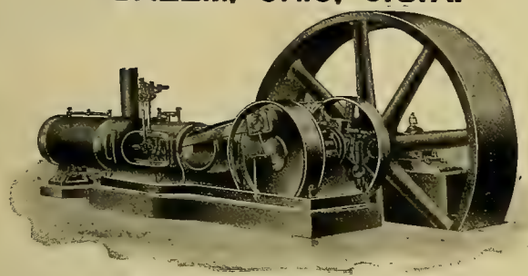

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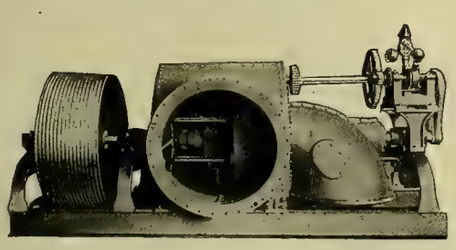

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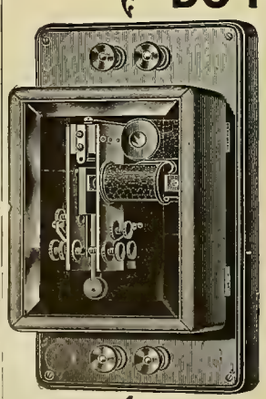

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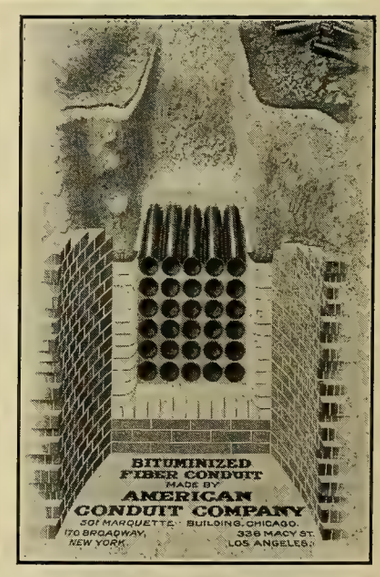

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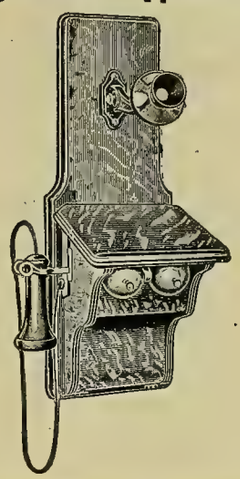

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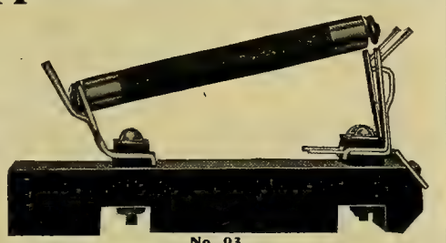

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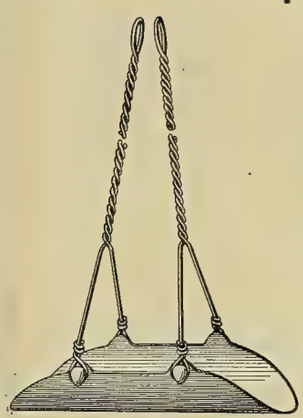

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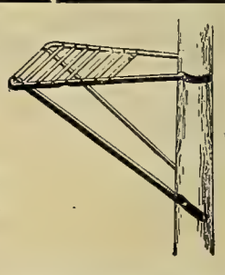

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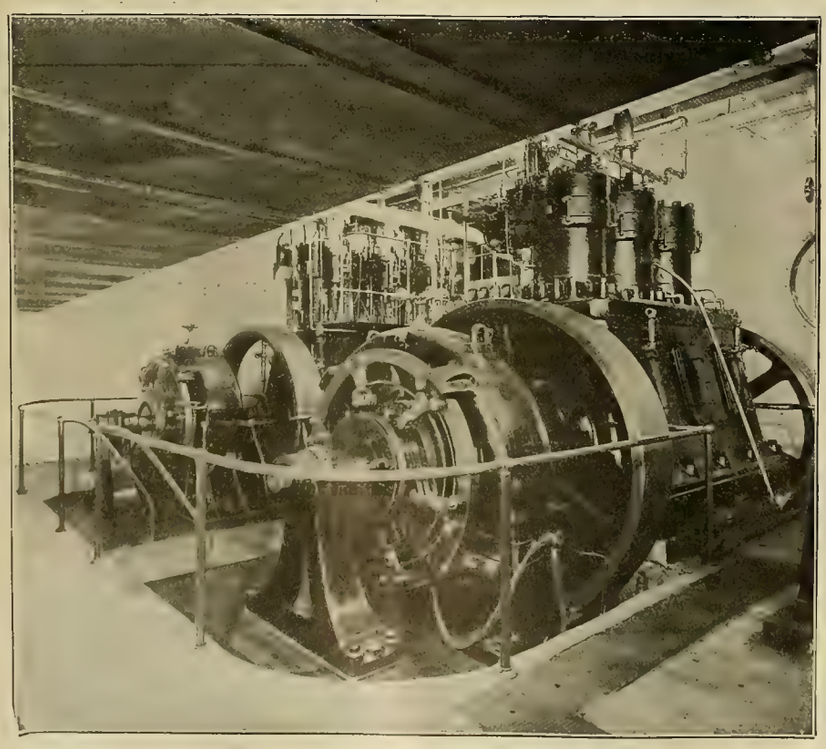

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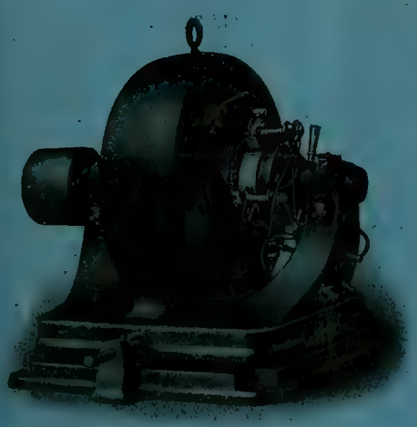

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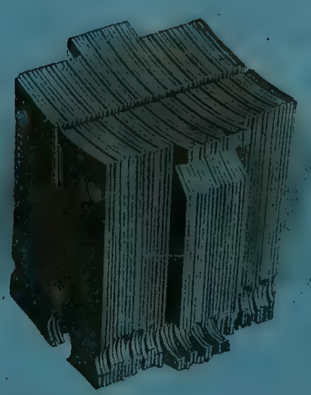

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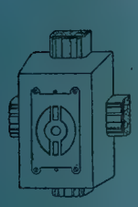

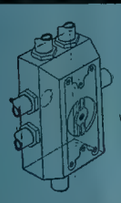

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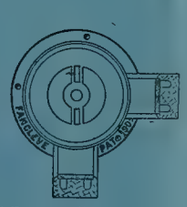

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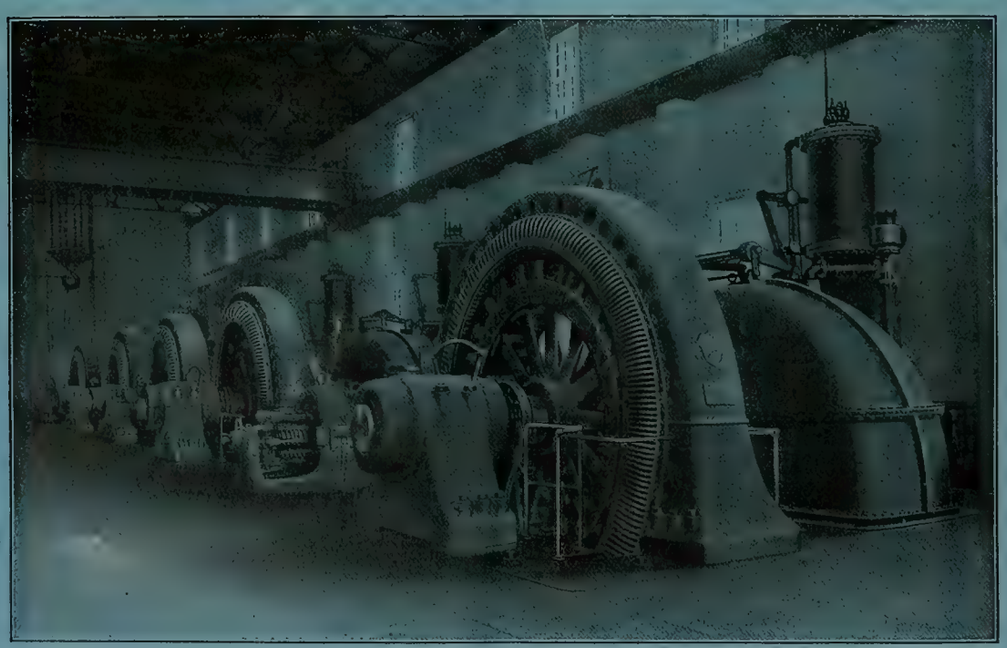

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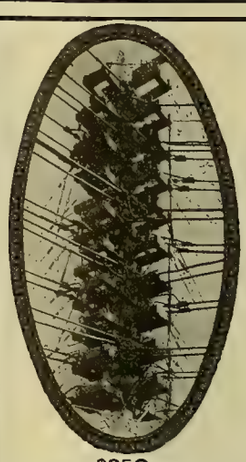

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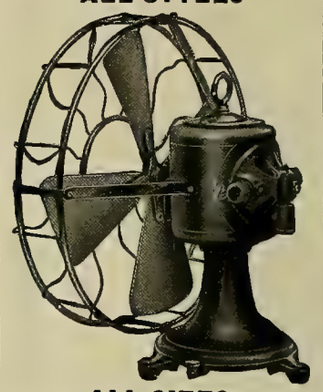

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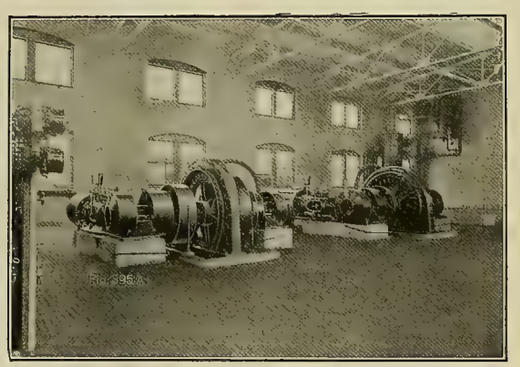

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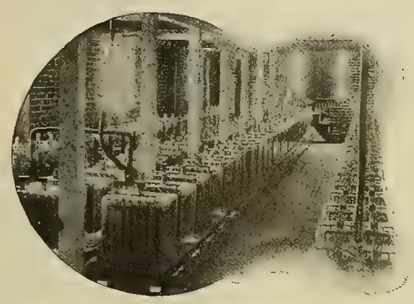

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Westinghouse El. & Mfg. Co.

Turbines, Steam.
Allis-Chalmers Co.
General Electric Co.
Westinghouse Machine Co.

Turbine Water Wheels.
Allis-Chalmers Co.
Leffel & Co., Jas.

Vacuum Drying.
Devine Co., Joseph P.

Vulcanized Fibre.
Vulcanized Fibre Co.

Wattmeters.
Duncan Elec. Mfg. Co.
Wesco Supply Co.

Wire Rope Machinery.
Aiton Machine Co.

Wires and Cables—Magnet Wires.
Acme Wire Co.
American Electrical Works.
Belden Mfg. Co.
Bissell Co., The F.
Central Electric Co.
Chicago Ins. Wire & Mfg. Co.
Crescent Ins. Wire & Cble. Co.
Driver-Harris Wire Co.
General Electric Co.
Hazard Manufacturing Co.
Indiana Rub. & Ins. Wire Co.
India Rubber & Gutta Percha Insulating Co.
Kellogg Switch. & Sup. Co.
Manhattan Elec. Supply Co.
Marion Ins. Wire & Rub. Co.
National India Rubber Co
New York Insulated Wire Co.
Okonite Co., The.
Phillips, Eugene F.
Phillips Insulated Wire Co
Roebling's Sons Co., J. A.
Runzel-Lenz Elec. Mfg. Co.
Safety Ins. Wire & Cable Co.
Simplex Electrical Co.
Standard Underground Cable Co.
Wesco Supply Co.
Western Electric Company.

For Alphabetical Index of Advertisements See Page 3.

THE NEW Incandescent LAMP

THIS is to announce that the undersigned company is now putting on the market **a New Incandescent Lamp,** and hereby solicits your patronage.

For a long time it has been recognized that the time was ripe for a new lamp manufacturing company to enter the field, **owing to the present high price and dictatorial policy of the association of lamp manufacturers.**

It is "up to you," Mr. Lamp Buyer, to say whether the Czars of the Lamp business shall dictate to you the price you shall pay for lamps.

WE OFFER YOU A STRICTLY FIRST CLASS LAMP AT A REASONABLE PRICE—AND THAT PRICE IS LESS THAN THE "ASSOCIATION PRICE!"

As we mean business and want your trade, we urge you to "look us up," to investigate us fully, financially and otherwise, and we, therefore, refer you to the First National Bank of Emporium, Pa., and the Farmers & Merchants Bank of St. Marys, Pa.

Give us a trial order for a barrel and let us prove our proposition.

NOVELTY INCANDESCENT LAMP CO.

St. Marys, Elk Co., Penna.

WILLARD STORAGE BATTERIES

FOR ALL PURPOSES

Manufactured by

THE WILLARD STORAGE BATTERY CO.

CLEVELAND, OHIO

RELIABLE "Unit Accumulator"

National Battery Company

ELECTRIC STORAGE BATTERIES

Branch Offices:
NEW YORK, CHICAGO

BUFFALO, N. Y.

IF YOU ARE INTERESTED IN STORAGE BATTERIES IT WILL PAY YOU TO

WRITE! WRITE!! WRITE!!!

And Learn the Merits and Details of the MUCH CONTESTED BUT VICTORIOUS

HENSEL STORAGE BATTERY

JOHN A. HENSEL & CO., 11 and 13 ELDREDGE COURT, Near Michigan Avenue CHICAGO

Grimshaw

Raven White Core

Raven Black Core

ALL OUR WIRES pass inspection and carry the above TRADE-MARKS on our tags. We also manufacture Grimshaw and Competition Tapes and Splicing Compounds.

NEW YORK INSULATED WIRE COMPANY,

MAIN OFFICE: 114, 116 & 118 Liberty St., New York.

BRANCHES: CHICAGO: 192 Desplaines St. BOSTON: 7 Otis St. SAN FRANCISCO: 638 Mission St.

BOSSERT'S BOXES

Drawn steel. One blow of a hammer gives clean round hole. No filing.

SAVE TIME, BOXES AND MONEY

Be up to date. Use them. Write for bulletin giving full particulars.

Bossert Electric Construction Co., UTICA N.Y.

"THE STANDARD"

MOTORS-DYNAMOS-FANS

ARE WELL MADE AND YOU'LL LIKE THEM FOR ALL DIRECT CURRENT CIRCUITS

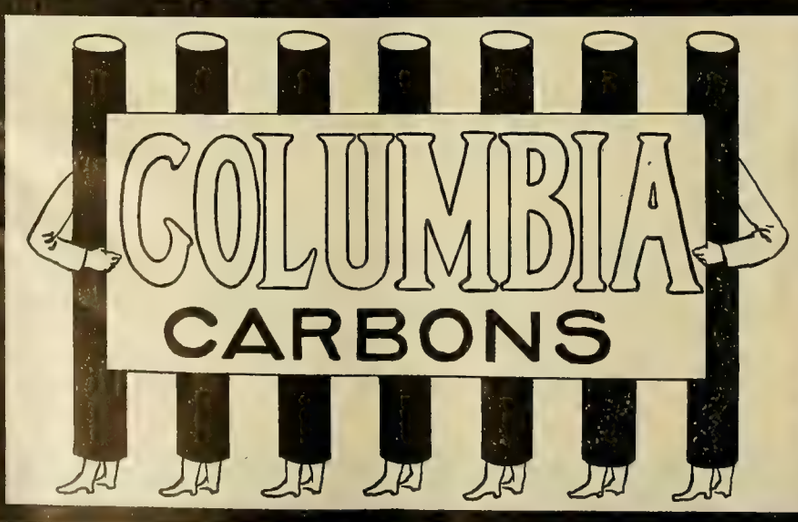
THE ROBBINS & MYERS CO.

SPRINGFIELD, OHIO.

AS YE SOW SO SHALL YE REAP

SOW AN ADVERTISING APPROPRIATION AND YE SHALL REAP INCREASED BUSINESS

THE NIGHT SHIFT



THEY WILL LIGHTEN YOUR LIGHTING TROUBLES. GIVE THEM A TRIAL. NATIONAL CARBON COMPANY CLEVELAND, O.

THE "LAMP ORGANIZATION" does not dare openly to cut prices!

Do you know why the "Organization" does not dare to try to drive us out of business by cutting prices around us---as you would naturally suppose it would do, because such is the old-time "trust method?"

The answer to this is easy, although you might not see it at first glance.

The chief reason why the "Organization" does not dare to get after us by cutting prices is, because to cut prices around us would be to cut the price on itself!

The lamp "Organization" was not formed with the idea of doing anything for you, "Mr. Consumer"---that is, all the manufacturers in it were not gotten together with the idea of giving the world at large incandescent lamps at a lower figure---NOT ON YOUR LIFE!!!

To the contrary, it is now generally believed that the lamp "Organization" is not one formed to lower prices, like some other "Amalgamations" that are really a benefit, but gradually to raise them to the maximum and KEEP THEM RAISED.

Can you not see, therefore, if the "Organization" cut "in the open" to our customers in an attempt to confiscate our trade (and thus eventually---the Organization would hope---put us out of business), don't you see that the Organization would thus break its own high "16c to 18c per" market?

You see the point, of course.

Consequently, remember you have not the slightest chance of getting anything but the "16c to 18c per" price (and maybe a dinner) out of the Lamp Organization.

Why, then, do you not give us a chance and see what we can do for you?

St. Mary's Incandescent Lamp Company

Wm. M. Rothschild - Pres
St. Mary's, Pa.

Let us quote you

P.S. 6000 Lamps daily capacity -
We protect buyers against litigation -
Penna. Corporation - Capital Stock $100,000.

THE BEST

MONARCH PRISMO CLUSTERS

List Prices Style P Arc-Burst

Complete with tipless lamps and Prismo glass shades on all lamps.

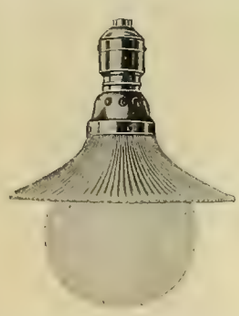
Cat. No.	No. Lamps.	Total C. P.	90-130 Volts.	200-250 Volts.
P43	3	120	$12 00	$13 00
P44	4	150	13 60	14 80
P45	5	185	15 20	16 60
P46	6	225	16 80	18 40

For Turn Down feature, add $1.40 to list.

Specify lamp voltage.

Frosted lamps will be furnished unless otherwise ordered.

Write for Discounts



"MONARCH SPECIAL" with Prismo shade and holder

We can furnish any style of

Incandescent Lamp

The Monarch Electric Mfg. Co.

WARREN, OHIO, U. S. A.

(Licensed Manufacturers)

LOOK FOR THE LICENSE LABEL IN THE STEM

8

USE

"SAFETY" RUBBER COVERED WIRE AND CABLE

FOR EVERY ELECTRICAL SERVICE

M. B. AUSTIN & CO.,

CHICAGO REPRESENTATIVE

THE SAFETY INSULATED WIRE & CABLE CO.

BAYONNE, NEW JERSEY

Insulated Electrical Wires and Cables

JOHN A. ROEBLING'S SONS CO.

171-173 Lake Street CHICAGO

Trenton, N. J.

"AMERICAN" STORAGE CELLS

ARE THE BEST. Send for descriptive Circular.

AMERICAN BATTERY CO., ESTD 1889. 171 S. Clinton St., Chicago.

CENTURY ELECTRIC CO.

MANUFACTURERS OF

SINGLE-PHASE SELF-STARTING

MOTORS AND CEILING FANS

ST. LOUIS, MO.

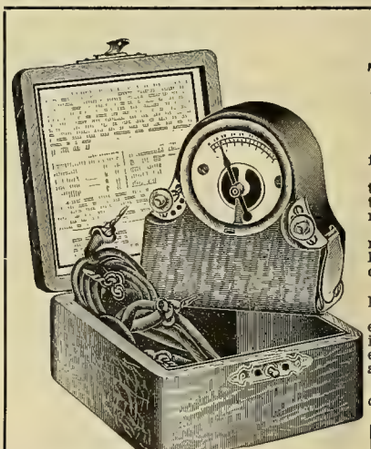


Illustration is ½ size of outfit. Weight of instrument and case complete, 8 oz.

AVERY

TESTING GALVANOMETER

Always Tells the Truth

Small enough for the pocket—large enough for serious work.

The Avery Testing Galvanometer supplants the clumsy testing bell. It is extremely sensitive in locating leaks and is a practical instrument for measuring resistance.

Delicate parts in the make-up of this galvanometer have been omitted. Once the needle is locked all the hard knocks in the world can't derange its adjustment or mechanism.

Battery can be easily renewed at small expense.

The beauty and value of the Avery Galvanometer to linemen lies in its accuracy, portability, convenience and surprising resistance to every-day wear and tear. It goes in the pocket and is always ready for instant use.

Catalog No. 13,395. Price, $8.00, subject to discount.

Manhattan Electrical Supply Co.

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NEW YORK CITY, 17 Park Place—14 Murray St.

Factories, Jersey City, N. J., Ravenna, Ohio

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WOUND BY AUTOMATIC MACHINE

ACME WIRE CO., NEW HAVEN, CONN.

NEW YORK OFFICE: 26 COURTLANDT ST.

LICENSEES OF THE VARLEY DUPLEX MAGNET CO

W. R. OSTRANDER & CO.

Manufacturers and Dealers in all kinds of

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Arc Lamp Poles

In Iron

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ORNAMENTAL

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for public buildings, hotels, etc. In bronze and iron

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FROM CHICAGO.

$14.40	TORONTO and Return. On sale daily.
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$21.00	CONCORD and Return. On sale June 15 to 30 and July 18; Aug. 8 & 22; Sept. 5 & 19.
$22.50	PORTLAND, Me., & Ret. Selling dates same as to Concord.
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Proportionate rates to many other points in Canada and New England.

For complete details as to stop-overs, etc., address

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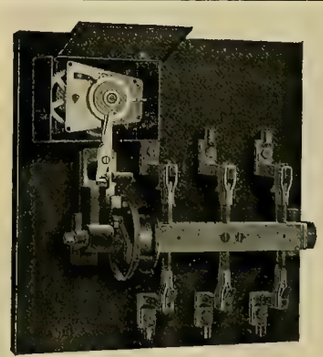
Don't Stop! Keep On! Read! Improve!

ELECTRICIAN PUBLISHING CO.

507 MARQUETTE BLDG.

Publishers and dealers of electrical books



Type C.

The best and most reliable time switch on the market, for turning on and off the light, guaranteed to give perfect satisfaction.

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15 Dunham Pl., Brooklyn, N. Y.

General Electric Company

Large Oil Transformers

Highest Commercial Voltages

Including Largest Units

For more than 20 years every distinct advance in transformer construction has been identified with some step in the development of transformers built by the General Electric Company.

General Electric Types of oil immersed transformers are secure from burnouts and absolutely reliable in operation.

The highest attained commercial working voltages are made possible by the application of the General Electric Method of utilizing oil as insulation.

1021.

Relative sizes of 1 kilowatt and 2700 kilowatt General Electric Transformers

50 K. W. 160,000 Volt Type H Testing Transformer

Chicago Office
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Principal Office
Schenectady, N. Y.

Sales Offices in
All Large Cities

INNER GLOBES

BEFORE PLACING YOUR ORDER FOR GLOBES REMEMBER THAT

THIS STANDS FOR QUALITY
NOBLAC
Reg. U. S. Pat. Off., Nov., 21st, 1905.

INNER GLOBES

Both Heat-Resisting and Ordinary, Are Superior Because

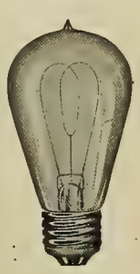
They are made accurately, honestly and perfectly. They do not blacken and require cleaning much less frequently than any other make.

There is no guesswork about them. The glass of which they are made does not soften under the fiercest heat. They are fitted for especially severe conditions of service.

SEND FOR "THE STORY OF THIS STANDS FOR QUALITY FOSTORIA" It contains much valuable information for inner globe users

THE THIS STANDS FOR QUALITY FOSTORIA GLASS SPECIALTY CO.

THIS STANDS FOR QUALITY FOSTORIA, OHIO



EDISON LAMPS

Can be Obtained Promptly

Extensive Factory Facilities and Large Stocks insure quick and accurate delivery.

LOOK FOR THE LABEL IN THE STEM

All Types and Varieties
Regular Multiple Lamps
Street Series Lamps
Miniature Lamps

GENERAL ELECTRIC COMPANY
Main Lamp Sales Office:
HARRISON, N. J.

(477)

MICABOND will save you money in your repair work as well as in your new machines. It is good insulation—made out of the best materials and is sold at reasonable prices.

CHICAGO MICA CO. VALPARAISO, IND.

Cope's Patent Quick Coupling Conduit Rod

Remember these rods have no lost motion. These Couplings are of Steel and are made in the best possible manner.

Write for list of persons using these rods—26,000 sold since May 1902. Made in 3 ft. and 4 ft. lengths. Price, 3 ft. 75 cents, 4 ft. 85 cents. Patented February 24, 1903.

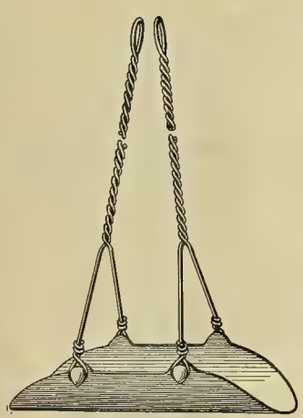
T. J. COPE

3244 North Fifteenth Street PHILADELPHIA, PA.

USE

The Holden Guy-Anchor

NONE BETTER



The rods are of one piece
No welds nor threads to weaken them

Greatest surface in ground

A 15-inch Anchor squares up in a 6-inch hole, over 55 square inches in solid earth

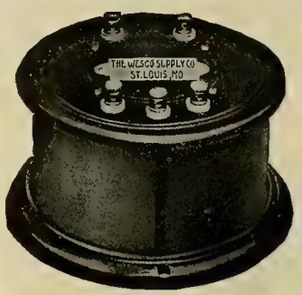
MOST INEXPENSIVE AND BEST ANCHOR MADE

Pat. Jan. 9, 1906 Write for Circular

THE HOLDEN ANCHOR CO.
Manufacturers
DES MOINES, IOWA

SPOT THE SPOT
SAMSON SPOT CORD
FOR
ARC LAMP AND TROLLEY CORD
SAMSON CORDAGE WORKS, BOSTON, MASS.

ADAMS SECONDARY GENERATOR



is a money-saver and a practical device for operating annunciator systems, gaslighters and bells of all kinds, absolutely **without expense** after once installed. Wherever an all-day alternating is available this instrument can be employed to immense advantage. Write for bulletin.

"EVERYTHING ELECTRICAL"

WESCO

THE WESCO SUPPLY CO.

Ft. Worth, Texas ST. LOUIS, MO.

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Of all Qualities, in any Form at Lowest Prices

EUGENE MUNSELL AND CO.
NEW YORK and CHICAGO

INSULATION That Is.

Micanite, Linotape, M. I. C. Compound, Empire Cloth and Paper. For Years the Standard.

MICA INSULATOR CO., Originators
NEW YORK and CHICAGO

BIJUR

"HIGH-DUTY"

General Storage Battery Co.

TRADE MARK
BIJUR
HIGH-DUTY

42 BROADWAY, N. Y.

RECO FLASHERS

Are easy to sell. You make a fine profit. Everybody with an electric sign wants one. Write us today for particulars and prices. Also pointers on electric signs.

Reynolds Electric Flasher Mfg. Co.
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3-in-1 VOLT-AMMETERS

Measure low and high voltages; besides amperes and ordinary resistances. They are inexpensive and reliable. Send for catalog of portable and switchboard voltmeters and ammeters.

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You Who are Troubled with Sparking and Cutting of Commutators to Use

The only article that will PREVENT SPARKING. Will keep the commutator in good condition and PREVENT CUTTING.

Absolutely Will Not Gum The Brushes . . .

It will put that high gloss on the commutator you have so long sought after.

50 Cts. per Stick. $5.00 per Dozen

For Sale by all Supply Houses, or

FREE, Sample Stick.

K. McLENNAN & CO.,
Sole Manufacturers,
Room 411, Inter Ocean Bldg., 130 Dearborn St., CHICAGO, ILL.

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MODEL AND MACHINE WORKS
Experimental Work a Specialty
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Scheeffer Integrating Watt-Meter.

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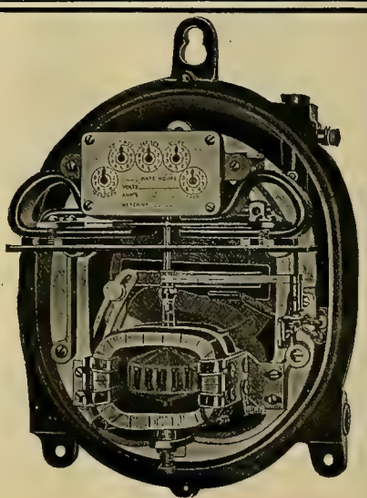
For Direct or Alternating Current

Dust and Bug Proof :: Improved Construction

Moving parts are extremely light, insuring a highly sensitive and accurate meter.

Write for Prices and Descriptive Literature

With Case.



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DIAMOND METER CO.

PEORIA, ILL., U. S. A.

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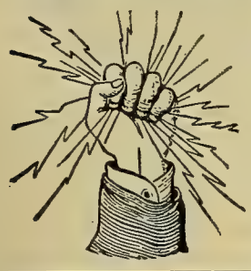
PROVIDENCE, R. I.



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ELECTRIC LIGHT LINE WIRE,
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Patent Lawyer and Solicitor of U. S. and Foreign Patents

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There's No Friction
with the Fibre-Graphite Commutator Brush. Being 90 per cent. pure graphite, it insures low resistance, no sparking under a varying load, and longer wear. There is no greasing required. The Fibre-Graphite is therefore the most economic brush on the market. Send for price list.
HOLMES FIBRE-GRAPHITE MFG. CO.
5155 Wakefield Street, Germantown, PHILADELPHIA.

SHOWING THE DETAIL
of the
NEW TYPE B ANCHOR AND WRENCH.

The upper part shows the new malleable eye.
The middle shows the square wrench and sliding handles locked to the anchor by the eye.
The lower part shows the square malleable key and the square shank of the anchor.

THE RODS OF
Stombaugh Guy Anchors
Are not weakened by welds or holes for pins and rivets.

They are made of one piece.
The threading of the eyes on the Type B Anchors equals the strength of the rod.

STOMBAUGH GUY ANCHORS
SCREW INTO THE GROUND

When in at the proper depth they are set. The strain can then be put on without fear of any back give. You are sure.

An anchor is as strong as its weakest part.
Stombaugh Guy Anchors have no weak parts.

W. N. MATTHEWS & BRO.
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203 North 2d Street - ST. LOUIS
Eastern Office: 203 Taylor Bldg., Cortlandt St., New York

NATIONAL CODE STANDARD

WEATHER-PROOF TRADE MARK "O.K." LINE AND HOUSE WIRES

"O. K." Weatherproof Wire.
Slow-Burning Weatherproof and Ideal Wire.

Prices and Samples on Application.

Phillips Insulated Wire Co.

Office and Factory: PAWTUCKET, R. I.

Absolutely Accurate Tachometers

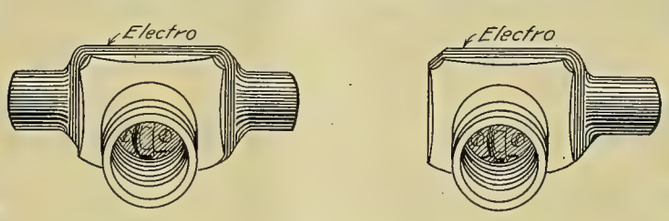
All of the defects of the old style instruments are eliminated. No springs or delicate mechanisms; wide range of speed variations.

Vertical scales graduated in accordance with customer's requirements. They are adaptable to all classes of rotary machinery. Full particulars of our many types furnished upon application. Send for catalogue.

NIAGARA
Tachometer & Instrument
COMPANY
Niagara Falls, N. Y.

ANOTHER OF THE 1,000 THINGS
YOU CAN DO WITH

"CONDULETS"



Receptacle Condulets make a tight job
WEATHERPROOF
WATERPROOF
A thousand styles All sizes
HOW ARE YOU DOING IT NOW?

THE MOST SENSIBLE AND CHEAPEST WAY TO GET WIRES OUT OF OR INTO CONDUIT IS TO USE CONDULETS.

Condulets to the electrical man are what "T's" and "L's" are to plumbers and steamfitters.

WRITE FOR COMPLETE CATALOGUE

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MANUFACTURERS
CHICAGO BRANCH OFFICE
70 W. JACKSON BOULEVARD, CHICAGO
FACTORY, SYRACUSE, N. Y.
BRANCHES
NEW YORK. CINCINNATI.
If You Don't Use 'Em—We Both Lose Money

In 1905

The Western Electrician published 1042 LARGE pages of reading matter and 1575 illustrations. This is 3126 columns or about 3,000,000 words. Equivalent in amount to 23 average $2 technical Books. On the book basis $46 worth given for $3. If you are not a subscriber, send in your order now.

Western Electrician
507 Marquette Building, Chicago

WANTED, FOR SALE *and similar* **WANT COLUMN** *advertisements (50 words or less), $1.50 an insertion; additional words 3c each.* **POSITION WANTED** *advertisements (50 words or less), $1.00 an insertion; additional words 2c each.*

POSITION WANTED

Mechanical and electrical engineer wishes employment with a power and lighting or water power development company. Fourteen years' experience in design, construction, operation and management of steam, electric and hydro-electric plants. Northern or central Michigan location preferred. Address Box 637, care Western Electrician, 507 Marquette Building, Chicago.

POSITION WANTED

As manager or superintendent of light or power plant, by an electrician and engineer of 15 years' experience. Can run plant to make money. Will take an interest in the right kind of a plant. Also a good draftsman. Am sober and married. Address Box 635, care Western Electrician, 507 Marquette Bldg., Chicago.

POSITION WANTED

As superintendent of lighting and power company. Up to date in the business end as well as the mechanical. Sixteen years' practical experience. Best of references. Am holding position as superintendent now, but wish to make a change. Am 38 years old and married. Would consider an isolated plant. Address Box 633, care Western Electrician, 507 Marquette Bldg., Chicago, Ill.

POSITION WANTED

As superintendent of electric plant in town of five or six thousand, by young man of good education and experience in electric work. Can give good references. Experience with A. C. and D. C. apparatus; also understands telephone work. Address Box 634, care Western Electrician, 507 Marquette Bldg., Chicago.

WANTED

Competent foreman and chief electrician for electric light and railway plant. Must be experienced in installing and repairing induction motors, meters, arc lamps, construction of lighting and power circuits and general supply business. Must be competent to take charge of workmen. Box 636, care Western Electrician, 507 Marquette Building, Chicago.

WANTED

In medium-sized central Ohio city, a first-class working foreman, experienced in outside railway and lighting overhead construction. Married man preferred. Write, giving references, experience and salary expected. Position permanent. Address Box 632, care of Western Electrician, 507 Marquette Building, Chicago.

WANTED

Two strictly first-class armature winders and two strictly first-class transformer and coil winders. Permanent positions and liberal salaries paid. State age and experience. Gregory Electric Company, 16th and Lincoln streets, Chicago.

FOR SALE

A bargain—an Edison 350-light dynamo, complete with rheostat, voltmeter and amperemeter; only used 6 months; practically good as new. Price—**submit a bid.** Rogers Supply Co., Wamego, Kansas.

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The work for which proposals are invited is as follows:

Division A—Transmission line to Morgan Park.

Division B—Transmission line to Blue Island.

Division C—Transmission line to Dalton.

Division D—Transmission line to Garfield park.

Division E—Transmission line to Oak Park.

Division F—Transmission line to town of Cicero.

Division G—Transmission line materials.

Division H—Transmission line construction.

For the purpose of receiving proposals in part, the specifications are divided into the foregoing divisions. Proposals must be made on each separate division, as each division will constitute a contract. Also separate proposals on the required materials, and the labor of installing the same.

Each proposal must be accompanied by a certified check on some responsible bank doing business in Chicago for 5 per cent of the total proposal, or a like sum in cash may be deposited. All certified checks must be made payable to the clerk of the Sanitary District.

The amounts deposited with bids will be held by the Sanitary District until all proposals for said work have been canvassed and the contracts awarded and signed. The return of said checks or cash to bidders to whom an award of any part of said work shall be made shall be conditioned upon their appearing within ten (10) days after receiving notice of such award, with bondsmen, and executing a contract with the Sanitary District for the work so awarded them or each of them and giving a bond or bonds satisfactory to said board of trustees for the performance of the work contracted for, in amounts equal to fifty (50) per cent of the contract price, noted in the proposal.

All proposals must be on blank forms furnished with the specifications, inclosed in blank envelopes and indorsed "Proposals for Divisions A, B, C," or such division or divisions as may be covered by proposal. All specifications must be returned with the proposals.

No bid will be considered unless the party making it shall furnish evidence satisfactory to the board of trustees of his financial ability to prosecute said contract in case the same shall be awarded to him.

Plans and specifications are on file in the office of the electrical engineer, 1500 American Trust building, Chicago.

Contractors are required to state in their bid their individual names and places of residence in full.

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SANITARY DISTRICT OF CHICAGO,
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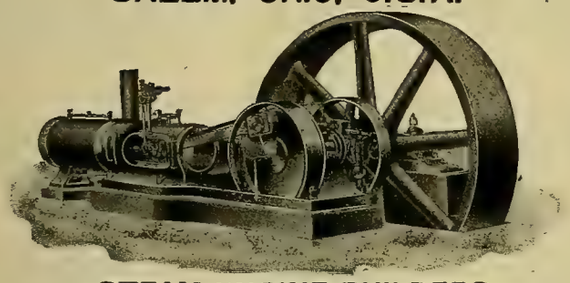

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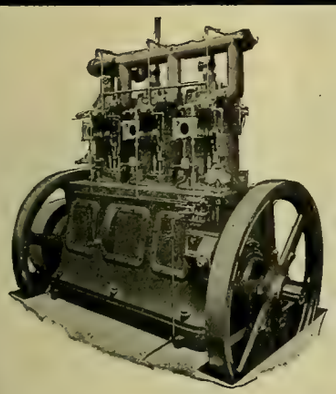

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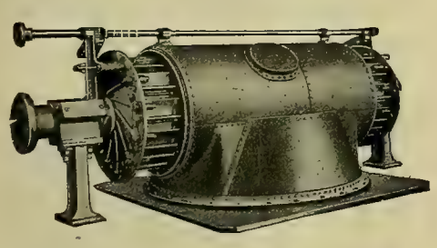

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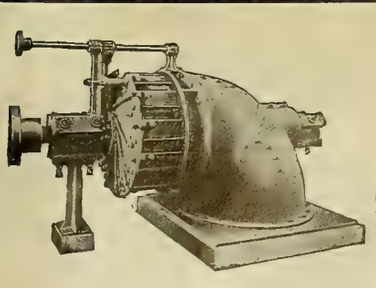

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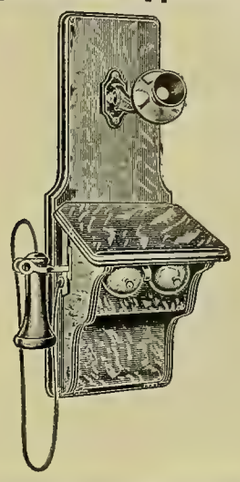

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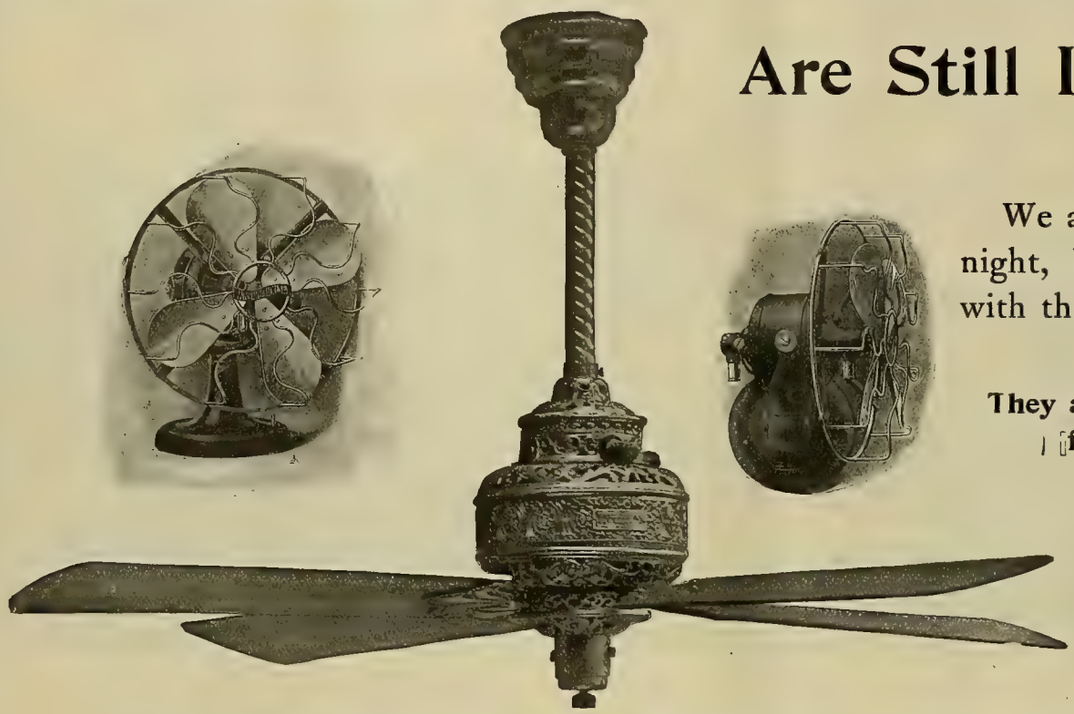

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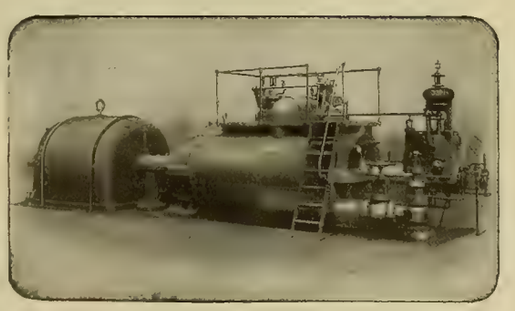

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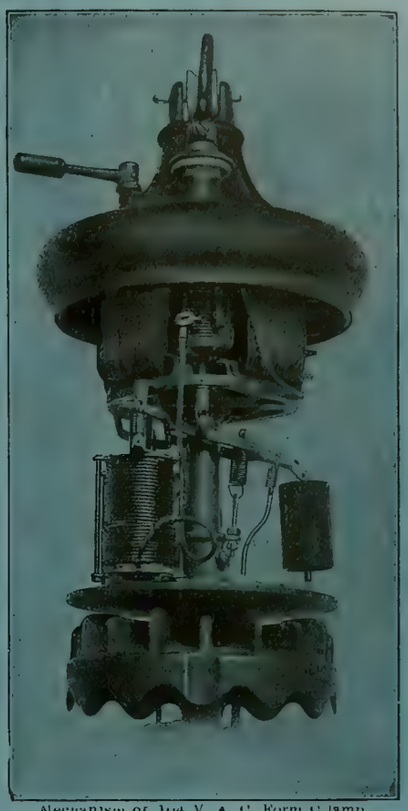

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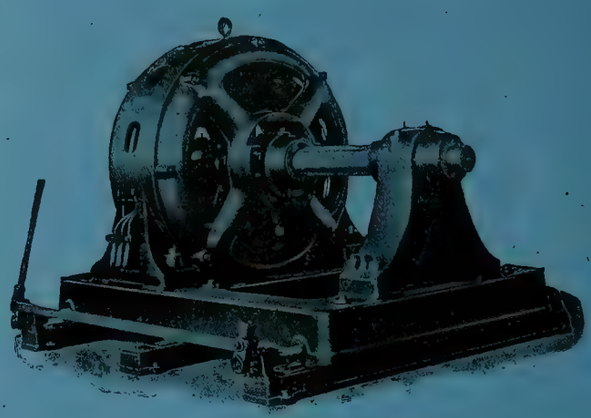

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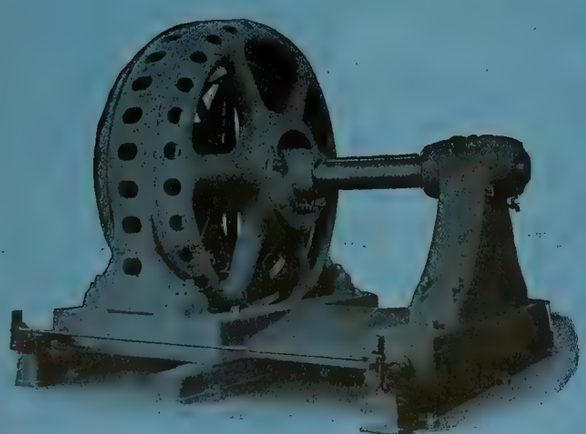

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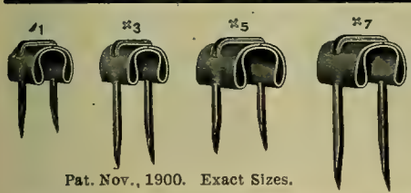

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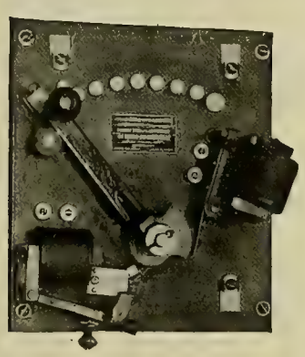

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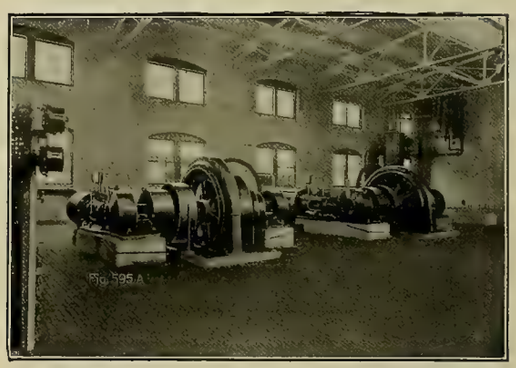

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Leffel & Co., Jas.

Vacuum Drying.
Devine Co., Joseph P.

Vulcanized Fibre.
Vulcanized Fibre Co.

Wattmeters.
Duncan Elec. Mfg. Co.
Wesco Supply Co.

Wire Rope Machinery.
Alton Machine Co.

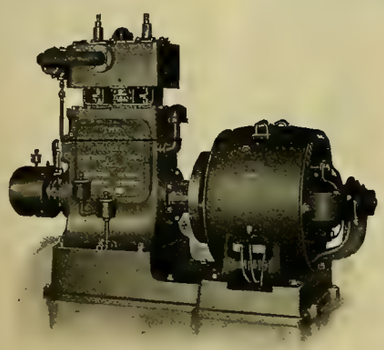
Wires and Cables—Magnet Wires.
Acme Wire Co.
American Electrical Works.
Belden Mfg. Co.
Bissell Co., The F.
Central Electric Co.
Chicago Ins. Wire & Mfg. Co.
Crescent Ins. Wire & Cble. Co.
Driver-Harris Wire Co.
General Electric Co.
Hazard Manufacturing Co.
Indiana Rub. & Ins. Wire Co.
India Rubber & Gutta Percha Insulating Co.
Kellogg Switch. & Sup. Co.
Manhattan Elec. Supply Co.
Marion Ins. Wire & Rub. Co.
National India Rubber Co
New York Insulated Wire Co.
Okonite Co., The.
Phillips, Eugene F.
Phillips Insulated Wire Co
Roebling's Sons Co., J. A.
Runzel-Lenz Elec. Mfg. Co.
Safety Ins. Wire & Cable Co.
Simplex Electrical Co.
Standard Underground Cable Co,
Wesco Supply Co.
Western Electric Company.

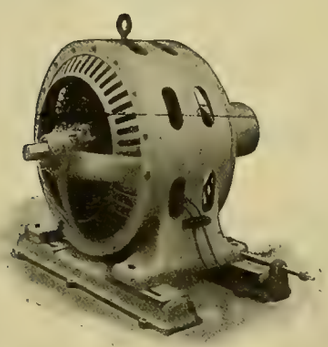
For Alphabetical Index of Advertisements See Page 8.

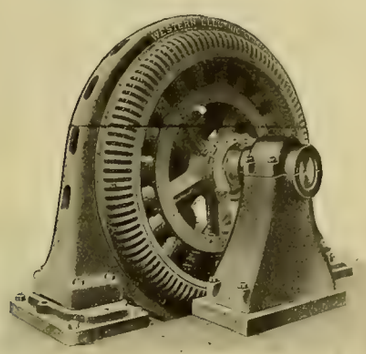
DIRECT AND ALTERNATING CURRENT

GENERATORS

All Sizes *All Capacities* *For Every Service*







Write for Bulletins Nos. 8H and 8B.

CONSULT THE MAP

WRITE OUR NEAREST HOUSE

THE BRIGHTEST IN THE FIRMAMENT

STANDARD ELECTRICAL MFG. CO., NILES, O.

LOOK FOR THE LICENSE LABEL MADE IN THE STEM

RELIABLE **"Unit Accumulator"**

National Battery Company

ELECTRIC STORAGE BATTERIES

BUFFALO, N. Y.

Branch Offices:
NEW YORK, CHICAGO

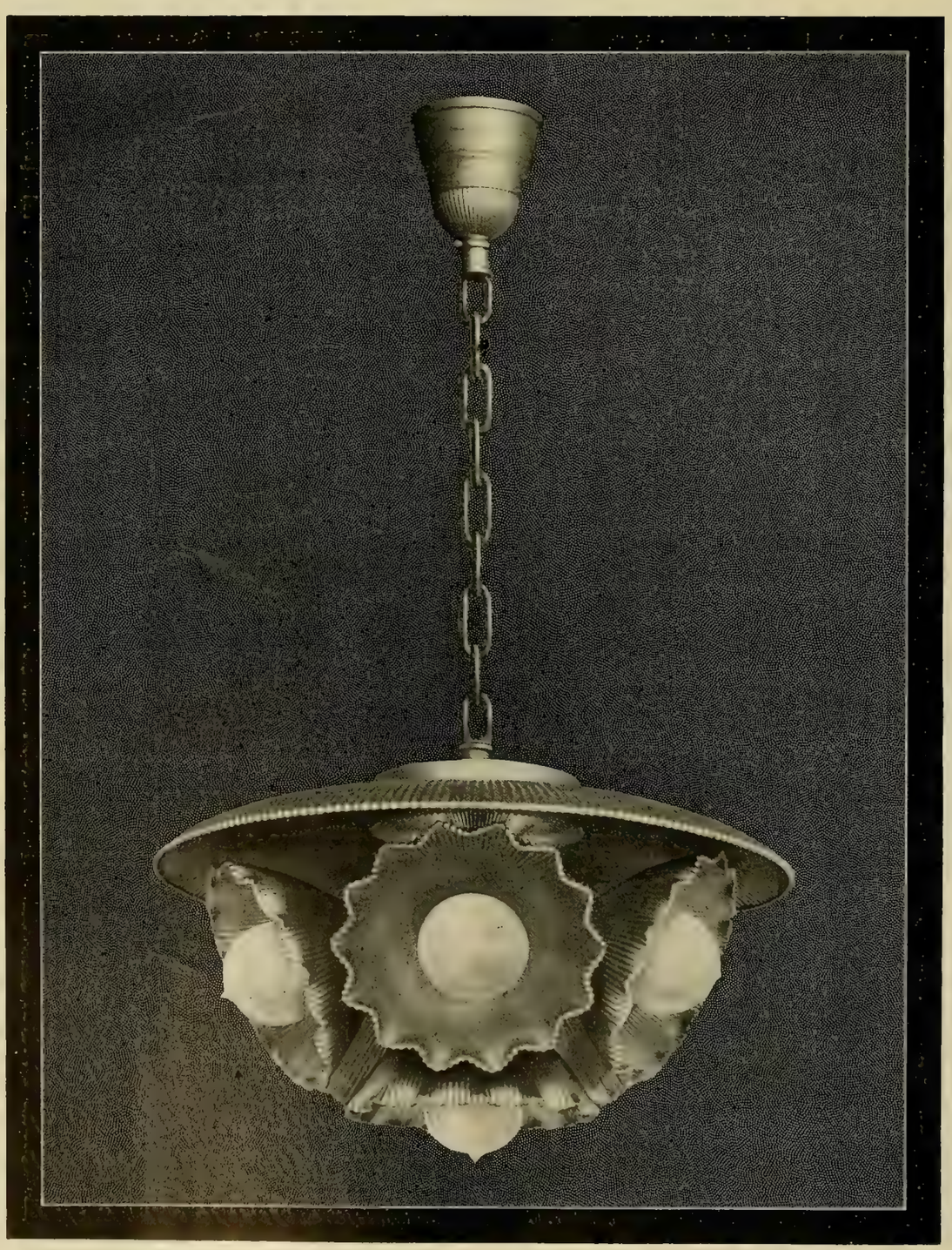
CARBONS

Are the CLEANEST BURNING
Are the MOST EFFICIENT
Are the MOST UNIFORM
Are the MOST ECONOMICAL
Have the LONGEST LIFE

NATIONAL CARBON COMPANY. CLEVELAND, O.

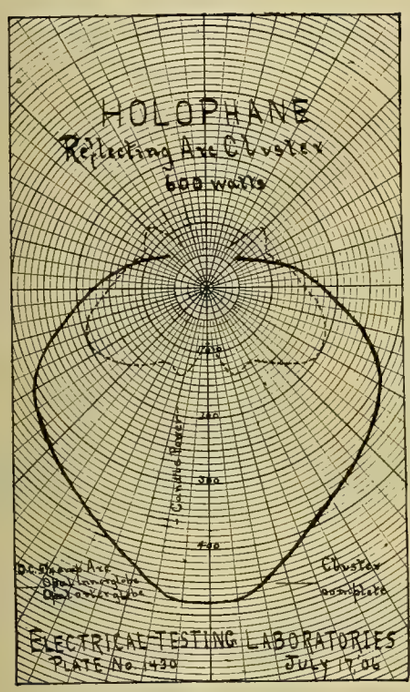
COLUMBIA CARBON PRODUCTS

HOLOPHANE REFLECTING ARC CLUSTERS



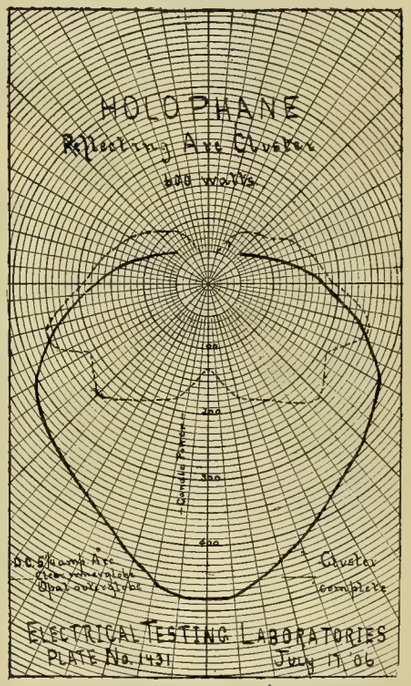
HOLOPHANE
REFLECTING ARC CLUSTERS

of 600 Watts
in Comparison With Enclosed Arcs

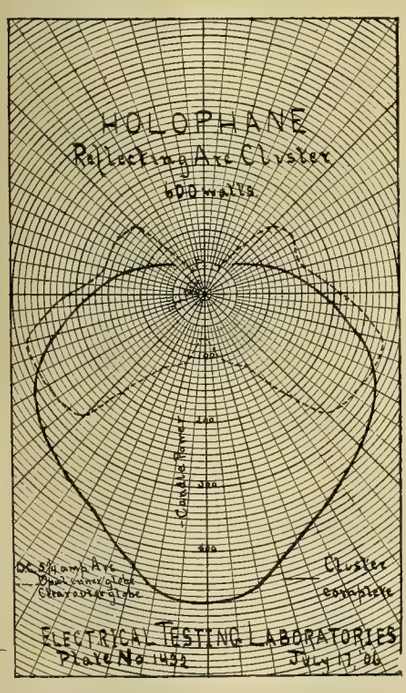


Direct Current, 5¼ Ampere Arc—Opal Inner Globe, Opal Outer Globe

CLUSTER LIGHTS
VERSUS
ARC LIGHTS



Direct Current, 5¼ Ampere Arc—Clear Inner Globe, Opal Outer Globe



Direct Current, 5¼ Ampere Arc—Opal Inner Globe, Clear Outer Globe

Holophane Clusters designed for 40 C. P. high efficiency lamps

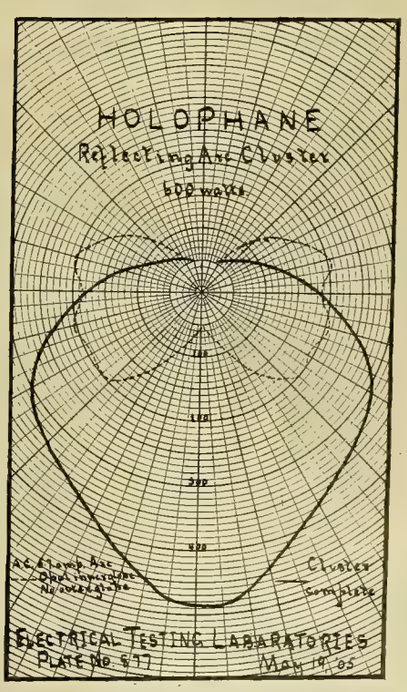
LIST PRICE

4 LIGHTS, $20.80
5 LIGHTS, $22.10
6 LIGHTS, $23.40

WRITE FOR DISCOUNT

HOLOPHANE GLASS CO.
(SALES DEPT.)

227 Fulton Street - - - NEW YORK



Alternating Current, 5.7 Ampere Arc—Opal Inner Globe, No Outer Globe

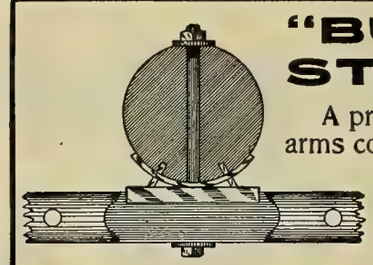
The India Rubber and Gutta Percha Insulating Company

HALL OF RECORDS, NEW YORK CITY

Habirshaw Red Core Wire Installed Throughout

OFFICE AND WORKS
YONKERS, N. Y.
W. M. HABIRSHAW
President and General Manager

SALES DEPARTMENT
253 Broadway
NEW YORK CITY
J. B. OLSON, Manager of Sales

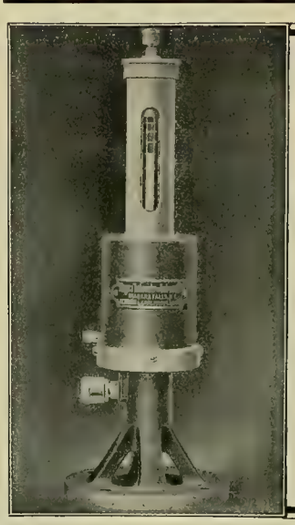


"BULL DOG" STEEL GAIN

A pressed steel support for cross arms consisting of two plates, one engaging the arm and the other the pole. It provides a means of mounting arms without cutting gains. It strengthens the arm and pole. It facilitates the placing and alignment of cross arms. It saves braces on four and six pin arms. It can be purchased at a cost slightly exceeding the cost of cutting a gain. It is made for telephone and standard arms and will fit any pole.

WRITE FOR PRICES AND DESCRIPTIVE CIRCULAR

STEEL GAIN MANUFACTURING CO.
10 South Clinton St. Chicago, Ill.



NIAGARA TACHOMETERS

represent the acme of perfection in high-speed indicating devices: simplicity in construction, absolute accuracy, and require minimum attention.

The type "C" instrument shown is for direct connection to vertical shafts adapted to apparatus having high rotary speed where belt drive is not practical. We make instruments that will exactly meet your requirements. Write for catalogue.

NIAGARA TACHOMETER AND INSTRUMENT CO.
NIAGARA FALLS, N. Y.

The Western Electrician's Seventh Annual Fall Trade Number

will, as usual, be of the greatest interest and importance to the manager of the local plant—to the man on the spot where the orders come from. It will post him up and in general awaken early interest in fall and winter business, besides placing manufacturers and dealers in touch with the real users of their products.

It will be read and carefully studied by managers, engineers and superintendents in the most important consuming district of the United States—*The Great Central and Western States.*

To insure receiving the consideration your goods deserve, you should advertise them in this most desirable number. An attractive announcement will not fail to receive the attention of buyers, and we hope you will take advantage of this excellent opportunity to increase the demand for your product.

Our Fall Trade Number will be dated September 15th, and in order to insure a good location, permit us to urge you to forward your order for a special announcement early.

WESTERN ELECTRICIAN

EASTERN OFFICE, 150 Nassau Street, New York
Suite 507 Marquette Building, Chicago

Why we talk more of the "Organization" than of our Lamp.

Because it is really no trick now to make a good incandescent lamp—but it is a trick—a trick indeed—to get a good lamp for less than "the 16 or 18 cents per"—see?

We know full well that "talk is cheap."

The "Organization" says: "We make a good lamp—the best lamp."

"St. Marys" says: "We make a good lamp—the best lamp."

But what does all this talk amount to in these days when everyone has a photometer—or can get one—and can prove out the lamps for himself?

Consequently, knowing positively that we can "deliver the goods" and that the "goods" are "strictly O. K."—we spend our time showing you "things" that are pertinent and valuable, Mr. Lamp Buyer; provided, of course, you're not such a small buyer that you're indifferent as to whether you pay the "high organization price" or not.

Our proposition is simple:

Don't ask questions—it's too easy and cheap to "try out" a barrel of our lamps. Use your photometer on a barrel before your present contract expires and then, maybe, you'll order "St. Marys."

St. Mary's Incandescent Lamp Company

Wm. M. Rothschild, Pres
St. Mary's, Pa.

Let us quote you

P.S. 6000 Lamps daily capacity—
We protect buyers against litigation—
Penna. Corporation—Capital Stock, $100,000.

CEST'S
Patent Cable Racks

Used by the largest Electric Light and Telephone Companies in the country

PRICES ON APPLICATION

C. M. CEST

Expert Electrical Subway Contractor

NEW YORK: 277 BROADWAY

CINCINNATI: UNION TRUST BLDG.

You will confer a favor upon the advertiser by telling him—when you write him—that you saw his ad. in the Western Electrician.

Illustration is ⅓ size of outfit. Weight of instrument and case complete, 8 oz.

AVERY

TESTING GALVANOMETER

Always Tells the Truth

Small enough for the pocket—large enough for serious work.

The Avery Testing Galvanometer supplants the clumsy testing bell. It is extremely sensitive in locating leaks and is a practical instrument for measuring resistance.

Delicate parts in the make-up of this galvanometer have been omitted. Once the needle is locked all the hard knocks in the world can't derange its adjustment or mechanism.

Battery can be easily renewed at small expense.

The beauty and value of the Avery Galvanometer to linemen lies in its accuracy, portability, convenience and surprising resistance to every-day wear and tear. It goes in the pocket and is always ready for instant use.

Catalog No. 13,395. Price, $8.00, subject to discount.

Manhattan Electrical Supply Co.

CHICAGO, 188 Fifth Ave.
NEW YORK CITY, 17 Park Place—14 Murray St.
Factories, Jersey City, N. J., Ravenna, Ohio

"TELEPHONE TROUBLES ...AND... HOW TO FIND THEM,"

By W. H. HYDE and J. A. McMANMAN,
FORMERLY
HASKINS' TELEPHONE TROUBLES.

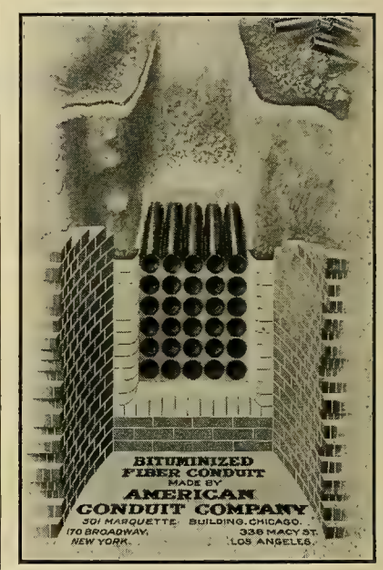
This little book is strictly up-to-date on all matters pertaining to telephone troubles and their remedies.

Sent Postpaid for 25c.

New (ninth) edition just out, 52 pages. Many diagrams showing connections. A complete hand-book for telephone inspectors.

Telephone exchange managers and employes will find this book a great help in locating telephone troubles and remedies therefor.

ELECTRICIAN PUBLISHING CO.,
507 Marquette Bldg., Chicago.



"Flexduct" is that high standard required in all high-class work. It is very flexible, a high insulation and indestructible

FLEXIBLE CONDUIT

"Flexduct" the National Code Standard. It does not deteriorate, always usable to highest degree

OSBURN FLEXIBLE CONDUIT COMPANY,

NEW YORK CHICAGO SAN FRANCISCO

TELEPHONES, SWITCHBOARDS AND EXCHANGE EQUIPMENT

THE NORTH ELECTRIC CO.

CLEVELAND KANSAS CITY DALLAS

As your ad in the Western Electrician will be read, you will never be blue.

BOSSERT'S BOXES

Drawn steel. One blow of a hammer gives clean round hole. No filing.
SAVE TIME, BOXES AND MONEY
Be up to date. Use them. Write for bulletin giving full particulars.
Bossert Electric Construction Co., UTICA, N.Y.

USE

"SAFETY" RUBBER COVERED WIRE AND CABLE

FOR EVERY ELECTRICAL SERVICE

M. B. AUSTIN & CO.,
CHICAGO REPRESENTATIVE
THE SAFETY INSULATED WIRE & CABLE CO.
BAYONNE, NEW JERSEY

McRoy Conduits.

"ROOKERY"—Chicago—

General Electric Company

G. E. Enclosed Fuses

National Electrical Code Standard

Sectional View of Knife Blade Type
600 Volts Enclosed Fuse

Sectional View of Knife Blade Type
250 Volts Enclosed Fuse

Mechanically Strong

ENCLOSING TUBE

The enclosing tube is made of thick fibre of the highest quality.

END CAPS

The end caps are extra heavy and held in place in the strongest manner possible. In the smaller capacities with ferrule contact, the caps are held by two pins or screws firmly fastened or screwed into the fibre tube. In the larger sizes having knife blade contact the caps are made of copper plated steel, fastened by means of steel screws to steel yokes inside of the fibre tube, and these yoke pieces are riveted to the knife blade contact. This combined holding of all parts makes the strongest end construction possible, ensuring the quiet rupturing of the arc within the tube.

FUSE

The amount of metal changed to a metallic vapor is reduced to a minimum when fuse is blown by having a copper leading-in wire or strip reducing the length of the fuse metal.

FILLER

The granular filler allows the distribution of the gases thoroughout the tube, minimizing the pressure exerted on any one part.

1069

Chicago Office
Monadnock Bldg.

Principal Office
Schenectady, N. Y.

Sales Offices in
All Large Cities

EDISON SIGN LAMPS

4 C.P.—19 watts
3 C.P.—14 watts
2 C.P.—13 or 9 watts

RELIABLY LONG AND BRILLIANT LIFE.

We supply a number of 2 C. P. sign lamps taking only 9 watts and operating two in series on 100-130 volt circuits.

LOOK FOR THE LABEL IN THE STEM

Most Economical Sign Lamp Made.

GENERAL ELECTRIC COMPANY

Main Lamp Sales Office, Harrison, N. J.

(484)

MICA INSULATION

Of all Qualities, in any Form at Lowest Prices

EUGENE MUNSELL AND CO.
NEW YORK and CHICAGO

That Is.

Micanite, Linotape, M. I. C. Compound, Empire Cloth and Paper. For Years the Standard.

MICA INSULATOR CO., Originators
NEW YORK and CHICAGO

The insulation is the most important part of your machine—be sure you buy only the best. Cheap insulation cannot be good insulation.

IF IT'S MICABOND YOU CAN BE SURE YOU HAVE THE BEST—OUR GUARANTEE IS BEHIND IT

CHICAGO MICA CO. : : : Valparaiso, Ind.

DIRECT CURRENT

SHOP LAMPS

BUILT TO WEAR

FEATURES

Indestructible Coils.

Accessible parts.

Simplicity of Construction.

Low Initial Cost.

Low Cost of Maintenance.

Catalogue Ready

Manufactured By
AMERICAN ARC LAMP CO.
KALAMAZOO MICH.

THE W. R. CARTON CO., Agents
118-132 W. JACKSON BLVD.
CHICAGO

RECO FLASHERS

Are easy to sell. You make a fine profit. Everybody with an electric sign wants one. Write us today for particulars and prices. Also pointers on electric signs.

Reynolds Electric Flasher Mfg. Co.
191 Fifth Ave., CHICAGO

3-in-1 VOLT-AMMETERS

Measure low and high voltages besides amperes and ordinary resistances. They are inexpensive and reliable. Send for catalog of portable and switchboard voltmeters and ammeters.

L. M. PIGNOLET
78-80 Cortlandt St. New York

BIJUR

"HIGH-DUTY"

General Storage Battery Co.

42 BROADWAY, N. Y.

HORNBERGER TRANSFORMERS

LAFAYETTE ELECTRICAL MFG. CO.
LAFAYETTE, IND.

SPARKING

Reduces the working capacity of a motor or dynamo, wears out the commutator, wastes power and may cause a fire. All this may be avoided if you use . . . . . .

50 Cents per Stick. $5.00 per Dozen.
SEND FOR FREE SAMPLE STICK
For sale by all supply houses, or

The only article that will PREVENT SPARKING. Will keep the Commutator in good condition and PREVENT CUTTING.

Absolutely Will Not Gum The Brushes.

It will put that high gloss on the Commutator you have so long sought after.

K. McLENNAN & CO., Sole Mfrs., Room 411, Inter Ocean Bldg., 130 Dearborn St., Chicago

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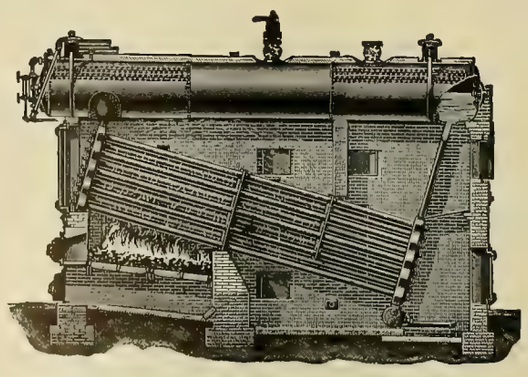
PHILADELPHIA, 1110-1112 NORTH AM. BLDG.
SAN FRANCISCO, 63 FIRST STREET.
PITTSBURG, 1218 FRICK BUILDING.
NEW ORLEANS, 339 CARONDELET STREET.
CHICAGO, 1216 MARQUETTE BLDG.
ATLANTA, EMPIRE BLDG.
CLEVELAND, 706 NEW ENGLAND BLDG.
MEXICO CITY, 7 AVENIDA JUAREZ.
HAVANA, CUBA, 116 1-2 CALLE DE LA HABANA



200 Pounds Working Pressure

WATER TUBE STEAM BOILERS

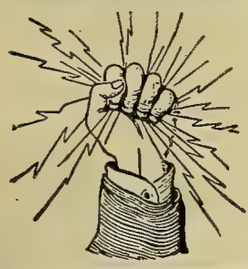
STEAM SUPERHEATERS

Our Book, STEAM, mailed free on application.

FRANK N. PHILLIPS, Pres. EUGENE R. PHILLIPS, V. P. C. H. WAGENSEIL, Treas. C. R. REMINGTON, Jr., Sec.

AMERICAN ELECTRICAL WORKS,

PROVIDENCE, R. I.



BARE AND INSULATED ELECTRIC WIRE,

ELECTRIC LIGHT LINE WIRE,
INCANDESCENT AND FLEXIBLE CORDS,
Railway Feeder and Trolley Wire,
AMERICANITE, MAGNET, OFFICE AND ANNUNCIATOR WIRES.
CABLES FOR AERIAL AND UNDERGROUND USE.

NEW YORK STORE, W. J. Watson, 26 Cortlandt St.
CHICAGO OFFICE, F. E. Donohoe, 135 Adams St.
MONTREAL BRANCH, Eugene F. Phillips' Electrical Works.
MAIN OFFICES AND FACTORIES, PHILLIPSDALE, R. I.

RICHARD WILLIAMSON, PRESIDENT — CHAS. E. UMMACH, SEC'Y AND TREAS.

R. WILLIAMSON & CO.

MANUFACTURERS OF GAS, ELECTRIC AND COMBINATION FIXTURES

AND DEALERS IN GAS AND ELECTRIC GLOBES MISCELLANEOUS GOODS
ELECTRICAL HOUSE LIGHTING SUPPLIES

88-90-92 W. WASHINGTON STREET, - - CHICAGO

Anchors that hold

Showing the 5, 6 and 7 in. style.

Holds 12,500, 15,000 and 17,500 lbs. respectively.

Popular with Street Railway, Electric Light and Telephone Companies.

The 5, 6 and 7 inch

Stombaugh Guy Anchors

HAVE NO WELDS

The full rod is cast into the helix. Our experience has shown that welds are dangerous in rods of less than one inch in diameter.

The rods of Stombaugh Guy Anchors are not weakened by holes for pins or rivets.

STOMBAUGH GUY ANCHORS BORE INTO THE GROUND WITHOUT DISTURBING THE SOLID EARTH.

When in at the proper depth they are set. The strain can then be put on without fear of any back give. You are sure. An anchor is as strong as its weakest part. Stombaugh Guy Anchors have no weak parts.

W. N. MATTHEWS & BRO.
MANUFACTURERS
203 N. 2nd St., - ST. LOUIS
Eastern Office: 203 Taylor Bldg., Cortlandt St., NEW YORK

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KUHLMAN ELECTRIC CO., - - ELKHART, IND.

BELDEN MAGNET WIRE

Our stock of copper and German silver magnet wire is the most complete in the west.

Try us on a rush order

Belden Mfg. Co.
CHICAGO

We are the real manufacturers of 75 per cent. of the Enameled Rings used in this country. Try us and see.

STAR EXPANSION BOLT CO.
147-149 CEDAR ST.,
N. Y. CITY

NATIONAL CODE STANDARD

WEATHER-PROOF TRADE MARK "O.K." LINE AND HOUSE WIRES

"O. K." Weatherproof Wire.
Slow-Burning Weatherproof and Ideal Wire.

Prices and Samples on Application.

Phillips Insulated Wire Co.

Office and Factory: PAWTUCKET, R. I.

THE NEW INCANDESCENT LAMP!

We offer you a strictly first class lamp at a reasonable price — **and that price is less than the "association price."**

It is "up to you," Mr. Lamp Buyer, to say whether the Czars of the lamp business shall dictate the price you shall pay for lamps.

Ours is a New Lamp, but we know the business. Give us a trial and we will prove our proposition so you will stay with us.

As we mean business and want your trade, we urge you to "look us up," to investigate us fully, financially and otherwise, and we, therefore, refer you to the First National Bank of Emporium, Pa., and the Farmers & Merchants Bank of St. Marys, Pa.

NOVELTY INCANDESCENT LAMP CO.
St. Marys Elk County, Pa.

Design, Finish and Accuracy

The above are the features of the

International

Instrument

which

ARE NOT and CAN NOT be EXCELLED

International Electric Meter Co.
Descriptive Catalogue Mailed Upon Request
330 W. Randolph St. Chicago

In 1905

The Western Electrician published 1042 LARGE pages of reading matter and 1575 illustrations. This is 3126 columns or about 3,000,000 words. Equivalent in amount to 23 average $2 technical Books. On the book basis $46 worth given for $3. If you are not a subscriber, send in your order now.

Western Electrician
507 Marquette Building, Chicago

WANTED, FOR SALE *and similar* **WANT COLUMN** *advertisements (50 words or less), $1.50 an insertion; additional words 3c each.*
POSITION WANTED *advertisements (50 words or less), $1.00 an insertion; additional words 2c each.*

POSITION WANTED

As chief engineer, electrician or superintendent of a light and power company, by first-class engineer, expert electrician, technical graduate. Seven years' experience operating and erecting light and power plants. Familiar with all types of modern apparatus. Young married man, prefer Ohio. Address Box 638, care of Western Electrician, 507 Marquette Bldg., Chicago.

POSITION WANTED

By man who can do things. I have had ten years' experience in the electric lighting business in the capacity of superintendent and chief engineer. I have had charge of both steam and water plants with high voltage transmission lines and sub-stations. Address Box 639, care of Western Electrician, 507 Marquette Building, Chicago.

WANTED

Engineers who are competent to take charge of Corliss, also high-speed, engines, generators, dynamos, water-tube boilers, etc. Good salary paid to right parties. Write experience. SOUTHWEST SMELTING & REFINING CO., Orogrande, New Mexico.

WANTED

Twenty first-class telephone construction foremen. Opportunity for advancement for the right men. No strike. Address Box 640, care Western Electrician, 507 Marquette Bldg., Chicago.

FOR SALE

We have for sale, ready for immediate delivery, the following electrical apparatus and engines: One Benton No 13 generator, 110 volts, 40 amperes; with this generator a New York safety engine, 5x6; one Northern, 125 volts, 15 K. W., 1,125 R. P. M.; one four-circuit switchboard; one No. 12 Benton & Sons M. P., speed 1,000, 200 amperes, 125 V.; one 9x8 Bailey & Sons vertical high-speed automatic cut-off engine. This material is all in first-class operative condition ready for immediate shipment. CLINTON GAS LIGHT & COKE CO., Clinton, Iowa.

For Sale—Bargains

ALTERNATORS—60 CYCLES

	Lights	
2	900	Westinghouse, 45 K.W., single phase.
2	1200	Westinghouse, 60 K.W., two-phase, 1100 volts.
1	1500	General Electric, 75 K.W., three-phase, 2200 volts.
1	1500	General Electric, 75 K.W., three-phase, 3300 volts.
1	1500	Warren-Medberry, 75 K.W., two-phase, 1100 or 2200 volts.
2	1500	Westinghouse, 75 K.W., two-phase, 1100 or 2200 volts.
1	2500	Gen'l Electric, 125 K.W., three-phase type, A T B, revolving field.
1	5000	Westinghouse, 250 K.W., three-ph., revolving field, 6000 volts.

125 TO 133 CYCLES

	Lights	
1	900	Westinghouse, 45 K.W., latest type.
1	1200	Westinghouse, 60 K.W., 1100 volts.
3	1200	General Electric, A, 60, 1100 volts.
1	2000	Wood, 100 K.W., type W. A. L.
1	240	Westinghouse, 120 K.W., 1100 or 2200 volts.
1	2400	General Electric, 120 K.W., type A S., 2200 v.
1	2400	General Electric, 120 K.W., type A, 120.
1	3000	Stanley, inductor type 150 K.W., two-phase.

We are now located in our new shops, the largest Repair Shops in this country. Send for our Monthly Bargain Sheet showing complete stock with net prices.

GREGORY ELECTRIC CO.
Cor. 16th and Lincoln Sts.
CHICAGO

LEGAL ADVERTISEMENT.

Board of Public Safety, Cincinnati, Ohio.

PROPOSALS

For the manufacture, delivery and installation of the necessary switch and protector boards, apparatus, storage batteries and racks, cables, cable shafts, new floor, brass railing, etc., necessary for the complete operation of the fire alarm telegraph system and Fire Department telephone exchange, to be located in the City Hall Building of Cincinnati, Ohio; also eighty fire alarm boxes used in connection with the same.

Sealed proposals will be received at the office of the Board of Public Safety of the City of Cincinnati, Ohio, until 12 o'clock noon of Saturday, September 15, 1906, for the manufacture, delivery and installation of the necessary switch and protector boards, apparatus, storage batteries and racks, cables, cable shafts, new floor, brass railing, etc., necessary for the complete operation of the fire alarm telegraph system and the Fire Department telephone exchange, to be located in the City Hall Building of Cincinnati, Ohio; also, eighty fire alarm boxes used in connection with the same, all in accordance with specifications and detail drawings on file in office of the Secretary of the Board of Public Safety.

The same to be paid for as stipulated in the specifications for the performance of the above work.

Detail drawings of the switch and protector boards, to be furnished, and copy of specifications for the work contemplated can be secured at the office of the Secretary of the Board of Public Safety by depositing a certified check in the sum of $200.00 on some Cincinnati bank, indorsed to or made payable to the President of the Board of Public Safety, as a guarantee that the said drawings and specifications will be returned with the proposal at the time specified for the opening of the bids.

The certified check will be promptly returned when drawings and specifications are deposited with the Secretary of the Board of Public Safety.

Bidders must enclose their bids in sealed envelopes and deposit the same with the Secretary of the Board of Public Safety before the 15th day of September, 1906, at 12 o'clock noon, and such envelopes must be addressed to the President of the Board of Public Safety, indorsed Proposal for Fire Alarm Headquarters Apparatus, Cables, etc., and must contain the blank form of proposal properly executed, furnished for the purpose, as none others will be considered, and such sealed envelopes must have indorsed thereon the name and address of the bidder.

Bids will be opened on Monday, the 17th day of September, 1906, at 9 o'clock a. m., at the office of the Board of Public Safety, Cincinnati, Ohio.

Each bid must be accompanied by a certified check for $5,000 on some Cincinnati national bank, indorsed to or made payable to the President of the Board of Public Safety, as a guarantee that the successful bidder will enter into a contract with the Board of Public Safety for the City of Cincinnati to furnish, erect and install in place all apparatus, material, etc., as called for in the specifications, and provide the bond specified in the event the contract is awarded him.

The certified check will be promptly returned to the unsuccessful bidder and to the successful bidder after the contract is signed and the bond executed.

The successful bidder will be required to furnish at the time that the contract is entered into a bond in the sum of forty thousand dollars ($40,000), to be signed by him and two fee holders of the City of Cincinnati, or a company authorized by the statutes of the State of Ohio to guarantee the performance of contracts, conditioned that the contract will be executed in accordance with the plans and specifications, and that the contract will guarantee the installation of all apparatus, material, etc., called for in the plans and specifications for the term of five years against all inherent defects.

No award will be made to the successful bidder until he furnishes satisfactory evidence to the Board of Public Safety and their Engineers that he has the experience and facilities for properly manufacturing and installing complete the necessary switch and protector boards and apparatus for supplying and installing complete the storage batteries, racks, cables, cable shafts, new floor, brass railing, etc., necessary for the complete operation of the fire alarm telegraph system and Fire Department telephone exchange, to be located in the City Hall Building; also, eighty fire alarm boxes used in connection with same, called for in these specifications, and the pecuniary resources to carry out this agreement in accordance with the plans and specifications of apparatus built or supplied by them.

Bidders must furnish certain samples called for in the specifications. These samples are to accompany the bid, and said samples will be returned to the unsuccessful bidders at their expense immediately after signing of the contract, and to the successful bidder at his expense at the time of final payment. These samples are to show the character of the construction, design, finish, etc., of apparatus and material the bidder proposes to furnish, and will enable the Board of Public Safety and their Engineer to verify the apparatus supplied under these specifications.

No bidder will be allowed to withdraw his proposition after it has been opened and read, unless the Board of Public Safety fails to accept same within thirty (30) days from date of opening bids.

These specifications and drawings must accompany proposal.

The Board of Public Safety reserves the right to reject any and all bids.

By direction of the Board of Public Safety of the City of Cincinnati, Ohio.

ABE FURST,
President.

J. J. MULVIHILL, Secretary.

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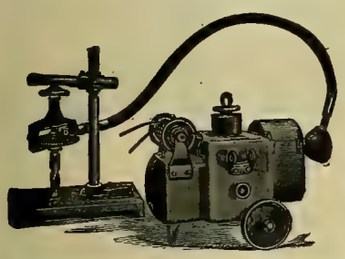

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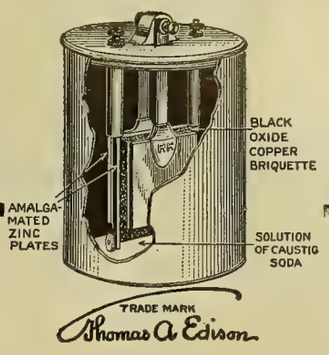

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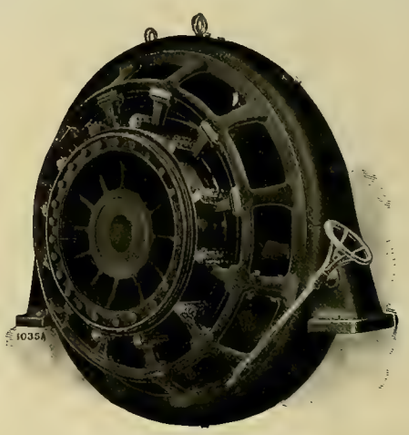

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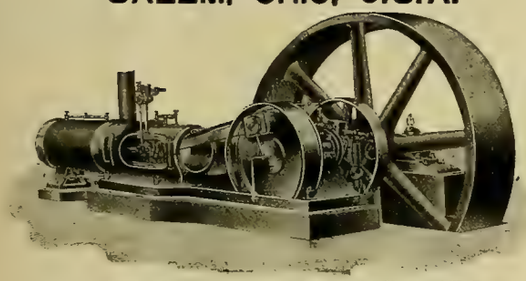

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39th ANNUAL STATEMENT

JANUARY 1, 1906

CAPITAL	$ 500 000.00
SURPLUS	1,261.459 69
RESERVES	1,926,686.81
ASSETS	3,688,146.50

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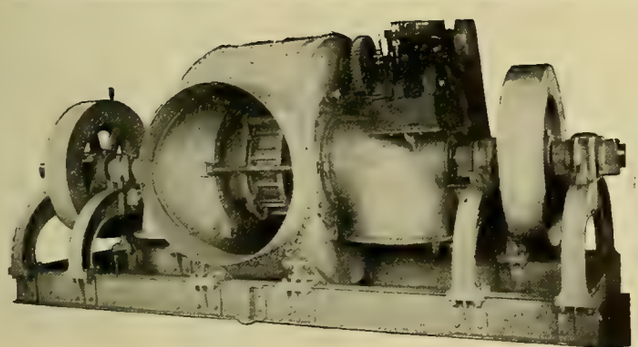

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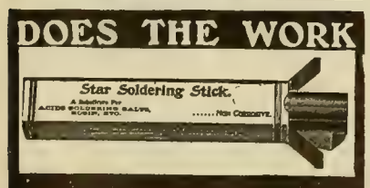

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Every other telephone user's wants are the same as yours.

If you got that kind of service right along you would support with your patronage and your influence the company that rendered it. Every other telephone user would do the same.

Our Automatic Telephone System gives that kind of service. That is why Independent telephone companies operating our Automatic System are so successful, because the service rendered is of the kind that you and every other telephone user wants, expects and is entitled to, the best obtainable. That is why subscribers to automatic service are loyal to it and to the companies furnishing it. This loyalty is the "good will" of the business and a valuable asset.

And, as for the operating companies, they know that it costs them less to produce this ideal service with our automatic equipment than it would to produce inferior service, with manual equipment, and they can get more money for it.

There's the whole thing in a nutshell—ideal telephone service, prompt, accurate and secret, costing the operating company much less than it costs to produce inferior service, and commanding a higher price.

It's because of all these advantages that the stocks and bonds of Independent telephone companies operating our Automatic System are stronger, more stable, more desirable and more profitable than any other. That's why it will pay you to look into these "Automatic" advantages when figuring on new equipment.

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Auburn, N. Y.	Jonesboro, Ark.	San Francisco, Cal.
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Next additional 50 calls in the month	5 cents each
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Single line : : : :	$75.00 per annum
Two-party line : : :	60.00 per annum

NICKEL SERVICE:

Direct line, 20 cents per day, including 4 calls
Direct line, 15 cents per day, including 2 calls
Two-party line, 15 cents per day, including 3 calls
Two-party line, 10 cents per day, including 1 call
Two-party line, residences only, 10 cents per day
Four-party line, residences only, 5 cents per day
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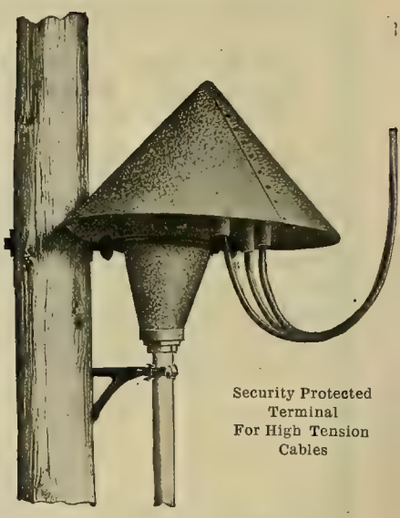

Security Protected Terminal For High Tension Cables

Do You Know

what your high tension distributing boxes cost you?

You think you're getting out of it cheap—we don't, because you didn't figure the cost of delay in installation, making up housing, and wiping joints. Doesn't this all count?

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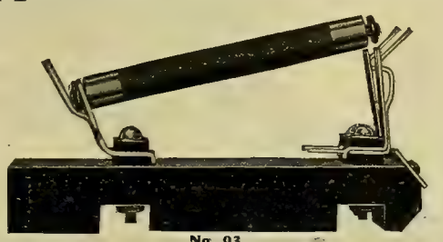

No. 93
All explained in Bulletin 21

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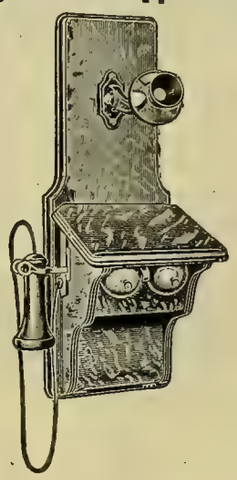

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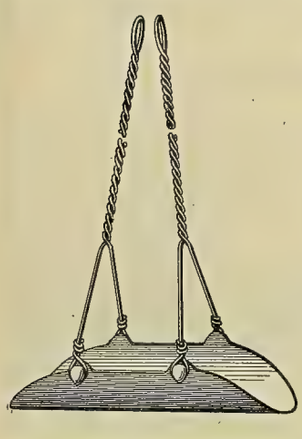

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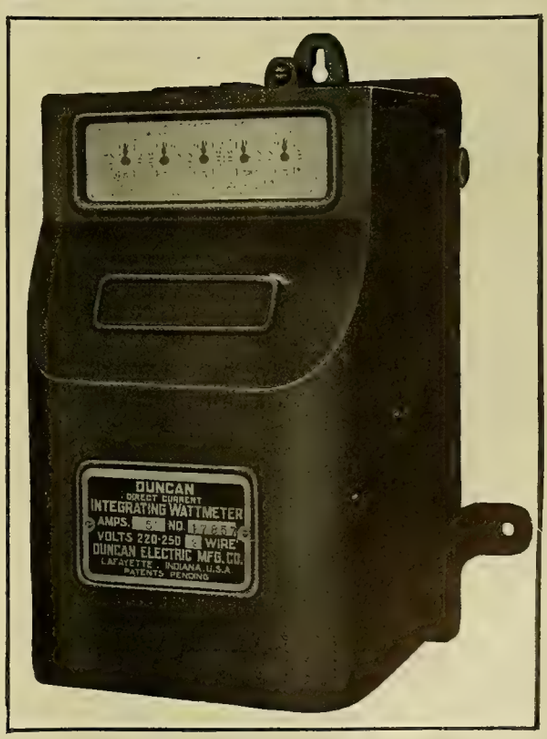

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LAFAYETTE INDIANA, U. S. A.

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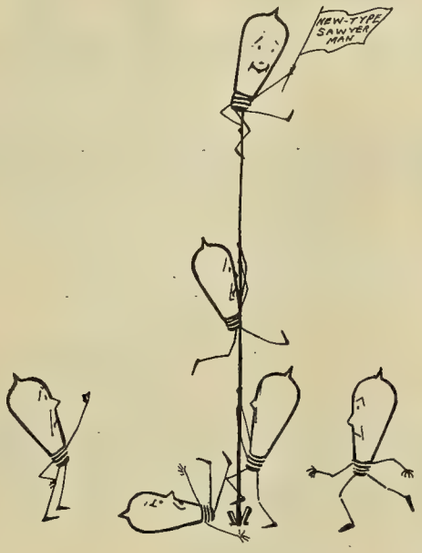

is like climbing a greased pole. But we are there, and we expect to stay. So if you want the best product of the lamp maker's art, get

THE NEW TYPE SAWYER-MAN

THEY ARE MADE BY

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AND SOLD BY THE

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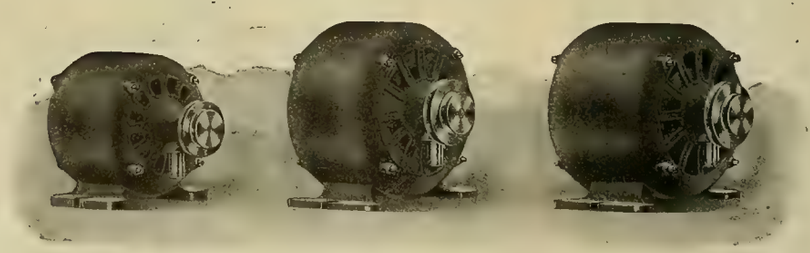

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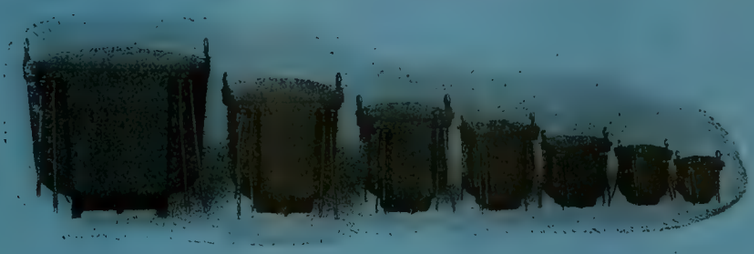

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The kind that have

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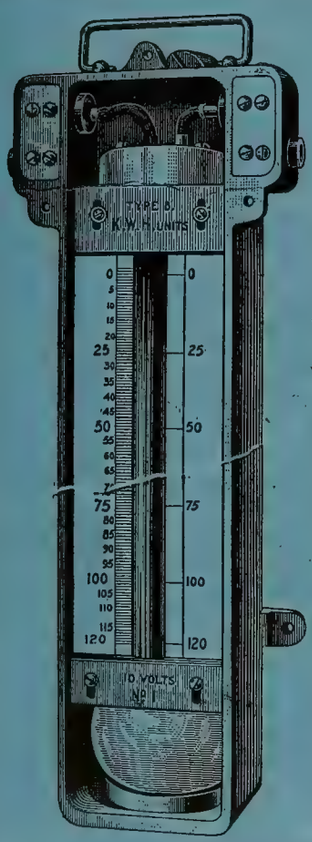

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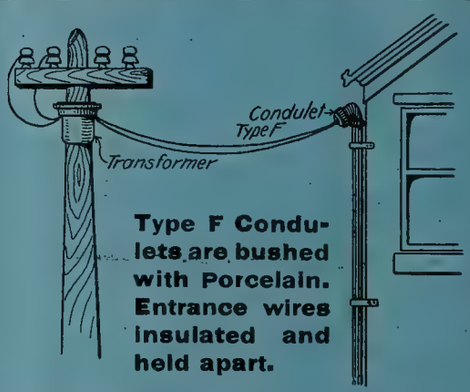

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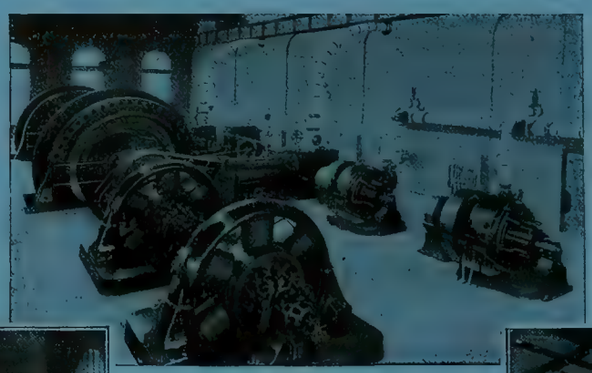

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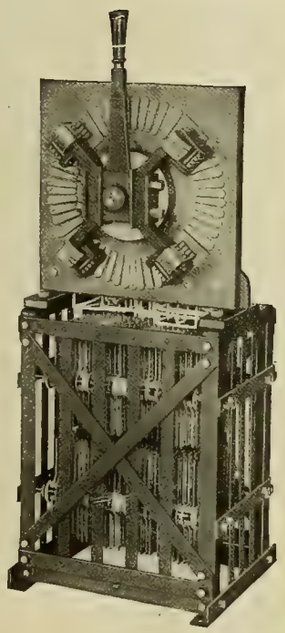

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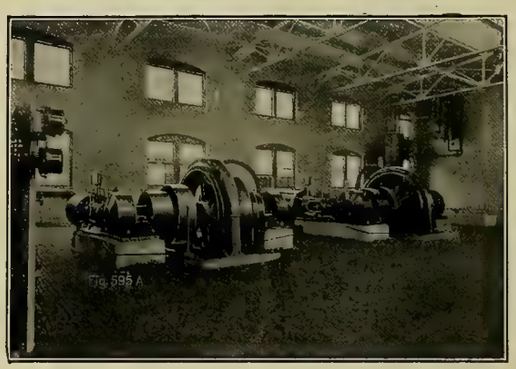

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Mica Insulator Co.
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Allis-Chalmers Company.

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Hoffmann, Emil R.

Motors (See Dynamos and Motors)

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Klein & Sons, Mathias.

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Bain, Foree & May.

Phosphor Bronze.
Phosphor Bronze Sm. Co. Ltd.
Seymour Mfg Co.

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Wrigley Co., Thos.

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Mott Iron Works, J. L.

Pole Changers,
Sandwich Pole Changer Co.

Poles and Ties.
Abeles & Taussig.
Berthold & Jennings.
Bissell Co., F. The
Bruer, Will F.
Fowler & Co., John H.
Greer Brokerage Co., J. C.
Kellogg Switch. & Sup. Co.
Lindsley Bros. Co., The
Loud's Sons Co., H. M.
Moss Tie Co.
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Perrizo & Sons.
Porter Cedar Company.
Sterling & Son, W. C.
Torrey Cedar Co.
Western Lumber & Pole Co.
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Worcester Co., C. H.

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Rail Joint Company, The

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(See Cut-outs and Switches.)

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Automatic Electric Co.
Bissell Co., The F.
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Western Electric Co.

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Bissell Co., The F.

Toggle Bolts.
(See Bolts, Toggle.)

Tools.
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Manufactured by
THE WILLARD STORAGE BATTERY CO.
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RELIABLE "Unit Accumulator"
National Battery Company
ELECTRIC STORAGE BATTERIES
BUFFALO, N. Y.

Branch Offices:
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IF YOU ARE INTERESTED IN STORAGE BATTERIES IT WILL PAY YOU TO
WRITE! WRITE!! WRITE!!!
And Learn the Merits and Details of the MUCH CONTESTED BUT VICTORIOUS
HENSEL STORAGE BATTERY
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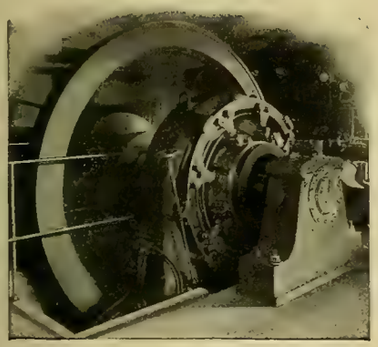
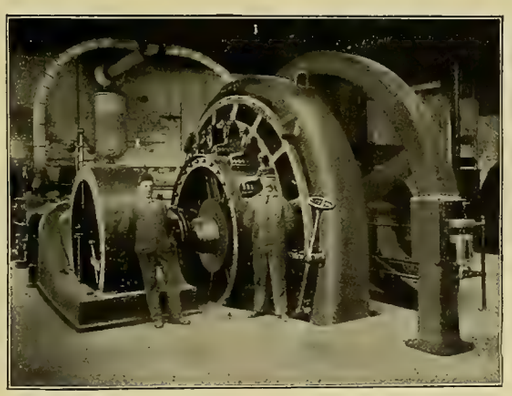
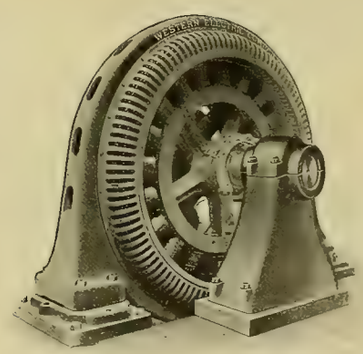
All Sizes *All Capacities* *For Every Service*







Write for Bulletins Nos. 8H and 8B.

CONSULT THE MAP

WRITE OUR NEAREST HOUSE

INCAND. LAMPS — $. SAVED
LOOK FOR THE LICENSE LABEL IN THE STEM
MONARCH ELEC. MFG. CO. WARREN, O.

A Splendid Opportunity —We've Seized it!

One of the "Napoleons," so called, in the lamp "organization" is reported to have remarked in effect, not very long ago:

"Oh, what a splendid opportunity now for the right man to start in as an independent lamp manufacturer!"

But he qualified this by saying that, unfortunately, the "right man," in his opinion, was now within the "organization."

He did not say that it was true, indeed, that one of the "right men" is perhaps now within the meshes of the net of the "ORGANIZATION" and is retained at a high salary BECAUSE THE "ORGANIZATION" FEARS THE BRAIN OF THIS MAN!

Of course it retained him---he is a magnificent investment. It would have paid the "ORGANIZATION" not only to have retained him but even to have allowed him to have remained in "masterly inactivity."

But he is not inactive. He is daily engaged in helping to "weave" the "red tape" of which the "net" is woven, that binds you to that "16 or 18 cents per."

The Napoleon within the "ORGANIZATION" forgot, however, that all the good ideas in the world cannot possibly come out of one head. He forgot that homely but trite expression---"there are others"(!) that can have an idea or two.

WE, TOO, SAW THAT OPPORTUNITY AND IT'S UP TO YOU TO HELP US MAKE THE MOST OF IT.

WE CAN GIVE YOU AS GOOD LAMPS AS THE "ORGANIZATION" AND WE CAN SAVE YOU MONEY. WHAT MORE DO YOU WANT?

St. Mary's Incandescent Lamp Company

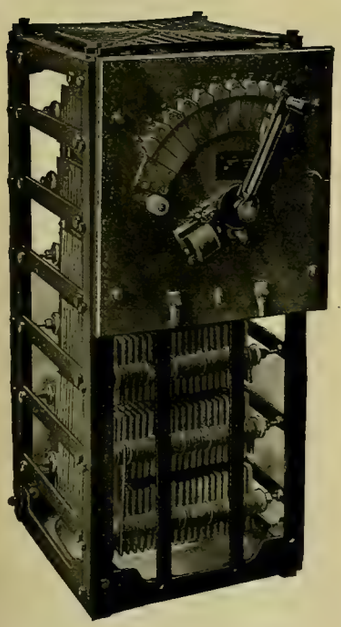
Wm. M. Rothschild - Pres

St. Mary's, Pa.

— Let us quote you —

P.S. 6000 Lamps daily capacity —
We protect buyers against litigation —
Penna. Corporation — Capital Stock, $100,000.

General Electric Company



Type RA Speed Regulating Rheostat
125 Volts—15 horsepower and larger.
250 Volts—7½ horsepower and larger.
500 Volts—10 horsepower and larger.

Speed Regulating Rheostats

FOR MACHINE TOOL EQUIPMENTS

TYPE RA

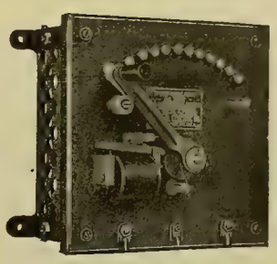
Will reduce speed of compound and shunt wound motors 50 per cent under normal full load conditions and 25 per cent at half load, by inserting resistance in armature circuit.

Will safely carry current when motor is overloaded 25 per cent.

Will operate continuously on any one of ten speeds.

Will open motor circuit on failure of voltage.

Will automatically stop motor if shunt field is broken and thus prevent "runaway" of machine. No-voltage coil is connected in series with shunt field.



Type RA Speed Regulating Rheostat
125 Volts—One-eighth to 10 horsepower inclusive.
250 Volts—One-eighth to 5 horsepower inclusive.
500 Volts—One-eighth to 7½ horsepower inclusive.

The General Electric Company has a motor for every service, a controller for every motor and engineers to combine them properly for any work.

1057

Chicago Office: Monadnock Building | PRINCIPAL OFFICE: SCHENECTADY, N. Y. | Sales Offices In All Large Cities

The Western Electrician's Seventh Annual Fall Trade Number

will, as usual, be of the greatest interest and importance to the manager of the local plant—to the man on the spot where the orders come from. It will post him up and in general awaken early interest in fall and winter business, besides placing manufacturers and dealers in touch with the real users of their products.

It will be read and carefully studied by managers, engineers and superintendents in the most important consuming district of the United States—*The Great Central and Western States.*

To insure receiving the consideration your goods deserve, you should advertise them in this most desirable number. An attractive announcement will not fail to receive the attention of buyers, and we hope you will take advantage of this excellent opportunity to increase the demand for your product.

Our Fall Trade Number will be dated September 15th, and in order to insure a good location, permit us to urge you to forward your order for a special announcement early.

WESTERN ELECTRICIAN

EASTERN OFFICE, 150 Nassau Street, New York

Suite 507 Marquette Building, Chicago

Edison Miniature Lamps

..FOR..

NOVELTY DEVICES

For use in electric flashlights, candlesticks, pocket lanterns, carriage and bicycle lamps, clock lights for bedrooms, ruby lanterns for photography, and for optical, dental and surgical instruments.

All types supplied—accurately rated—carefully selected.

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Candelabra Lamps
Decorative Lamps

EDISON DECORATIVE AND MINIATURE LAMP DEPARTMENT

General Electric Company, Harrison, N.J.

(512)

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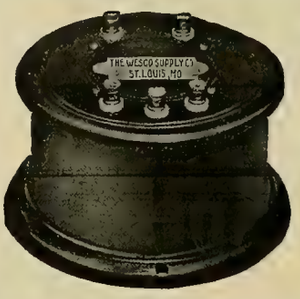

is a money-saver and a practical device for operating annunciator systems, gaslighters and bells of all kinds, absolutely **without expense** after once installed. Wherever an all-day alternating is available this instrument can be employed to immense advantage. Write for bulletin.

"EVERYTHING ELECTRICAL"

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THE WESCO SUPPLY CO.

Ft. Worth, Texas ST. LOUIS, MO.

LET US HAVE YOUR INQUIRIES WHEN IN NEED OF MICA OF ANY DESCRIPTION—WE CAN GIVE YOU WHAT YOU NEED QUICK AND AT THE RIGHT PRICES.
CHICAGO MICA CO., VALPARAISO, IND.

MICA

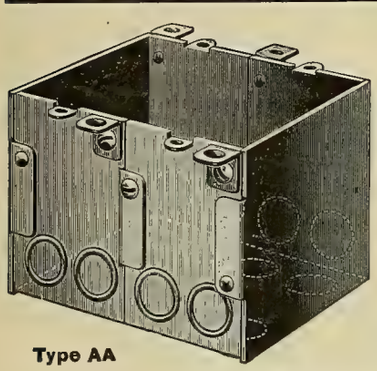
Of all Qualities, in any Form at Lowest Prices

EUGENE MUNSELL AND CO.
NEW YORK and CHICAGO

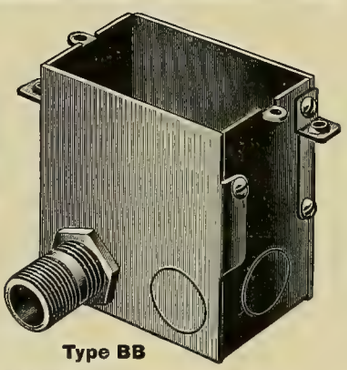
INSULATION That Is.

Micanite, Linotape, M. I. C. Compound, Empire Cloth and Paper. For Years the Standard.

MICA INSULATOR CO., Originators
NEW YORK and CHICAGO



Type AA



Type BB

For New and Old Work

UNION OUTLET SWITCH BOX

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Approved by the Underwriters National Electrical Association. Takes all Standard Switches and Receptacles

Designed so that a **two-gang** box can be converted into any number of gangs by releasing the clamping screws and inserting "Spacers." These gangs are easily assembled with the aid of a screwdriver, and fit together snugly, making a perfect and solid gang box for any required number of switches.

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"HIGH-DUTY"

General Storage Battery Co.

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Are easy to sell. You make a fine profit. Everybody with an electric sign wants one. Write us today for particulars and prices. Also pointers on electric signs.

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Measure low and high voltages; besides amperes and ordinary resistances. They are inexpensive and reliable. Send for catalog of portable and switchboard voltmeters and ammeters.

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LARGEST ELECTRICAL FACTORIES IN U. S. AND ABROAD NOW USE OUR—THE PASSBURG—SYSTEM.
INVESTIGATE—YOU MAY BE SURPRISED.

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428 MOONEY-BRISBANE BLDG.

YOU NEED IT!

Gale's Commutator Compound.

The Only Article That Will Prevent Sparking.

Will keep the Commutator in good condition and prevent cutting. Absolutely will not gum the brushes.

50c. per stick. $5.00 per dozen. Send 50c. for trial stick.

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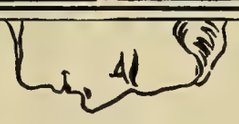
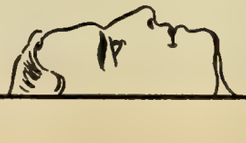


FROM EVERY POINT OF VIEW

COLUMBIA ENCLOSED ARC CARBONS

NATIONAL CARBON



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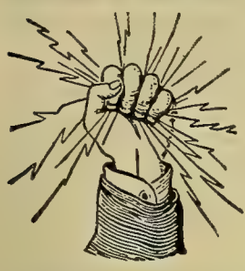
PROVIDENCE, R. I.



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MOTORS-DYNAMOS-FANS
ARE WELL MADE AND YOU'LL LIKE THEM
FOR ALL DIRECT CURRENT CIRCUITS
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Anchors that hold

Showing the 5, 6 and 7 in. style.

Holds 12,500, 15,000 and 17,500 lbs. respectively.

Popular with Street Railway, Electric Light and Telephone Companies.

The 5, 6 and 7 inch
Stombaugh Guy Anchors
HAVE NO WELDS

The full rod is cast into the helix. Our experience has shown that welds are dangerous in rods of less than one inch in diameter.
The rods of Stombaugh Guy Anchors are not weakened by holes for pins or rivets.

STOMBAUGH GUY ANCHORS BORE INTO THE GROUND WITHOUT DISTURBING THE SOLID EARTH.

When in at the proper depth they are set. The strain can then be put on without fear of any back give. You are sure. An anchor is as strong as its weakest part. Stombaugh Guy Anchors have no weak parts.

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MANUFACTURERS
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"O. K." Weatherproof Wire.
Slow-Burning Weatherproof and Ideal Wire.

Prices and Samples on Application.

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Absolutely Accurate Tachometers

All of the defects of the old style instruments are eliminated. No springs or delicate mechanisms; wide range of speed variations.

Vertical scales graduated in accordance with customer's requirements. They are adaptable to all classes of rotary machinery. Full particulars of our many types furnished upon application. Send for catalogue.

NIAGARA
Tachometer & Instrument
COMPANY
Niagara Falls, N. Y.

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BY ALL UNBIASED METER EXPERTS TO BE THE MOST RELIABLE DIRECT CURRENT WATTMETER IN THE WORLD

DUNCAN ELECTRIC MFG. CO.
LAFAYETTE INDIANA, U. S. A.

In 1905

The Western Electrician published 1042 LARGE pages of reading matter and 1575 illustrations. This is 3126 columns or about 3,000,000 words. Equivalent in amount to 23 average $2 technical Books. On the book basis $46 worth given for $3. If you are not a subscriber, send in your order now.

Western Electrician
507 Marquette Building, Chicago

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POSITION WANTED *advertisements (50 words or less), $1.00 an insertion additional words 2c each.*

POSITION WANTED

By an electrician of fifteen years' practical experience to take charge of an electric plant; competent to handle all branches and have first-class references. Address Box 643, Western Electrician, Chicago.

POSITION WANTED

By man who can do things. I have had ten years' experience in the electric lighting business in the capacity of superintendent and chief engineer. I have had charge of both steam and water plants with high voltage transmission lines and sub-stations. Address Box 639, care of Western Electrician, 507 Marquette Building, Chicago.

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Young man for testing room of Motor Factory in Middle West. Must be technical graduate, and have experience in testing small motors. Give experience fully and state salary wanted. Address Box 642, care Western Electrician, 507 Marquette Bldg., Chicago Ill.

WANTED

I have a customer for an Electric Light Plant in town, either in Ohio, Indiana, Michigan, Wisconsin, Illinois or Iowa, of 2,500 to 3,000 people. Must have good city contract and franchise. Address Box 641, care Western Electrician, 507 Marquette Bldg., Chicago, Ill.

FOR SALE.

Number one good paying electric light plant in town of 1,500 to 2,000. Good city contract, liberal franchise, and good, steady, healthy growth. Flat rate 75c per month; meter rate, 15c and 20c per K. W. majority on meters. LOCK BOX "D" Flemingsburg, Ky.

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500-VOLT MOTORS

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1	1	Crocker-Wheeler.
1	1	Towle.
1	1	New England.
1	1½	Northern, series.
1	1½	Belknap, self-oiler.
1	1½	Crocker-Wheeler.
1	3	T. H., self-oiler.
1	3½	Roth.
1	4	Fort Wayne.
1	5	Card.
1	5	Browning, M. P.
1	6	Westinghouse, M. P.
1	7½	Roth, self-oiler.
2	7½	Gen. Elec., M. P.
1	7½	Eddy, M. P.
1	7½	Crocker-Wheeler.
2	10	Kester, M. P.
2	10	Belknap, M. P.
2	12	Thomson-Houston.
1	15	Kester, M. P.
2	20	Bernard, M. P.
1	25	Belknap.
1	35	Gen. Elec., M. P.
1	40	Crocker-Wheeler, M. P.
1	50	Eddy, M. P., type G.
1	65	Gen. Elec., M. P.
1	100	Westinghouse, M. P.

Everybody says our new shops are "immense!" They are. We have the largest repair shops in this country. Send for our **Monthly Bargain Sheet** showing our complete stock with net prices.

GREGORY ELECTRIC CO.
Cor. 16th and Lincoln Streets, :: Chicago

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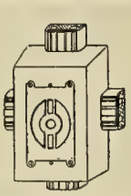
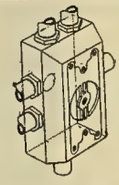

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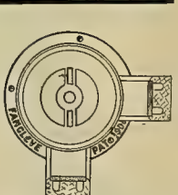

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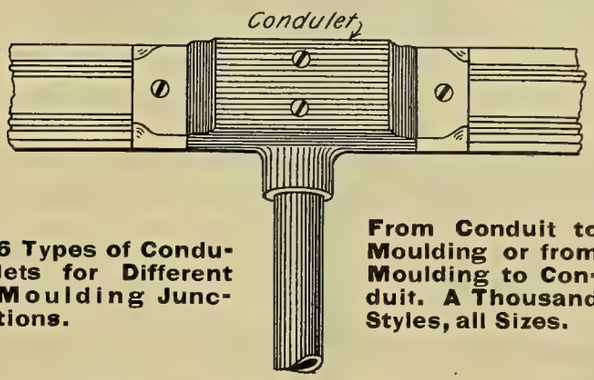

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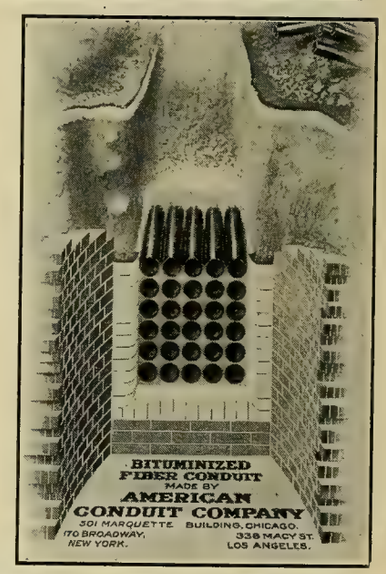

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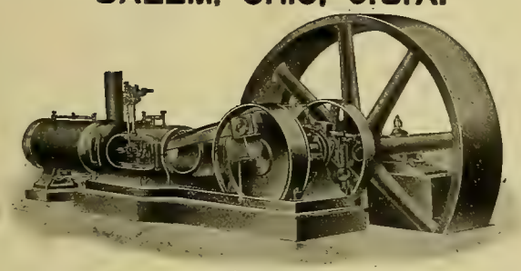

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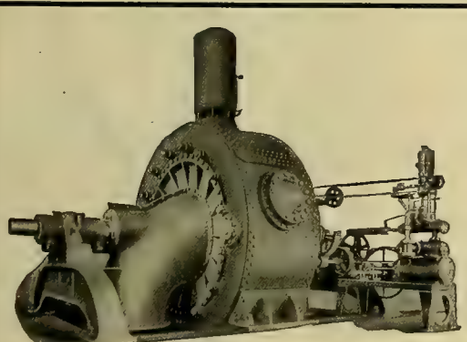

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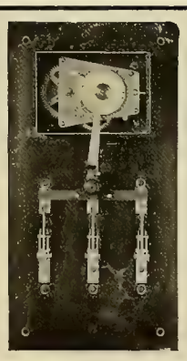

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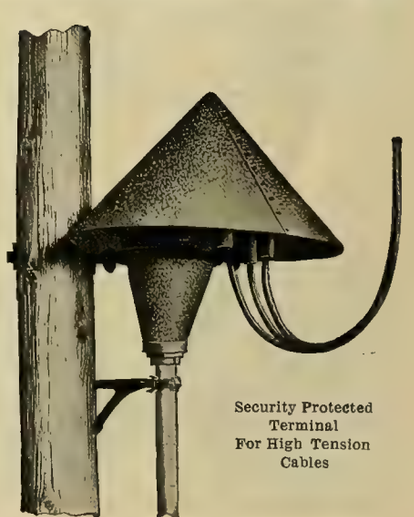

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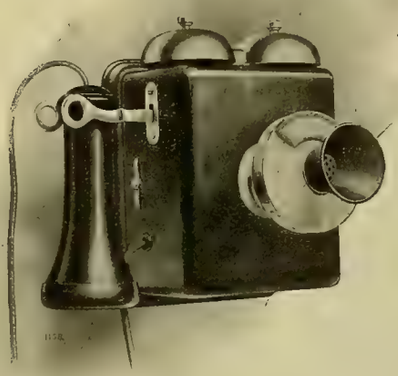

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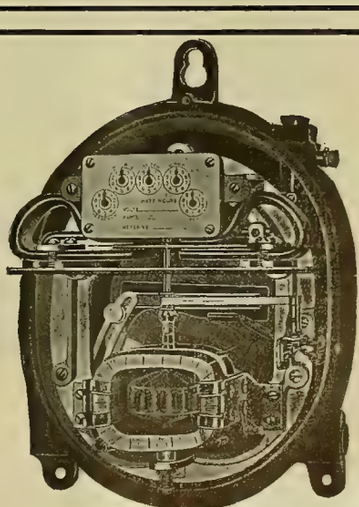

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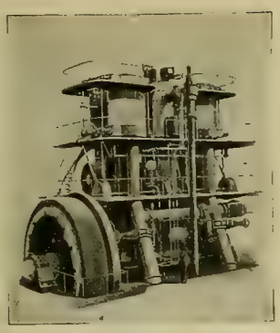

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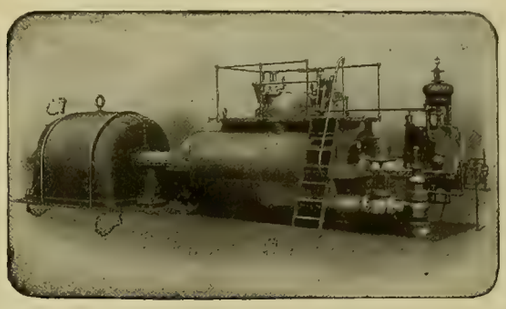

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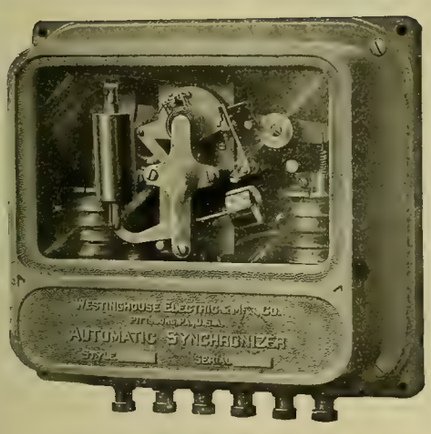

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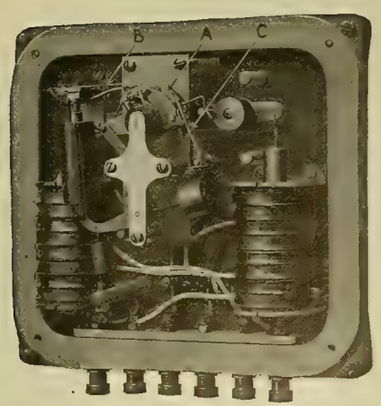

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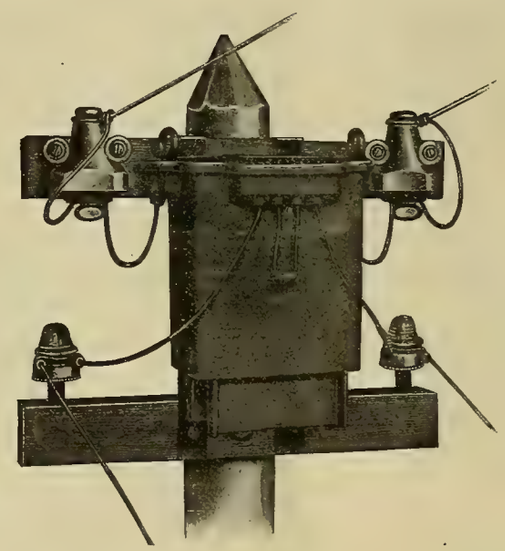

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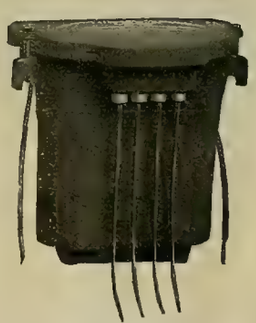

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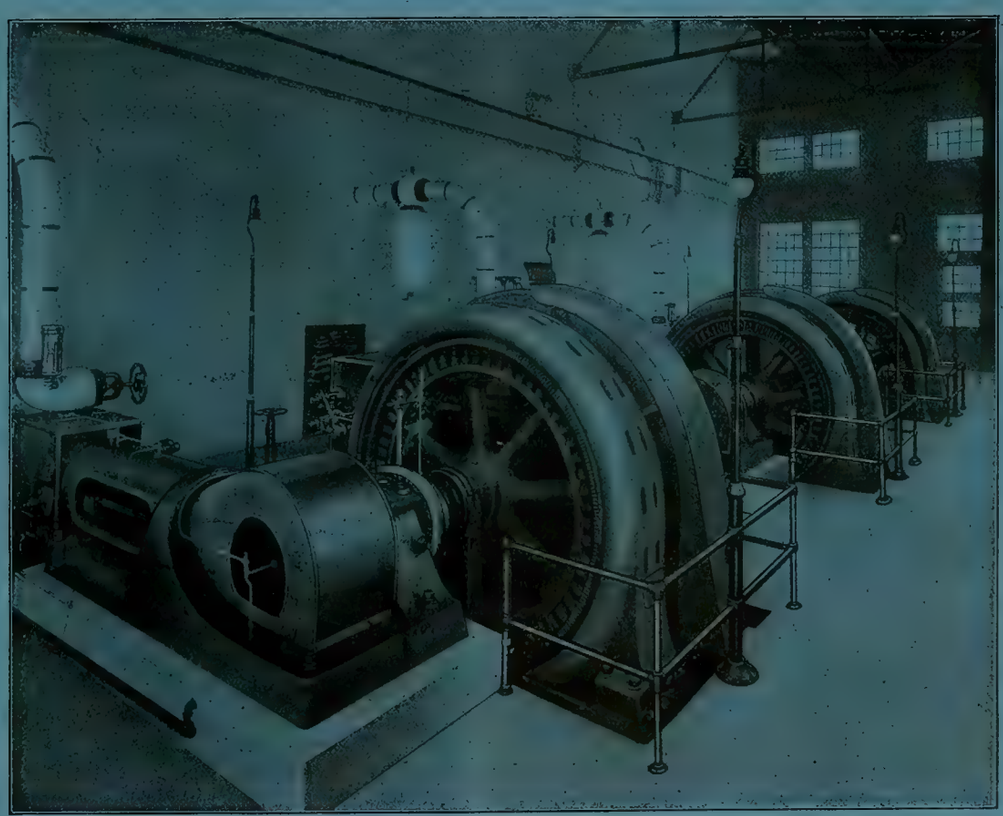

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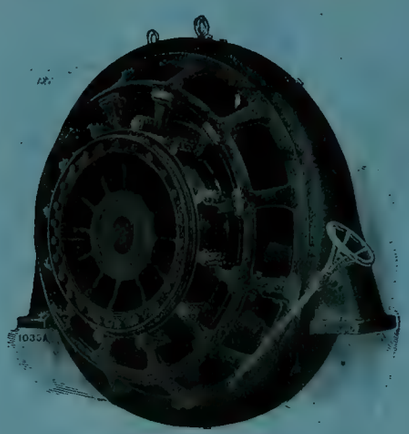

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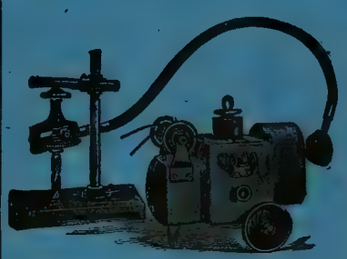

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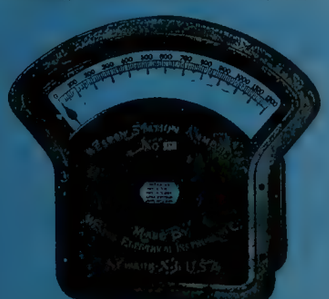

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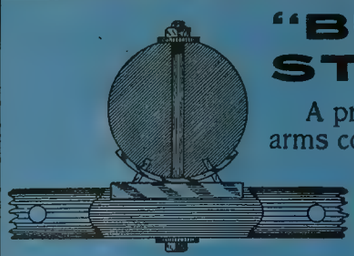

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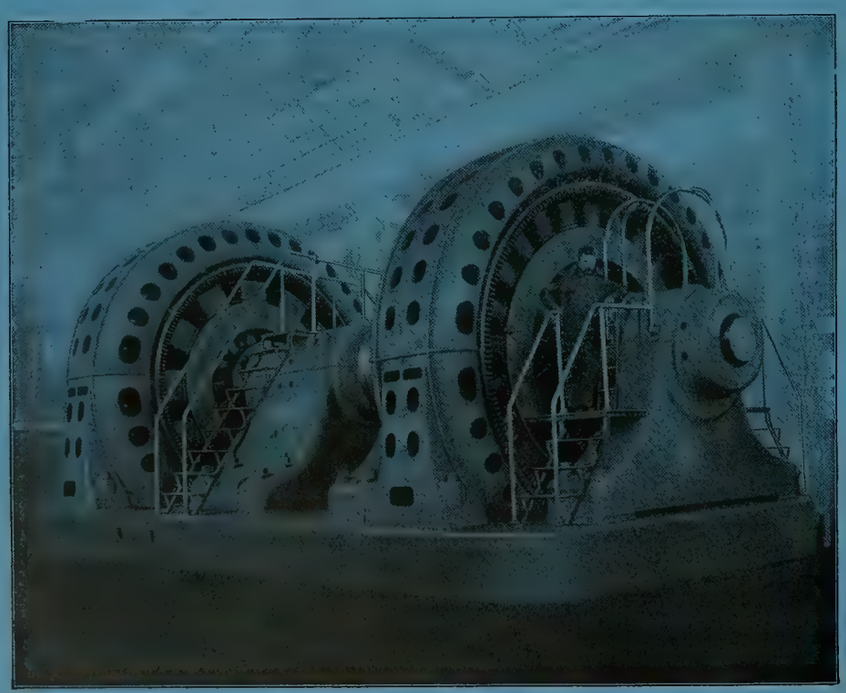

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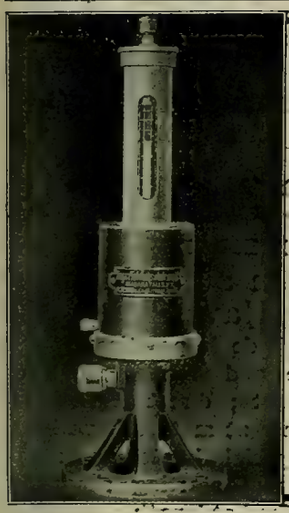

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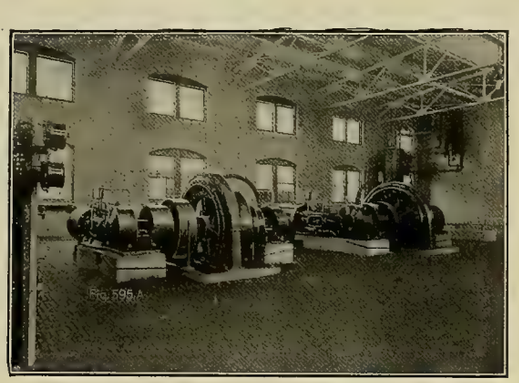

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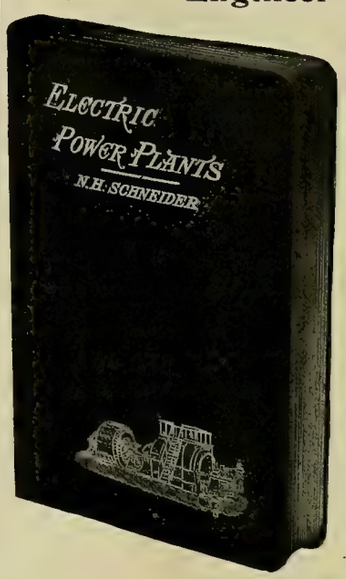

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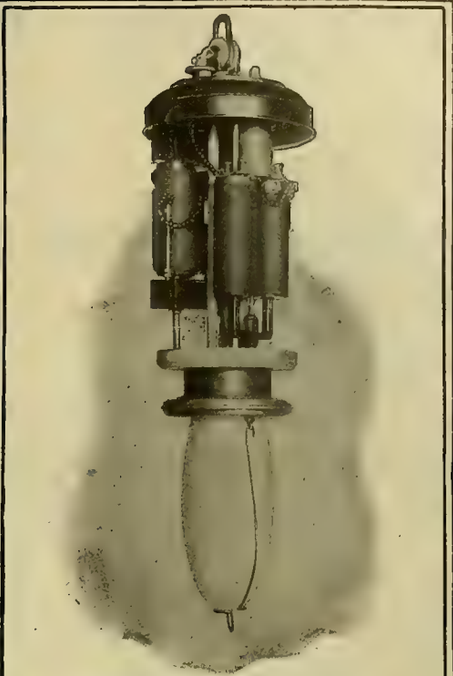

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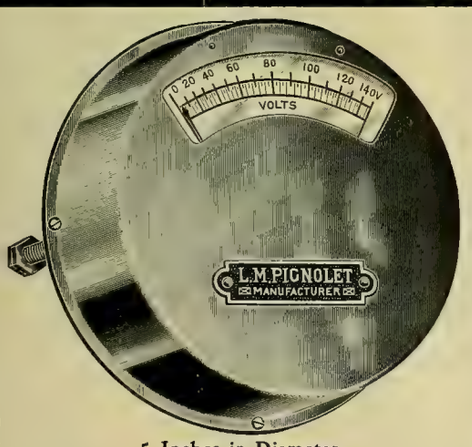

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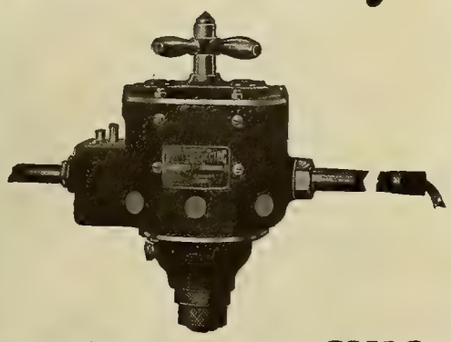

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Ft. Wayne Elec. Wks. Inc.
General Electric Co.
Gregory Electric Co.
Manhattan Elec. Supply Co.
Maquette Elec. Mfg. Co.
Stanley—G. I. Elec. Mfg. Co.
Wesco Supply Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.

Lamp Guards.
Benjamin Elec. Mfg. Co.
Matthews & Bros., W. N.
Morse, Frank W.

Lamps, Incandescent.
Bissell Co., The F.
Boston Ican. Lamp Co., The
Buckeye Electric Company.
Central Electric Co.
Chicago Edison Co.
Columbia Incan. Lamp Co.
Economy Elec. Co., The
Edison Decorative & Miniature Lamp Dept.
General Electric Co.
McCandless, H. W
Monarch Elec. Mfg. Co.
Novelty Incan. Lamp Co
Sawyer-Man Elec. Co.
St. Marys Incand. Lamp Co.
Standard Elect'l. Mfg. Co.
Wesco Supply Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.

Lamps, Incandescent—Replacers & Cleaners.
Morse, Frank W

Lamps, (Mercury Vapor).
Cooper Hewitt Elec. Co., The

Letters, Sign.
Haller Machine Co.
Matthews & Bros. W. N.

Lightning Arresters.
Central Electric Co.
Ft. Wayne Elec. Wks. Inc.
General Electric Co.
Manhattan Elec. Supply Co.
Stanley—G. I. Elec. Mfg. Co.
Wesco Supply Co.
Western Electric Co.

Line Material.
Ajax Line Material Co.

Linemen's Climbers.
Klein & Sons, Mathias.

Magnets, Autom. Wound
Acme Wire Co.

Magnet Wires.
(See Wires and Cables.)

Mica.
Chicago Mica Co.
Mica Insulator Co.
Munsell & Co., Eugene.

Mining Apparatus, Elec.
Allis-Chalmers Company.
Crocker-Wheeler Co.
General Electric Co.
Jeffrey Mfg. Co.
Wesco Supply Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.

Mining Machinery.
Allis-Chalmers Company.

Model and Machine Shop.
Hoffmann, Emil R.

Motors (See Dynamos and Motors)

Nippers and Pliers.
Klein & Sons, Mathias.

Patent Attorneys.
Bain, Foree & May.

Phosphor Bronze.
Phosphor Bronze Sm. Co. Ltd.
Seymour Mfg. Co.

Pipe Bending Machines.
Chicago Pneumatic Tool Co.
Wrigley Co., Thos.

Platinum, Wire and Sheet.
Baker & Co. Inc.

Poles, Arc Lamp.
Mott Iron Works, J. L.

Pole Changers.
Sandwich Pole Changer Co.

Poles and Ties.
Abeles & Taussig.
Berthold & Jennings.
Bissell Co., F. The
Bruer, Will F.
Fowler & Co., John H.
Greer Brokerage Co., J. C.
Kellogg Switch. & Sup. Co.
Lindsley Bros. Co., The
Loud's Sons Co., H. M.
Moss Tie Co.
Mueller Company, William.
Pacific Coast Pole Co.
Perrizo & Sons.
Porter Cedar Company.
Southern Exchange Co, The
Sterling & Son, W. C.
Torrey Cedar Co.
Western Lumber & Pole Co.
Wilson Co., Jas. I. M.
Worcester Co., C. H.

Polish (Metal).
Hoffman, Geo. W.

Porcelain, Specialties.
Artistic Porcelain Co.

Portables.
Plume & Atwood Mfg. Co.

Power Transmission Machinery.
Allis-Chalmers Company.
Jeffrey Mfg. Co.

Rail Joints.
Rail Joint Company, The

Re-Winding—Repairs.
Chicago Edison Co.
Gregory Electric Co.

Rheostats.
Cutler-Hammer Mfg. Co.
General Electric Co.
Wesco Supply Co.
Western Electric Co.
Westinghouse El. & Mfg. Co

Rosettes.
Pass & Seymour.

Rubber Machinery.
Alton Machine Co.

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Highland Park College.
Michigan College of Mines.
Pratt Institute.

Second-Hand Machin'y.
Bissell Co., The F.
Gregory Electric Co.
Rossiter, MacGovern & Co.

Signs, Electric.
Haller Machine Co.

Sleeving, Braided.
Belden Mfg. Co.

Solder, Self Fluxing.
Belden Mfg. Co.

Soldering Sticks, Salt and Paste.
Crollius & Son, E. R.
Western Electric Co.

Solenoids.
Acme Wire Co.
Schureman Co., J. L.

Spark Coils.
Acme Wire Co.

Speaking Tubes.
Central Electric Co.
Manhattan Elec. Supply Co.
Ostrander & Co., W. R.
Wesco Supply Co.
Western Electric Co.

Specialties, Electrical Mfrs. and Designers.
Haller Machine Co.

Speed Indicators.
Niagara Tachometer & Instrument Co.
Weston Electrical Inst. Co.

Speed Recorders.
Niagara Tachometer & Instrument Co.

Springs.
Manross, F. N.

Staples.
Blake Signal & Mfg. Co.

Steel Gains.
Steel Gain Mfg. Co.

Stokers.
Westinghouse Machine Co.

Storage Batteries.
American Battery Co.
Chicago Pneumatic Tool Co
Electric Storage Battery Co.
General Storage Battery Co.
Gould Storage Battery Co.
Hensel & Co., John A.
National Battery Co.
Willard Storage Bat. Co.

Supplies, General Elec.
Amer. Elect'l Supply Co.
Bissell Co., The F.
Central Electric Co.
Century Electric Co.
Chicago Edison Co.
Manhattan Elect'l Supply Co
Wesco Supply Co.
Western Electric Co.

Switches.
(See Cut-outs and Switches.)

Tachometers and Tachographs.
Niagara Tachometer and Instrument Co.

Telephones, Telephone Material and Switchboards.
American El. Telephone Co
Automatic Electric Co.
Bissell Co., The F.
Central Electric Co.
International Tel. Mfg. Co.
Kellogg Switchb. & Sup. Co.
Manhattan Elec. Supply Co.
North Electric Co.
Stromberg-Carlson Tel. M. Co.
Wesco Supply Co.
Western Electric Co.

Telephone Service.
Chicago Telephone Co

Time Switches.
Bissell Co., The F.

Toggle Bolts.
(See Bolts, Toggle.)

Tools.
Klein & Sons, Mathias.

Tools, Pneumatic.
Chicago Pneumatic Tool Co.

Transformers.
Allis-Chalmers Company.
Central Electric Co.
Crocker-Wheeler Co.
Ft. Wayne Elec. Works, Inc.
General Electric Co.
Kuhlman Electric Co.
La Fayette Elect'l. Mfg. Co.
National Brake & Elec. Co.
Stanley—G. I. Elec. Mfg. Co.
Wagner Electric Mfg. Co.
Wesco Supply Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.

Trucks, Electric Car.
General Electric Co.
Westinghouse El. & Mfg. Co.

Turbines, Steam.
Allis-Chalmers Co.
General Electric Co.
Westinghouse Machine Co.

Turbine Water Wheels.
Allis-Chalmers Co.
Leffel & Co., Jas.

Vacuum Drying.
Devine Co., Joseph P.

Vulcanized Fibre.
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Wattmeters.
Duncan Elec. Mfg. Co.
Wesco Supply Co.

Wire Rope Machinery.
Alton Machine Co.

Wires and Cables—Magnet Wires.
Acme Wire Co.
American Electrical Works.
Belden Mfg. Co.
Bissell Co., The F.
Central Electric Co.
Chicago Ins. Wire & Mfg. Co.
Crescent Ins. Wire & Cble. Co.
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Kellogg Switch. & Sup. Co.
Manhattan Elec. Supply Co.
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New York Insulated Wire Co.
Okonite Co., The.
Phillips, Eugene F.
Phillips Insulated Wire Co
Roebling's Sons Co., J. A.
Runzel-Lenz Elec. Mfg. Co.
Safety Ins. Wire & Cable Co.
Simplex Electrical Co.
Standard Underground Cable Co.
Wesco Supply Co.
Western Electric Company.

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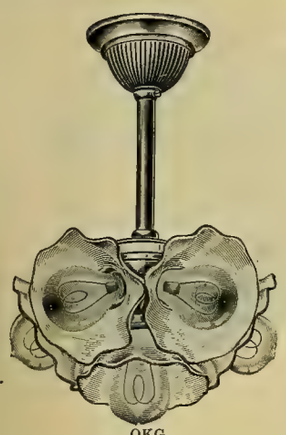
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BENJAMIN WIRELESS CLUSTERS

NATIONAL CODE STANDARD

SIMPLE
DURABLE

Type KY

ORNAMENTAL
EFFECTUAL

WITH "TURN-DOWN FEATURE"

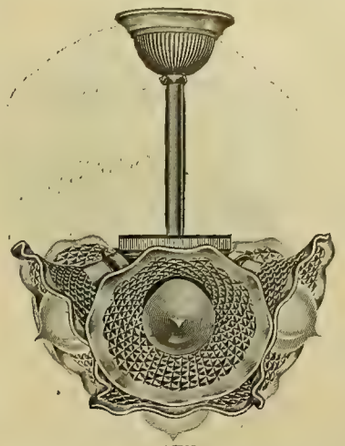
Three Degrees of Illumination

Center light only
Side lights only
Center and side lights

Write for New Catalogue B-17

BENJAMIN ELECTRIC MFG. CO.

NEW YORK CHICAGO SAN FRANCISCO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DIRECT CURRENT

SHOP LAMPS

BUILT TO WEAR

FEATURES

Indestructible Coils.

Accessible parts.

Simplicity of Construction.

Low Initial Cost.

Low Cost of Maintenance.

Catalogue Ready

Manufactured By
AMERICAN ARC LAMP CO.
KALAMAZOO MICH.

THE W. R. CARTON CO., Agents
118-132 W. JACKSON BLVD.
CHICAGO

Dry Battery Tests

When you use a battery for telephones or any specific purpose where the source of current must be relied on, the

ROCK ISLAND
NEW PATENT
DRY CELL

will not fail you. Subjected to the most thorough tests—competitive and exhaustive, in laboratory and actual use—the Rock Island has proved to be

20 TO 30 PER CENT BETTER

than any other battery in the market.

Standard No. 8—3½ by 8 inches—is our battery that telephone companies are finding just the sort of battery needed for their best work. Costs more, but lasts longer than Standard No. 6, the regular size, most generally used for all purposes.
Write to Department A for prices.

Rock Island Battery Co.
Ninth and Sycamore Sts.,
CINCINNATI, O.

RELIABLE "Unit Accumulator"

National Battery Company

ELECTRIC STORAGE BATTERIES

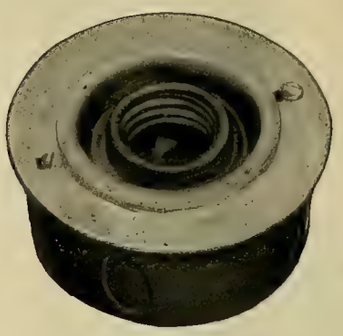
BUFFALO, N. Y.

Branch Offices:
NEW YORK, CHICAGO

THE BRIGHTEST IN THE FIRMAMENT

STANDARD ELECTRICAL MFG. CO., NILES, O.

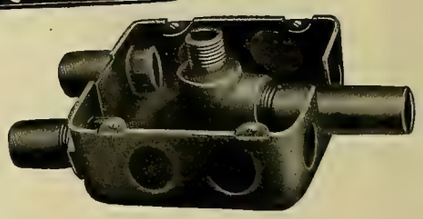
LOOK FOR THE LICENSE LABEL



THE STORY OF Bossert Boxes

Times and conditions have changed with a marked improvement in all lines. Steel has replaced iron to a marvelous extent, especially in building material. The formerly used old-fashioned cast-iron outlet box is not what the up-to-date contractor uses. He always specifies the only drawn steel box made.

The Bossert Box

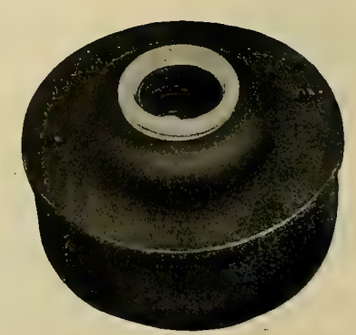


The reason is apparent. It is made of one piece of drawn steel plugged with a sufficient number of hermetically sealed outlets that can be removed with a sharp blow of a hammer, leaving a perfectly clean round hole that requires no filing or reaming. This *cannot be accomplished* with the *ordinary cast-iron box.*

The time, money and worry that Bossert Boxes *save are* proof of their superiority. For further information write for catalogue.

BOSSERT ELECTRIC CONSTRUCTION CO.

UTICA, NEW YORK



The Phoenix Glass Company calls attention to the following Reliable Inner Globe Testimony

OFFICE OF

VALLEY ELECTRIC COMPANY.

ELECTRICAL CONTRACTORS.

BEAVER VALLEY E. L. & P. CO
ROCHESTER ELECTRIC CO.
BEAVER RIVER POWER CO.

FANS, FIXTURES, BELLS, LAMPS AND ELECTRICAL SUPPLIES OF ALL KINDS CARRIED IN STOCK.

SPECIAL AND PROMPT ATTENTION GIVEN TO REPAIRING AND ELECTRICAL WIRING OF ALL KINDS.

NEW BRIGHTON, PA., May 24th, 1906.

Phoenix Glass Co.

Pittsburgh, Pa.

Gentlemen:-

Complying with your inquiry regarding results of inner & outer globes on our arc-lamps, we respectfully submit the following report takenfrom our records & is what we would call a triumph in the art of glass making.

We installed fifty-one Fort Wayne form "C" D. C. series arc-lamps in Beaver, July 1905, we have had these lamps burning from dark to daylight ever night since & have had to renew but three outer and five inner globes up to the present time.

The outer & three inner globes were broken by some unprincipled characters, who on last Halloween, unhooked & dropped three of the lamps into the street, & the carbon-setter broke one inner on Jan. 23d. & another May 21st.

One lamp burned out the magnets on Feb. 3d. & from indications of the carbons, drew a very long arc before cutting out, still the inner globe was not injured.

We are using #85356 & outer #6846,Phoenix Brand, & we might add in conclusion, that we are now on our second thousand box of carbons, showing that there is a small consumption of carbon due to the globes fitting the gas cap perfectly.

Yours very truly,

Valley Electric Co.

O. A. White

Gen. Supt.

THE PHOENIX GLASS COMPANY

NEW YORK PITTSBURGH CHICAGO

P and S Sockets have won first prize every time in comparative tests.

On any voltage up to 250 volts or any amperage up to 3 amperes—direct or alternating current—P and S have proven best.

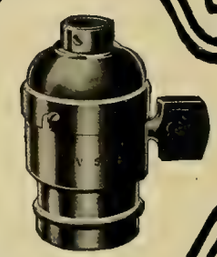
Write for testimonials and facts that prove.

PASS & SEYMOUR, Inc.

56 BOYD AVENUE

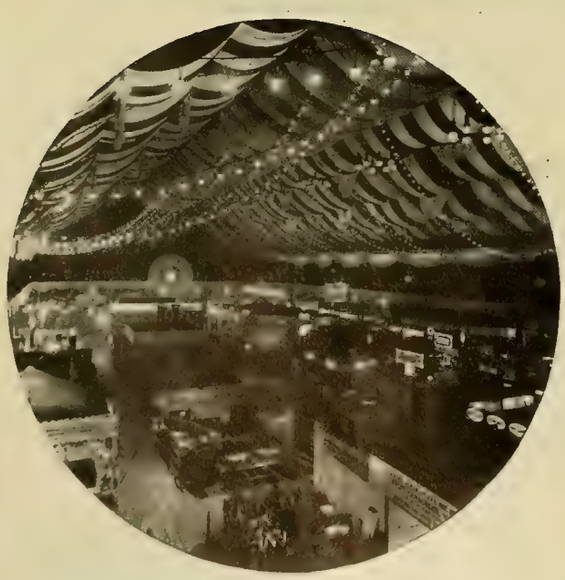
SOLVAY, N. Y., U. S. A.

SALES OFFICES: New York. Chicago. San Francisco.



Second Annual Electrical Show

COLISEUM, CHICAGO, JANUARY 14-26, 1907



The Market Place for Everything Electrical

The value of an Electrical Exhibition is direct and convincing. The trade and the public attend in large numbers and want to see and buy the newest and best in every line of electrical products. Will you show yours? Write for prospectus. Apply for space now.

ADDRESS

ELECTRICAL TRADES EXPOSITION COMPANY

HOMER E. NIESZ, Managing Director

139 Adams Street - - CHICAGO, ILL.

WAGNER ELECTRIC MFG. CO.

Main Office and Factory, ST. LOUIS, U. S. A.

CONTRACTORS' ATTENTION

WE DO NOT BUILD SWITCHBOARDS. We build instruments for you to put on your boards. We do not attempt to sell you instruments and then enter into competition and underbid you on the price of the boards. If we did this, we could possibly get a good many switchboard orders, as we could sell instruments cheaper to ourselves than we could to contractors.

We come to you, asking your support in the instrument line, guaranteeing not to compete with you on your switchboard business, guaranteeing to give you good instruments at a reasonable price.

We solicit your patronage with a full line of switchboard instruments, which we can ship from a large stock. Our Bulletin No. 67-H will tell you more about this.

TRANSFORMERS PORTABLE INSTRUMENTS
POLYPHASE MOTORS SINGLE-PHASE MOTORS

SALES OFFICES IN ALL OF THE PRINCIPAL CITIES

THE "LION" and the "MOUSE"! And the "RED TAPE NET"!

Have you seen the billboard poster advertising the sensational drama---"The Lion and the Mouse?"

In this striking picture you see the Great Lion, fierce and hungry but securely ensnared within the meshes of the Cruel Net.

Then if you look very closely you will see a Little Mouse.

Now that Lion is yourself, great and strong, Mr. Lamp Buyer; but you do not realize how strong!

That Net is the "red tape net" of the "ORGANIZATION."

And the Little Mouse---well, call us The Mouse.

We are not exactly that small, but we are just about as active (and as "white!") and our teeth are just as sharp, and we "know our business" like that little mouse, for we know how to gnaw at the meshes and break that red tape net.

Come, Mr. Lion, you're strong and all that; but waken up! You're certainly securely held down by that net. You're "in it," all right; and the longer you stay in it---like the Lion---the less you'll like it.

Give us a chance to help you break the red tape net by letting us quote you.

St. Mary's Incandescent Lamp Company

Wm. M. Rothschild - Pres
St. Mary's, Pa.

Let us quote you

P.S. 6000 Lamps daily capacity -
We protect buyers against litigation -
Penna. Corporation - Capital Stock $100.000.

9,800

Brake Horse Power in Diesel Oil Engines

From Jan'y 1st, 1906, to July 1st, 1906, contracts were closed for the following Diesel Oil Engines. We guarantee, under a surety bond, that every one of these engines, in the purchaser's hands, will develop 100 Brake H. P. Hours on 8 gallons of crude or fuel oil, or 100 K. W. Hours, measured on the switchboard, on 12½ gallons. With oil at 3 cents a gallon one Brake H. P. Hour will cost $2\frac{4}{10}$ mills and one K. W. Hour $3\frac{75}{100}$ mills.

THREE-CYLINDER ENGINES	
Beaumont Ice, Light & Ref'g Co., Beaumont, Tex.	525 H.P.
Kent Mfg. Co., Clifton Heights, Pa.	225 "
Laconia Electric Lighting Co., Laconia, N. H.	225 "
Estes Mills, Fall River, Mass.	225 "
Ball Bros. Glass Mfg. Co., Muncie, Ind.	225 "
Samson Cordage Works, Boston, Mass.	450 "
Sierra Consolidated Gold Mining Co., Hillsboro, N. Mex.	340 "
Prairie Pebble Phosphate Co., Mulberry, Fla.	3,150 "
Mansfield Municipal Lighting Plant, Mansfield, Mass.	225 "
Ball Bros. Glass Co., Muncie, Ind., 3d order	225 "
United Gas Improvement Co., Philadelphia, Pa., 2d order	675 "
Citizens Electric Light, Heat & Power Co., Perth Amboy	120 "
Westerly Electric Co., Westerly, R. I.	225 "
Pierce Phosphate Co., Mulberry, Fla.	450 "
Ansonia Mfg. Co., Ansonia, Conn.	170 "
United Wire and Supply Co., Providence, R. I.	120 "
Westerly Electric Co., Westerly, R. I., 2d order	450 "
Mineral Wells Elec. Lt., Power & Mfg. Co., Mineral Wells, Tex.	225 "
J. D. Beardsley, Mineral Wells, Texas	450 "
B. M. Young, Morgan City, La.	120 "
City of Bryan, Ohio	290 "
Trinity & Brazos Valley R. R. Co., Teague, Texas	240 "
Westerly Electric Co., Westerly, R. I., 3d order	225 "
SINGLE-CYLINDER ENGINES	
Hanscom Bros., Fall River, Mass.	75 "
Highland Water Co., El Paso, Texas	75 "
Bisbee Naco Water Co., Bisbee, Ariz.	75 "
	9,800 "

It is a fact worthy of all emphasis that every Diesel Engine plant thus far installed has surpassed our guaranteed fuel consumption by 20 to 25 per cent.

It will pay you to investigate the Diesel Engine—the most efficient and most economical prime mover on earth.

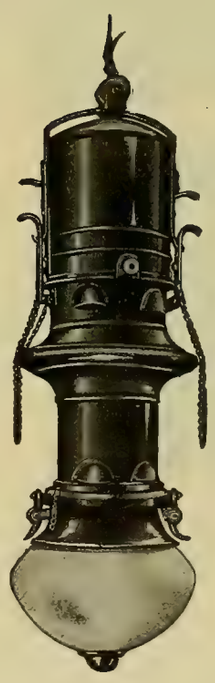
Complete Literature Free Upon Request

American Diesel Engine Co.

11 Broadway, New York City

We've Reached the Capitol
The Government Are Using 'Em

SUNRAY EFFECT



3,000 CANDLE-POWER

THE EXCELLO ARC LAMP CO.

24-26 East 21st Street : NEW YORK

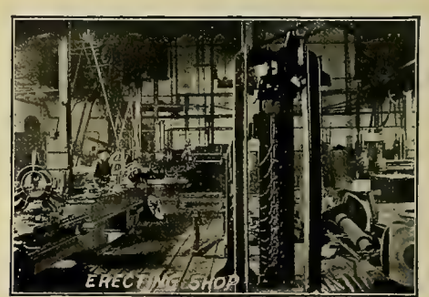
Send for our list No. 39

THE ELECTRIC LIGHTING

throughout an INDUSTRIAL PLANT
can be done most efficiently ONLY with

Cooper Hewitt Mercury Vapor Lamps

Office, Drafting Room, Machine Shop, Carpenter Shop,
Foundry, Store Room and Shipping Department.



If you purchase your current from the Central Station
YOU WANT { A Better Quality of Light. Smaller Bills for Current. More Light.

If you have your own power plant
YOU WANT { A Smaller Load. Maximum Amount of Light. Minimum Cost of Maintenance.

Let us prove to you, as we have to others,
that these WANTS are best filled by

THE COOPER HEWITT LAMPS

Write for the New Bulletin, "Economical Lighting of Industrial Plants."

COOPER HEWITT ELECTRIC CO., 220 West 29th Street, NEW YORK

LEADS THEM ALL

"ELECTRA"

CARBONS

ELECTRA

TRADE MARK

ELECTRA

TRADE MARK

HUGO REISINGER

SOLE IMPORTER

11 BROADWAY, NEW YORK

ELECTRA

TRADE MARK

THIS STANDS FOR QUALITY

NOBLAC

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INNER GLOBES

Try

THIS STANDS FOR QUALITY

NOBLAC

BOTH HEAT-RESISTING AND ORDINARY

YOU WILL NEVER USE ANY OTHER

THIS STANDS FOR QUALITY

FOSTORIA

THIS STANDS FOR QUALITY

FOSTORIA

Send for "The Story of THIS STANDS FOR QUALITY FOSTORIA" — It contains much valuable information for Inner Globe users

THE THIS STANDS FOR QUALITY FOSTORIA GLASS SPECIALTY CO.

THIS STANDS FOR QUALITY FOSTORIA. OHIO

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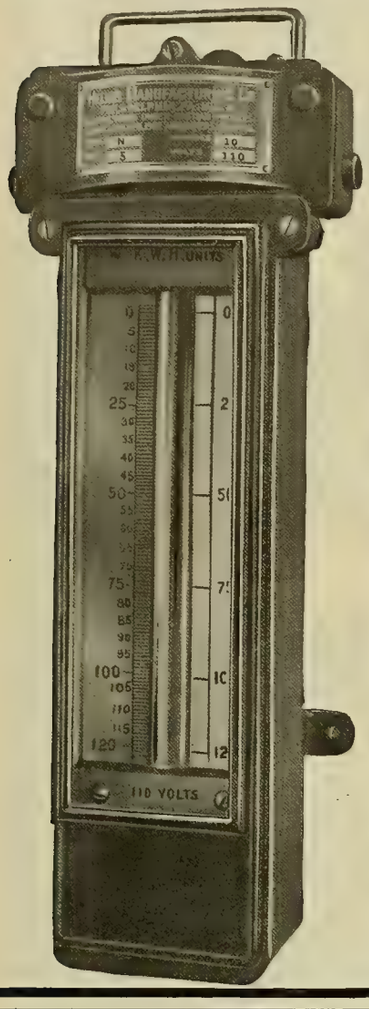


THE BASTIAN METER

DIRECT CURRENT ALL VOLTAGES FROM 1 TO 750

Owing to the entire absence of moving parts, coils, magnets, etc., this meter has met with the immediate approval of Direct Current Central Stations.

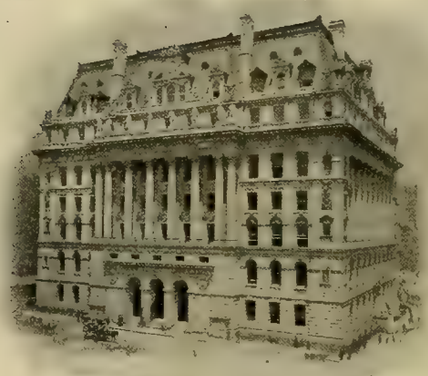
It is well known that small meters are liable to burn-outs, particularly on 220 and 550 volt circuits. THE BASTIAN HAS NOTHING TO BURN OUT. Even lightning proof.

The accuracy is equal to any; the price so small that managers have a revelation in store. Postal brings it.

Manufactured by
HELIOS MFG. COMPANY
Bridesburg, Phila., Pa.

FRANCIS RAYMOND
1635 OLD COLONY BLDG.
CHICAGO

The India Rubber and Gutta Percha Insulating Company



HALL OF RECORDS, NEW YORK CITY

Habirshaw Red Core Wire Installed Throughout

OFFICE AND WORKS
YONKERS, N. Y.
W. M. HABIRSHAW
President and General Manager

SALES DEPARTMENT
253 Broadway
NEW YORK CITY
J. B. OLSON, Manager of Sales

ILLUMINATION By The Columbia Method

has many advantages. Just a few here:

The COLUMBIA LAMP has greater spherical candle power than other lamps.
The COLUMBIA LAMP consumes less current than other lamps.
The COLUMBIA LAMP gives more light and has longer life than other lamps.

OKONITE — IT NEVER DISAPPOINTS

Central Electric Company,
General Sales Agents
264-266-268-270 Fifth Avenue, CHICAGO

LOOK FOR THE LICENSE LABEL PASTED IN THE STEM

INCANDESCENT LAMPS 12c Each!

A new factory, equipped entirely with new, up-to-date lamp machinery, enables us to supply the trade with the BEST RENEWED LAMP ON THE MARKET. Sold in standard packages at 12c each, f. o. b. all points on or east of the Mississippi River.

TRY A PACKAGE

THE ECONOMY ELECTRIC CO., Warren, Ohio

General Electric Company

Speed Controlling Rheostats

For Variable Speed, Shunt or Compound Wound Motors, Particularly Adapted to Machine Tool Equipments

Types RSF and SF

Type RSF Controlling Rheostat, Full Reverse

Reversing and non-reversing for one-quarter to fifteen H. P. Motors operating on 115, 230, 500 volt circuits.

SPEED VARIATIONS:
2:1 3:1, 4:1, by Field Control

Quick break action protects starting contacts on the smaller sizes.

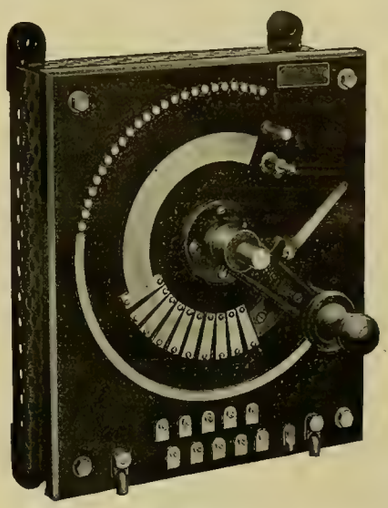
Quick break action in combination with magnetic blowout protects first starting points on the larger sizes.

Field resistance designed for continuous service.

Armature resistance designed for severe starting service.

Renewable segments used for all starting contacts.

Compact — Durable — Reliable



Type SF Controlling Rheostat, Non-Reverse

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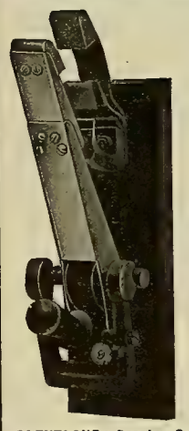

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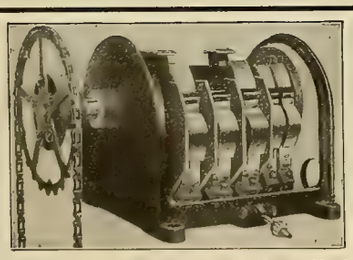

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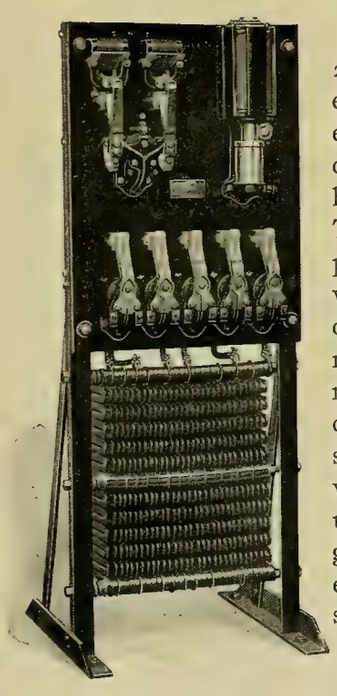

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I	The Electric Current
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IV	The Effects of Electric Flow Outside the Circuit—Magnetism and Induction—The Electrical Units
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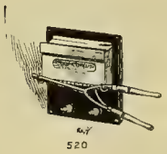

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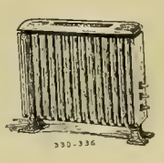

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This meter fills a much needed want, as is evidenced by the number of orders being received.

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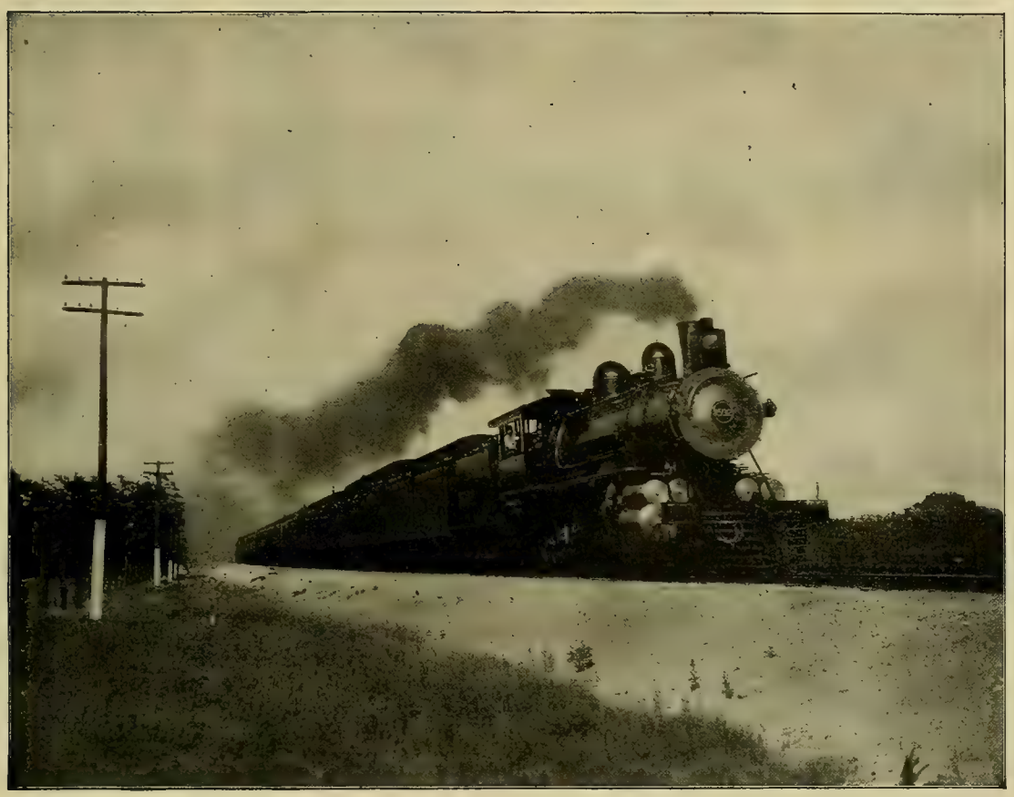

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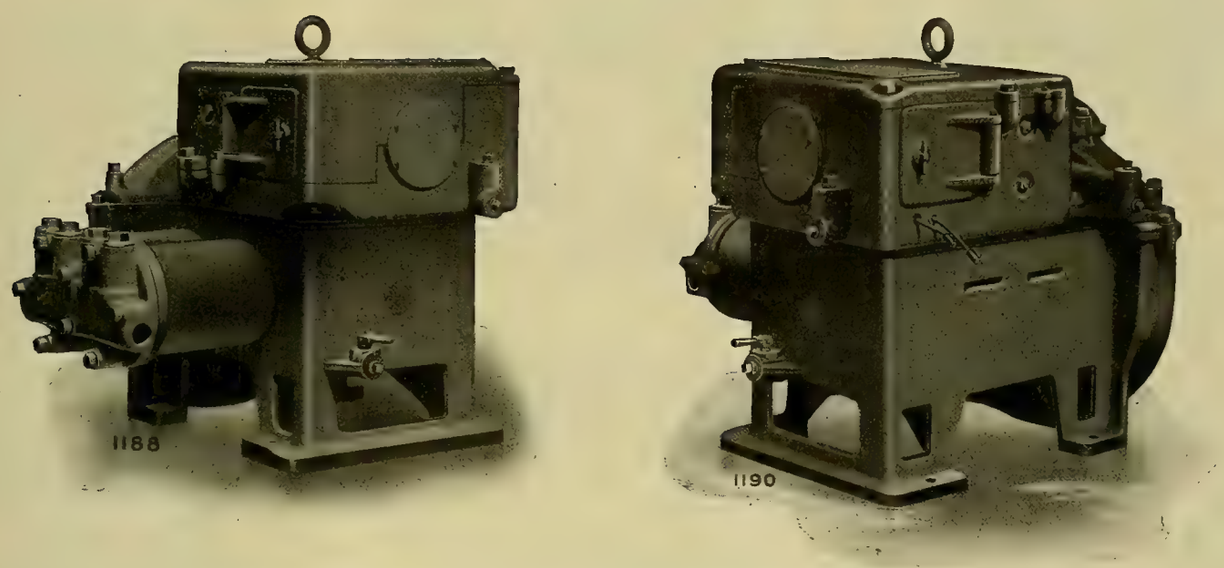

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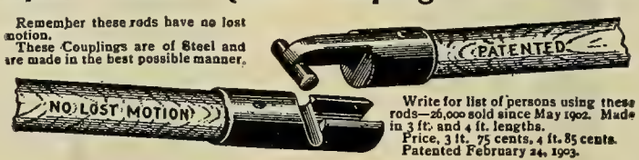

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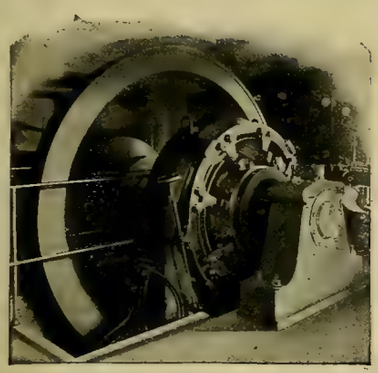

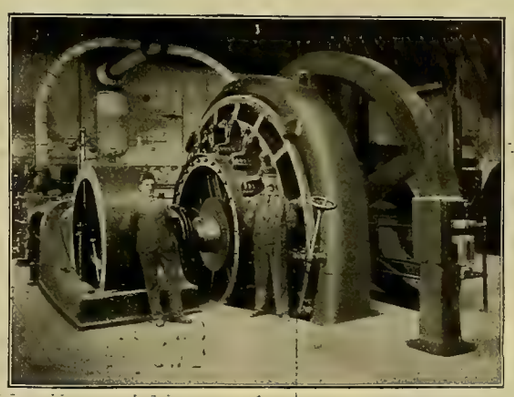

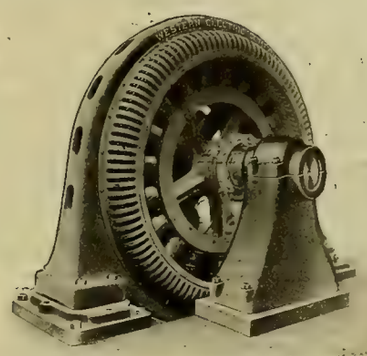

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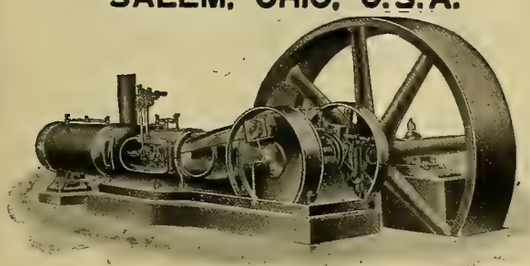

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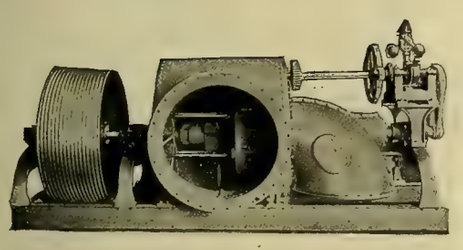

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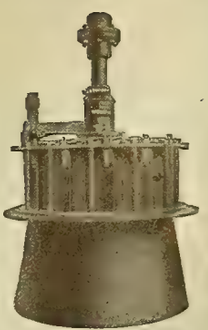

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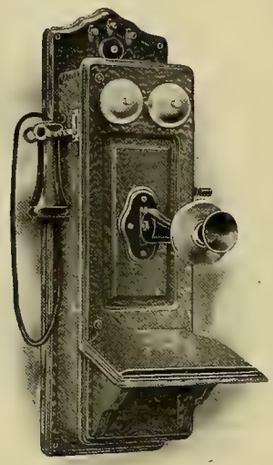

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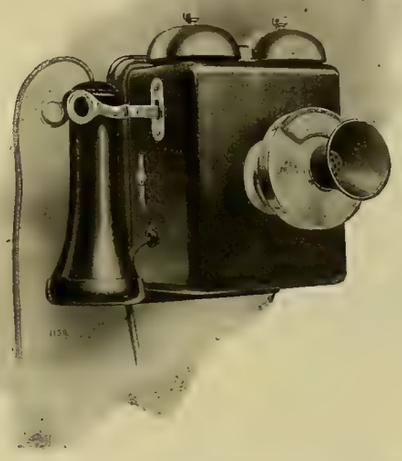

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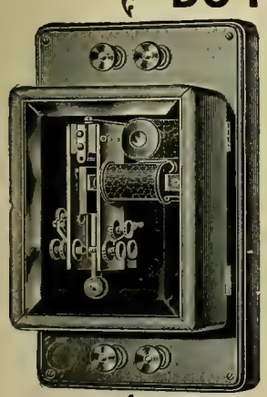

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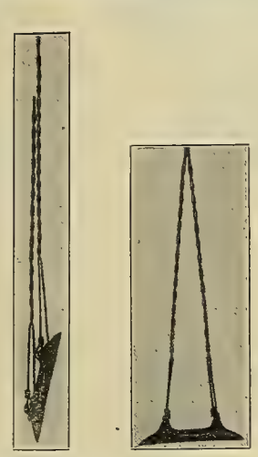

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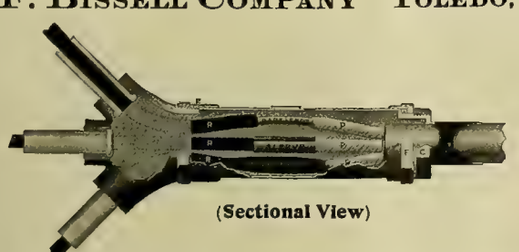

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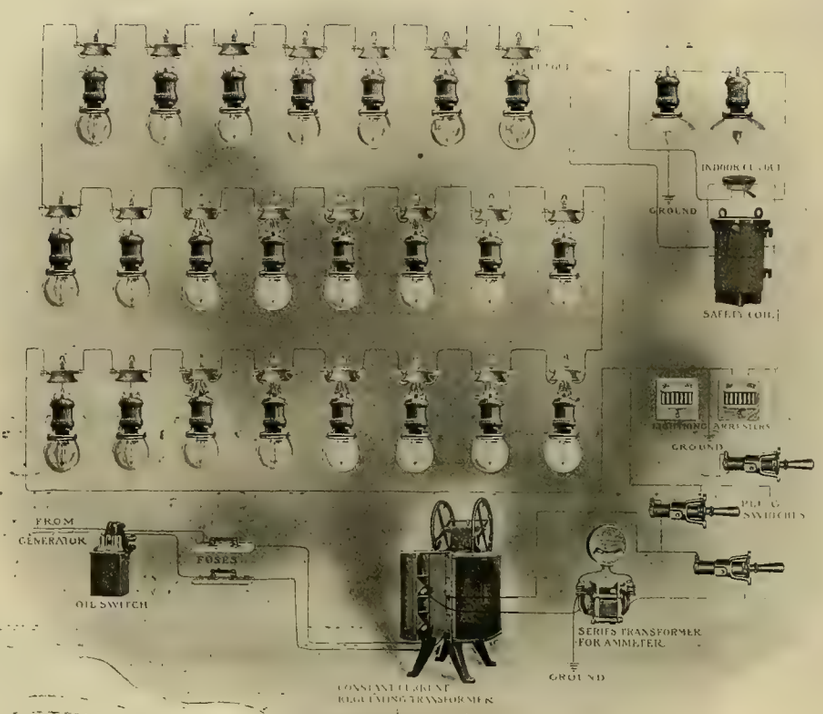

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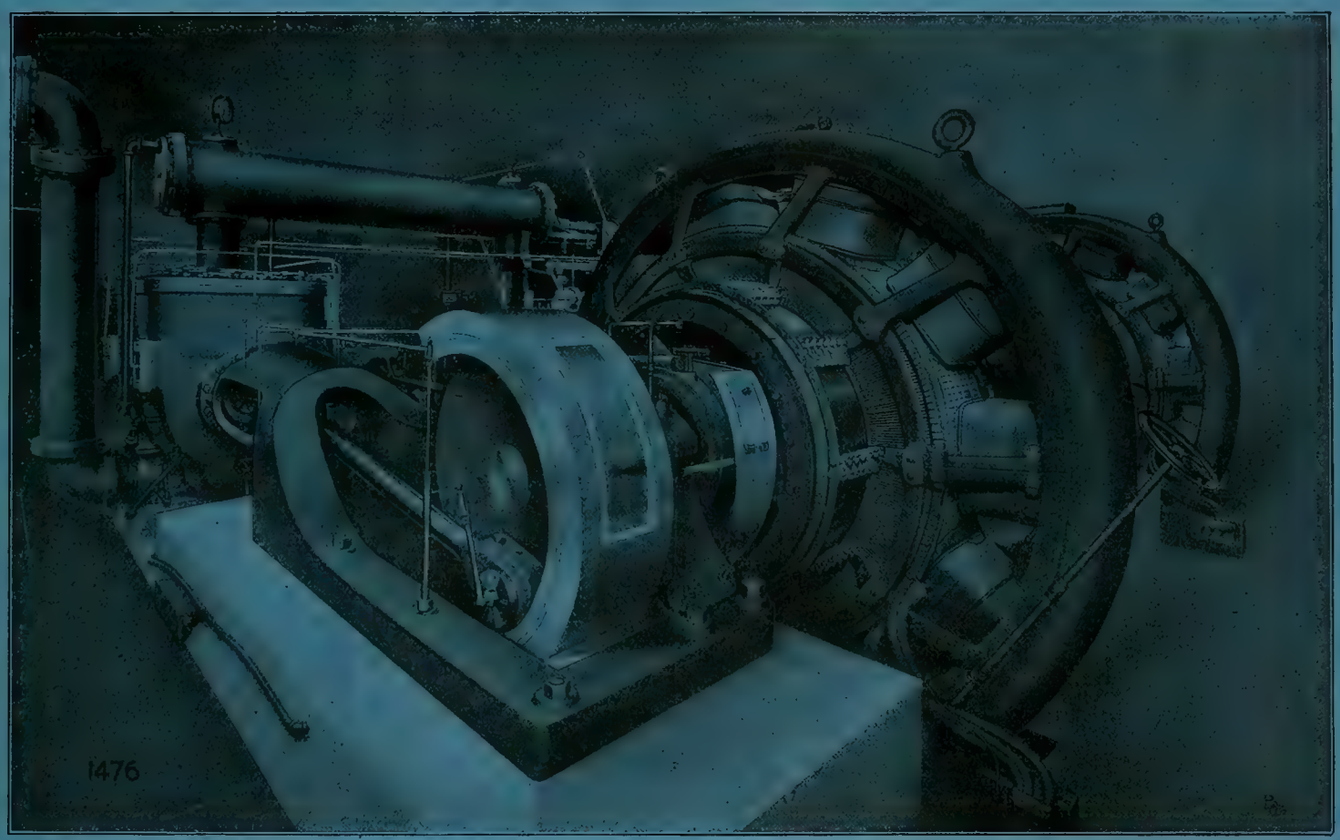

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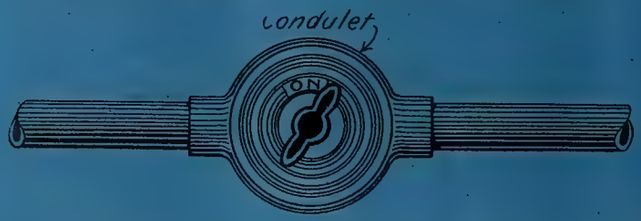

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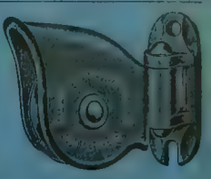

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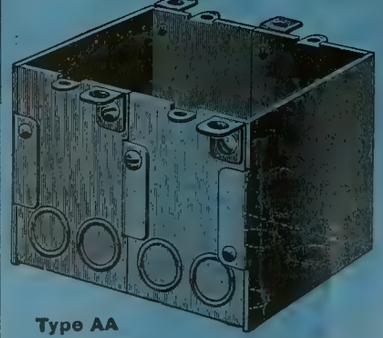

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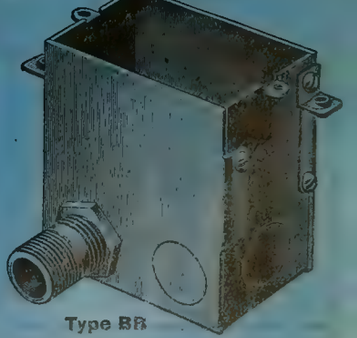

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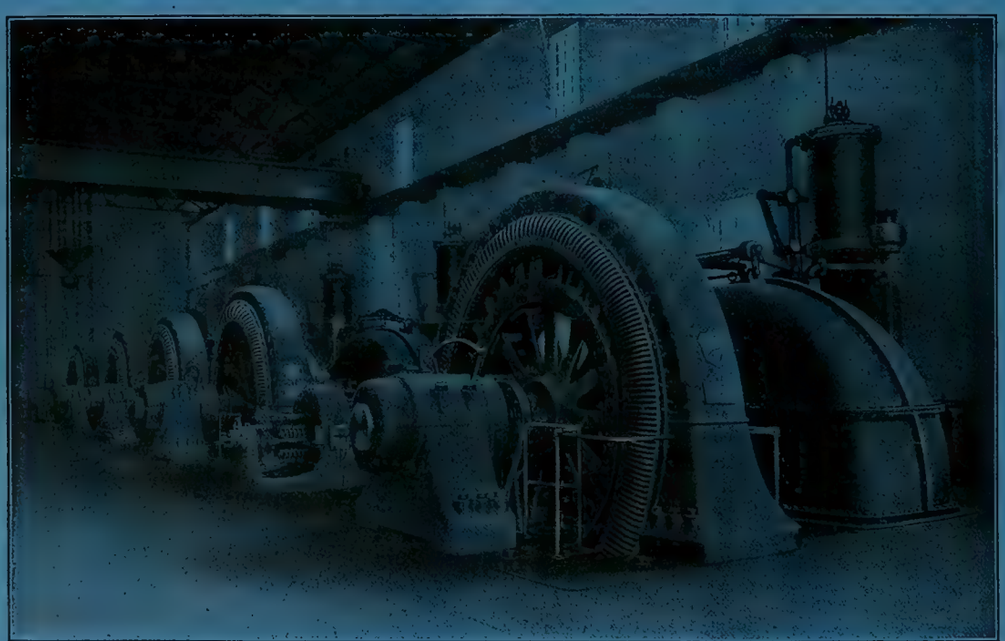

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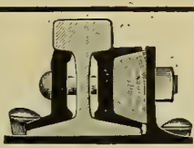

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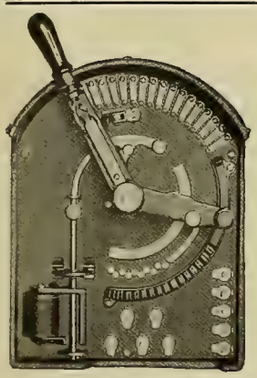

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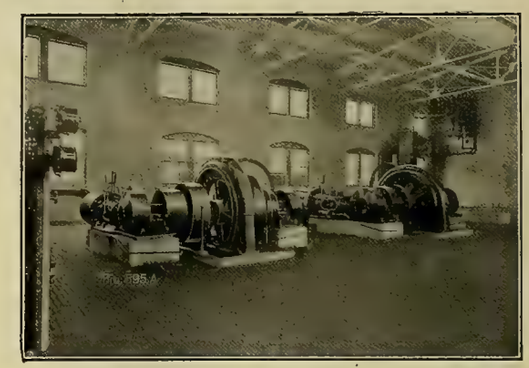

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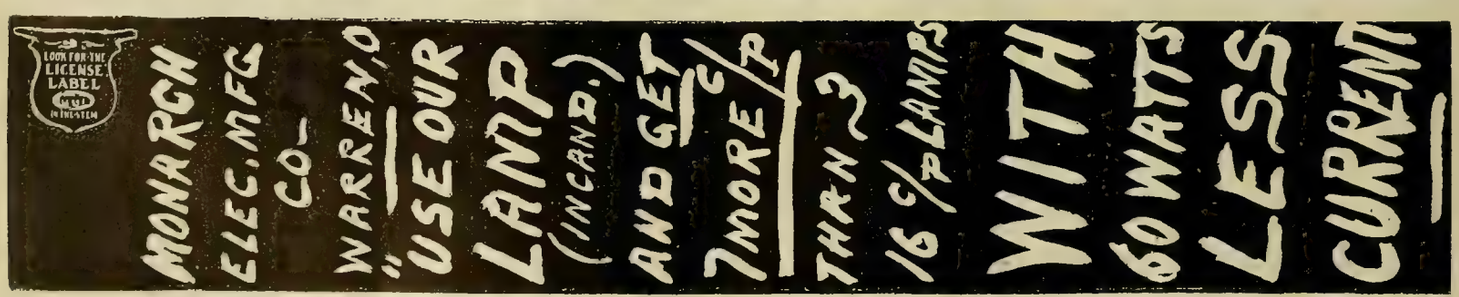

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has many advantages. Just a few here:

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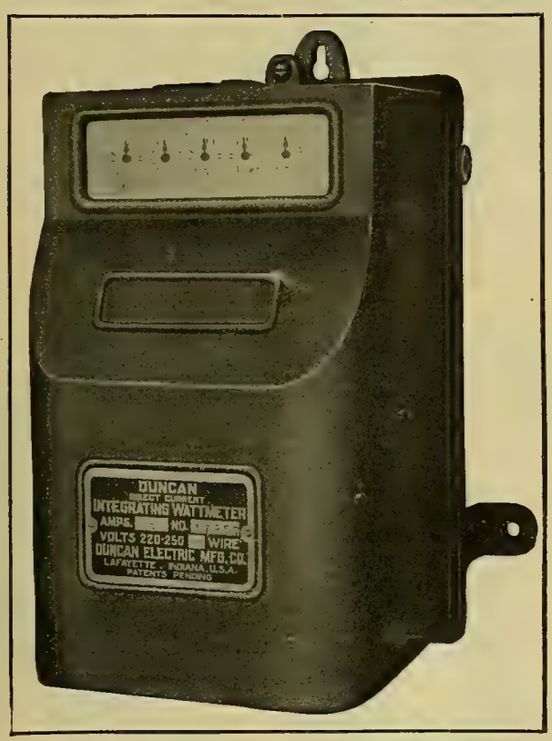
BY ALL UNBIASED METER EXPERTS TO BE THE MOST RELIABLE DIRECT CURRENT WATTMETER IN THE WORLD



DUNCAN ELECTRIC MFG. CO.
LAFAYETTE INDIANA, U. S. A.

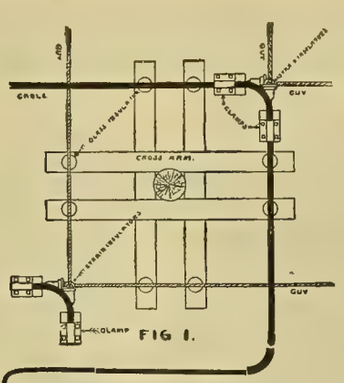


FIG 1.

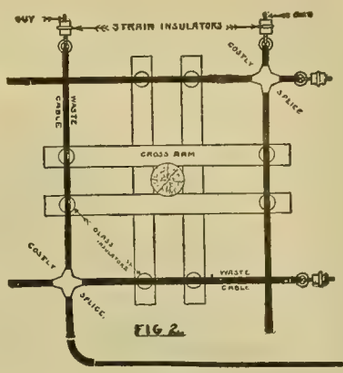


FIG 2.

KEARNEY CABLE CLAMPS

Fig. 1 shows a bird's-eye view of a corner pole with two 600,000 C. M. cables turning a right angle with the aid of four Kearney Cable Clamps.

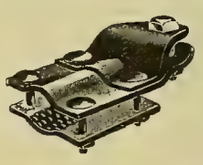
Fig. 2 shows the same conditions with the aid of spliced joints. Let us compare the two pieces of work.

The work on Fig. 1 can be done by two line men in 30 to 40 minutes without the services of a ground man. No cable is cut. No solder or blow torches are used. All that is necessary is to clean off four inches of insulation for each clamp, and clamp them to the bare surface of the wire. There is no waste cable.

The work on Fig. 2 can be done by two line men, and a ground man to tend the blow-torches and keep the solder hot, in not less than two hours, maybe more. They must cut the cable in four places (maybe some saw blades will be broken doing this). From 10 to 12 feet of cable will be wasted at each splice (maybe more). Figure up this cost on 20 feet of 600,000 C. M. Cable. Then there is the solder and the extra tape and gasoline needed. (Think of the danger of gasoline, not only to the men but to property.) A splice creates line loss, and is never as good as the solid wire.

Kearney Cable Clamps are much cheaper, more durable, stronger, save time, labor and material. Increase value of scrap cable. 25 or more will be shipped on 30 days' trial, freight prepaid. Ship them back if unsatisfactory. Pay for them otherwise.

W. N. MATTHEWS & BRO., Manufacturers, **203 N. 2d St., St. Louis, Mo.**



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Callahan Cable Rollers
ALL PATENTED

INDESTRUCTIBLE ARC LAMPS

No Burn-Outs.
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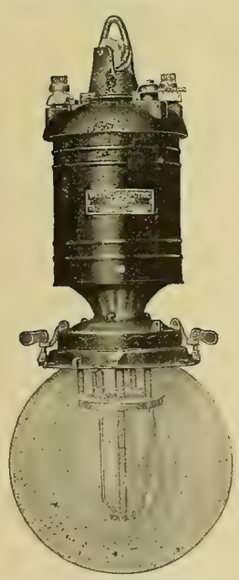
Tie the carbons together with copper wire and the lamp remains intact



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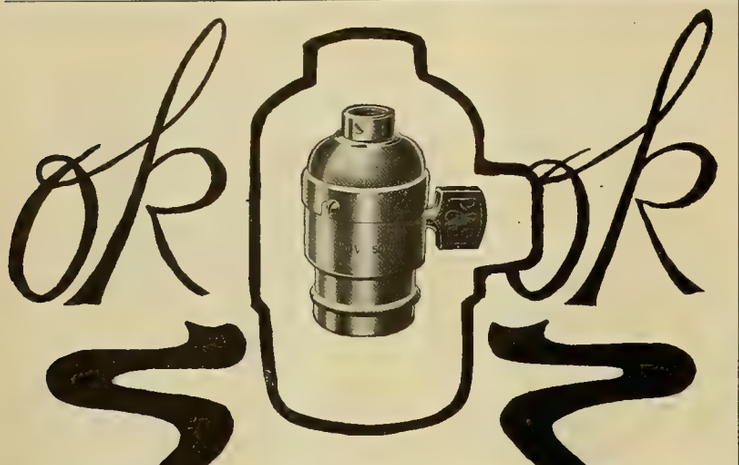

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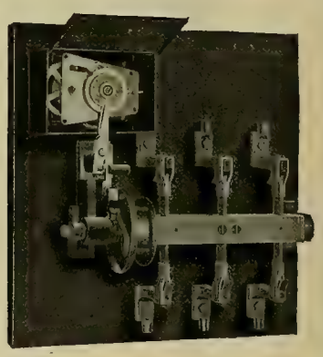

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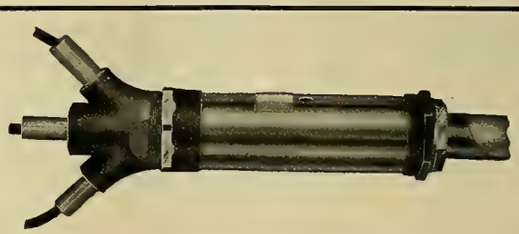

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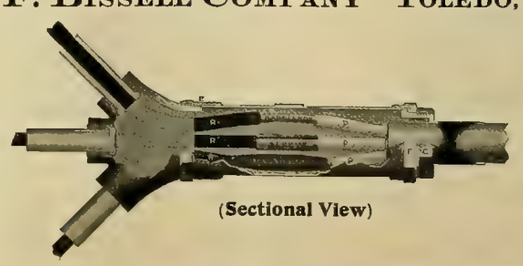

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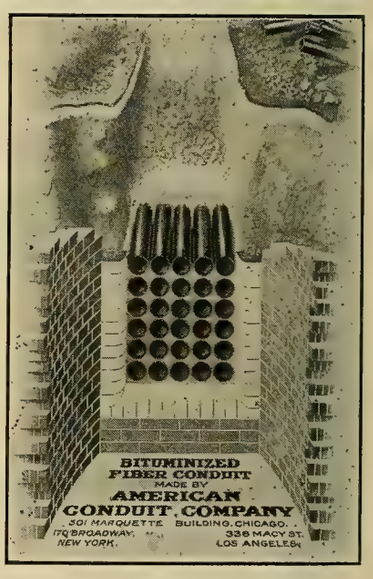

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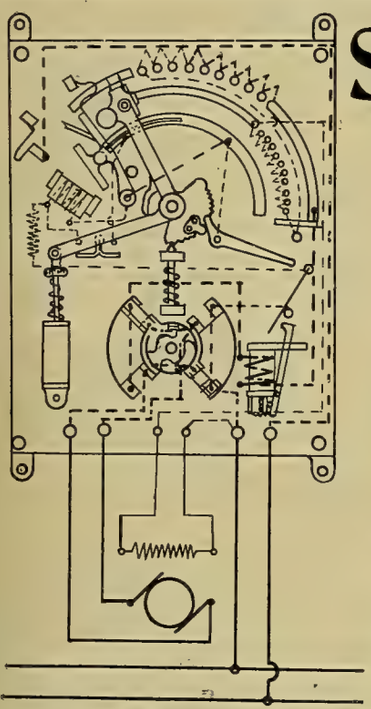

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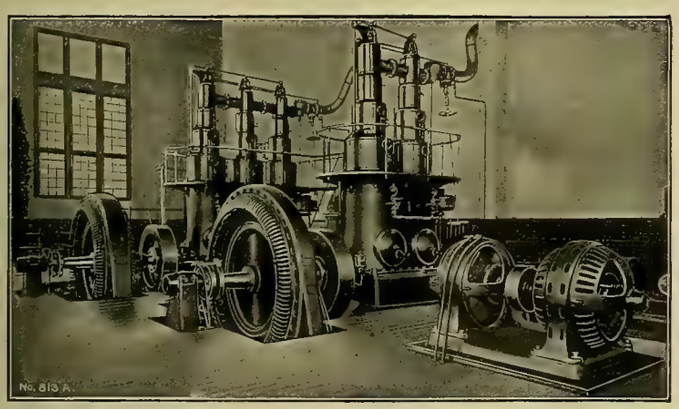

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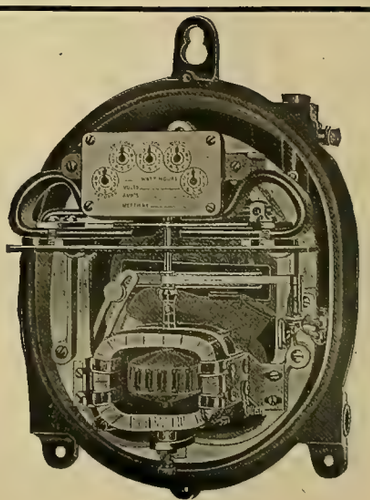

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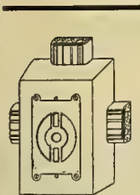

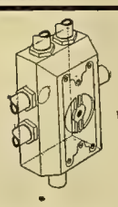

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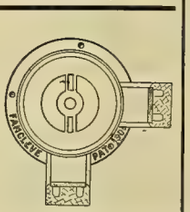

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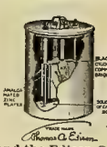

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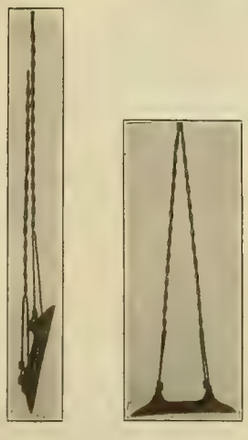

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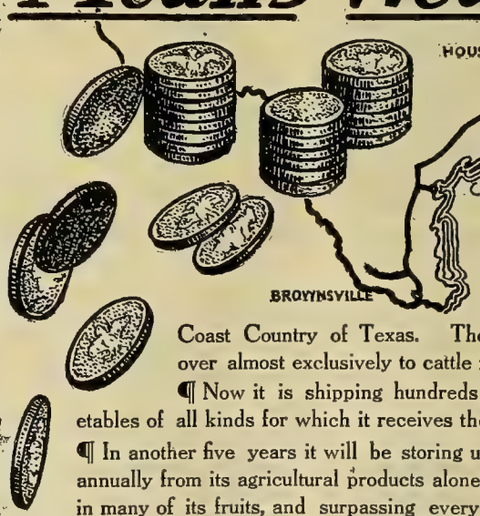

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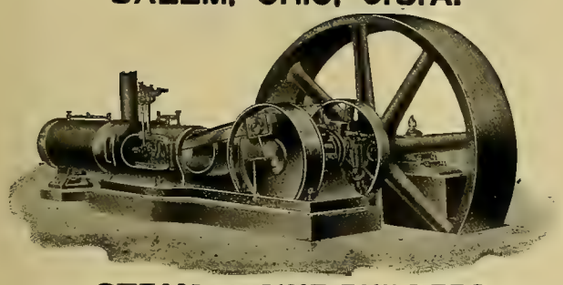

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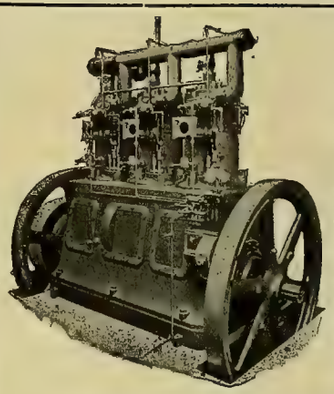

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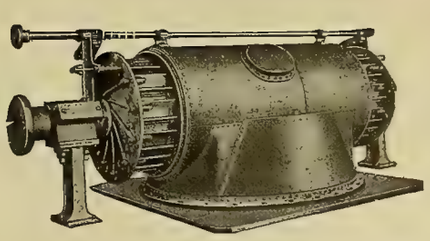

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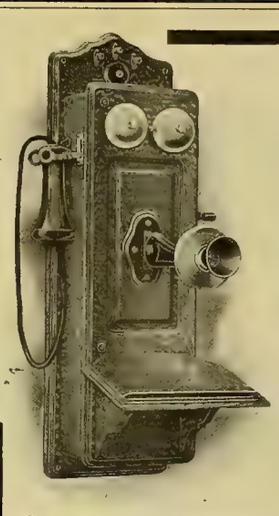

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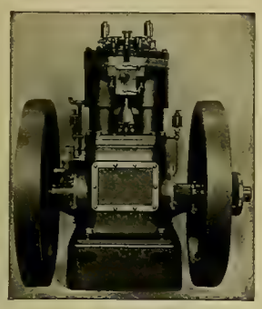

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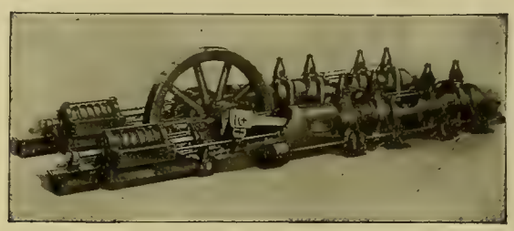

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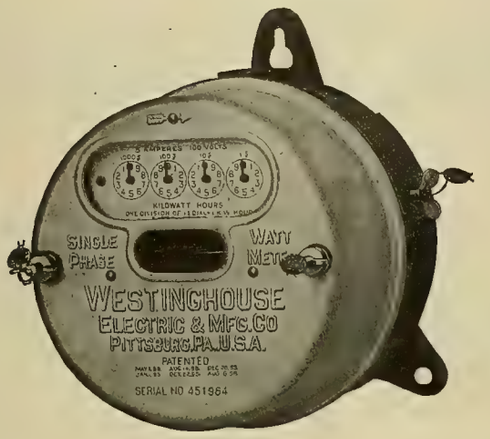

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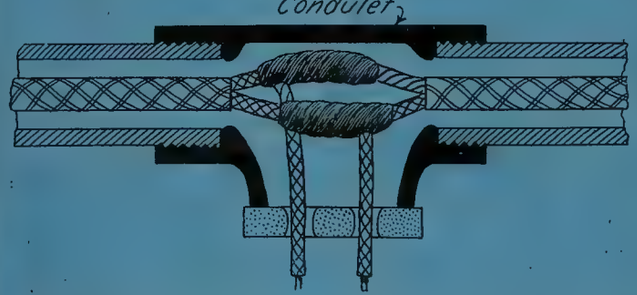

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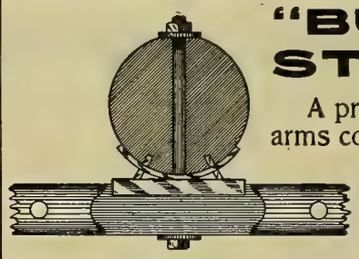

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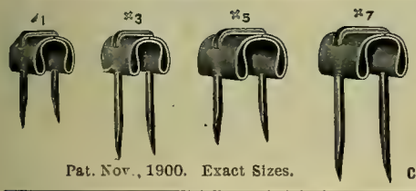

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Switches,
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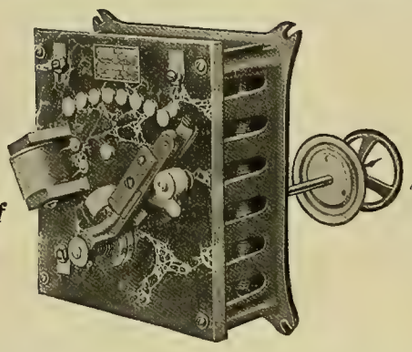

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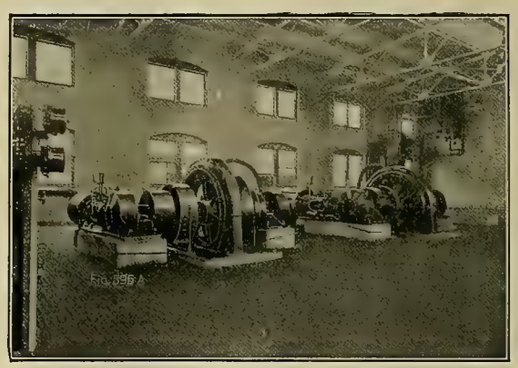

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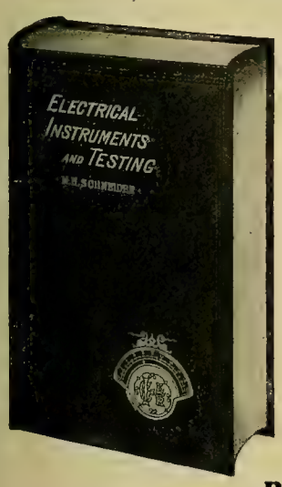

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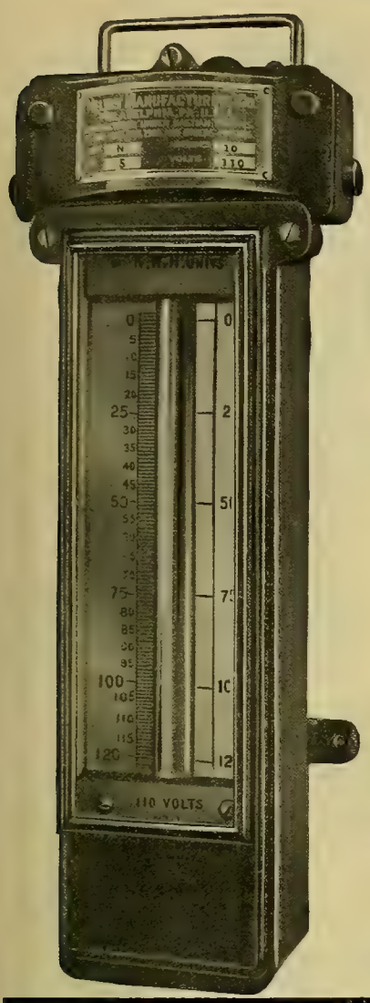

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DIRECT CURRENT ALL VOLTAGES FROM 1 TO 750

Owing to the entire absence of moving parts, coils, magnets, etc., this meter has met with the immediate approval of Direct Current Central Stations.

It is well known that small meters are liable to burn-outs, particularly on 220 and 550 volt circuits. THE BASTIAN HAS NOTHING TO BURN OUT. Even lightning proof.

The accuracy is equal to any; the price so small that managers have a revelation in store. Postal brings it.

Manufactured by
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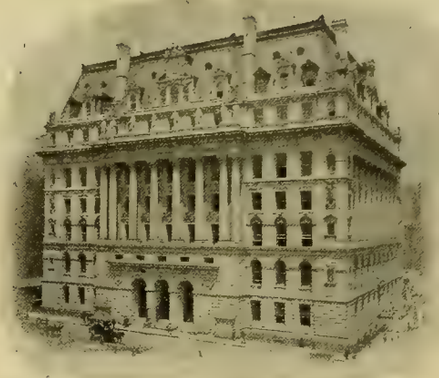
FRANCIS RAYMOND
1635 OLD COLONY BLDG.
CHICAGO

The India Rubber and Gutta Percha Insulating Company



HALL OF RECORDS, NEW YORK CITY

Habirshaw Red Core Wire Installed Throughout

OFFICE AND WORKS
YONKERS, N. Y.
W. M. HABIRSHAW
President and General Manager

SALES DEPARTMENT
253 Broadway
NEW YORK CITY
J. B. OLSON, Manager of Sales

Even the tiny, apparently unimportant, parts are carefully constructed. The fibre used for lining both cap and shell, tests Neutral, being boiled one hour in water.

Therefore, it is not affected by heat and protects socket from damage by crossed high potential lines grounding on the shell.

PASS & SEYMOUR, Inc.,

56 Boyd Ave., Solvay, N. Y., U. S. A.
Sales Offices: New York, Chicago, San Francisco.

Why does not the "Lamp" Organization "Kill" all Competition from outside?

Can you answer the above question?

Perhaps you can---perhaps you cannot.

Did it ever occur to you how much money the Lamp "Organization" has spent, and is now daily investing, in its strenuous efforts to retain absolute control of the majority of the men that know how to make and market incandescent lamps?

Ask any big lawyer with a reputation in electrical patent law what he thinks of the patents controlled by the incandescent LAMP "ORGANIZATION," and his answer will, we think, lead you to understand why it is that the "ORGANIZATION" spends apparently so much money attempting to control the brains of the lamp industry as well as its alleged patents.

We never heard of a real good patent on a brain, however. Consequently to control all the "ideas" that may spring up relative to the manufacture of incandescent lamps is no easy job; AND WE THINK WE HAVE GOT ONE OR TWO SCIENTIFIC AND COMMERCIAL IDEAS DOWN IN ST. MARYS THAT HAVE ESCAPED THROUGH THE "RED TAPE NET" OF THE "ORGANIZATION."

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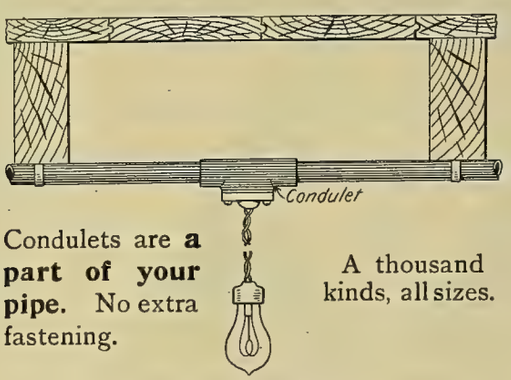

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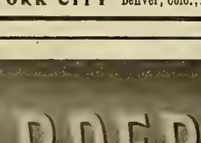

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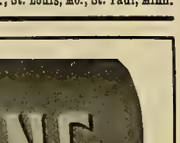

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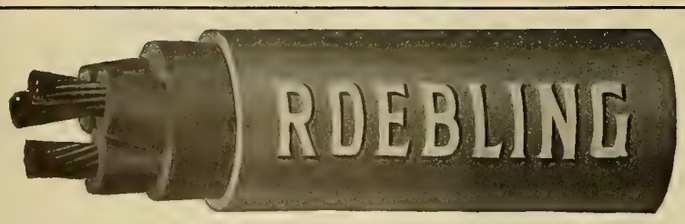

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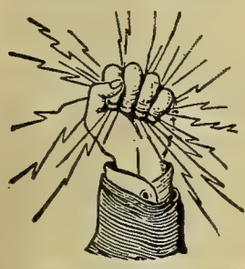

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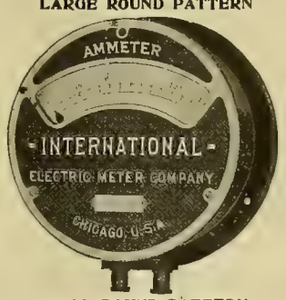

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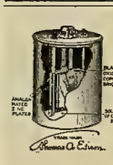

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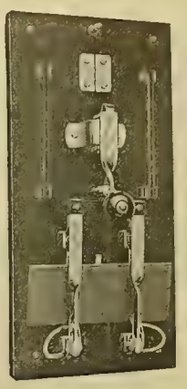

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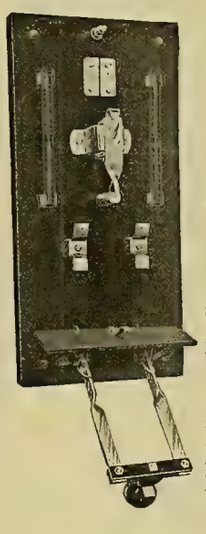

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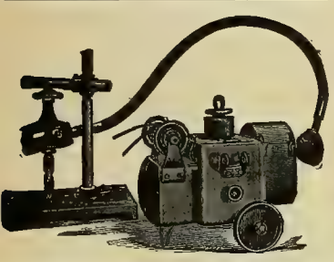

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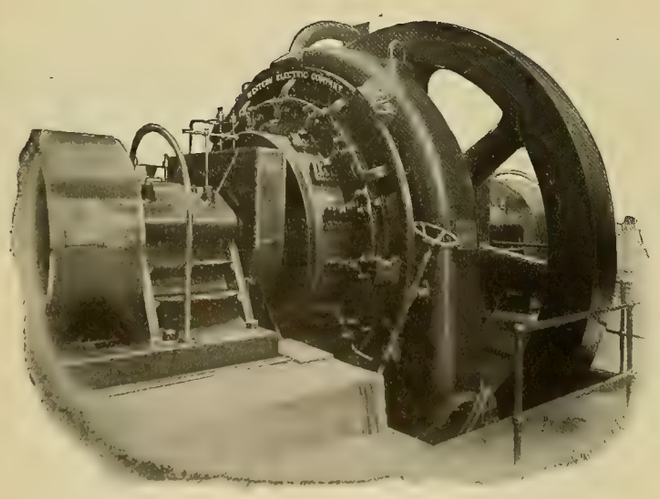

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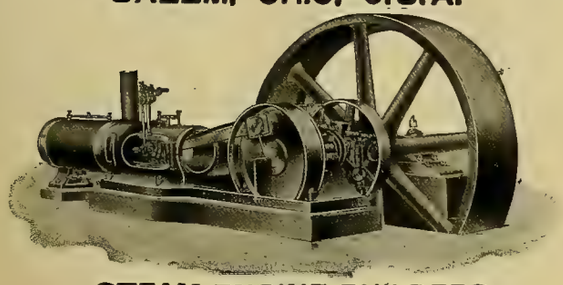

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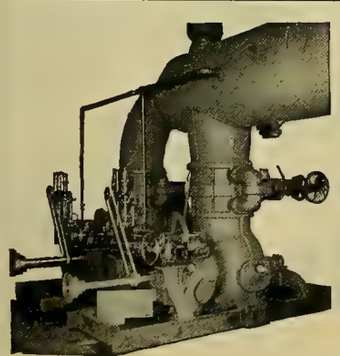

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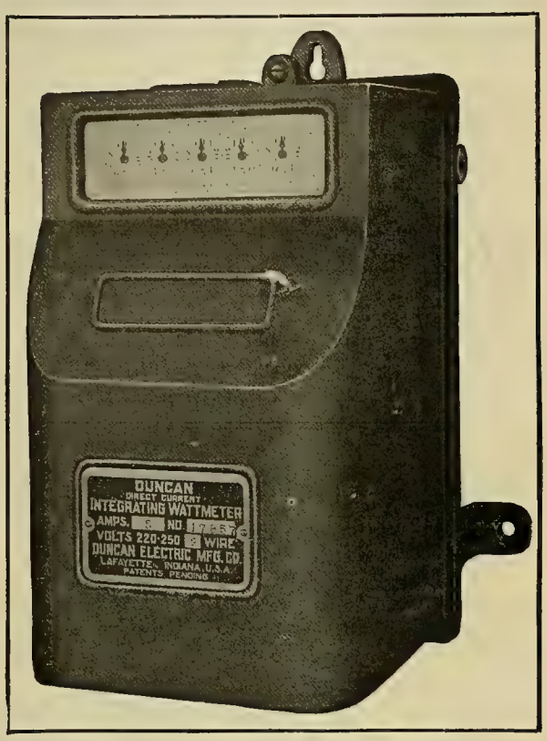

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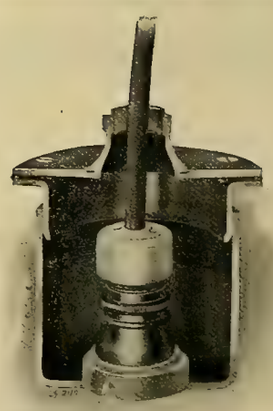

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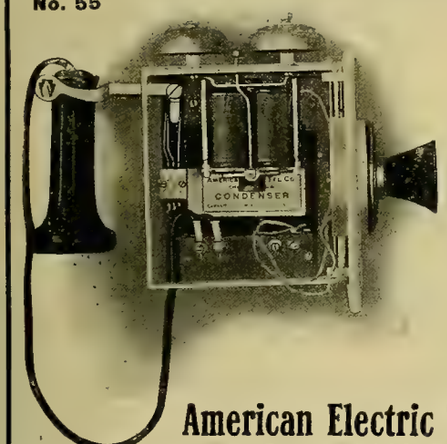

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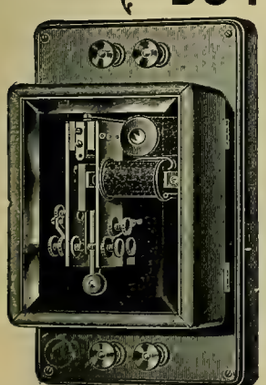

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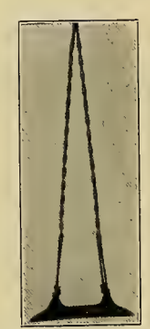

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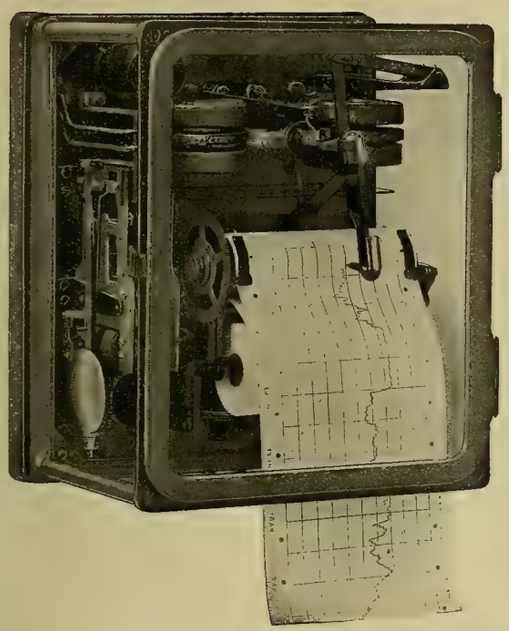

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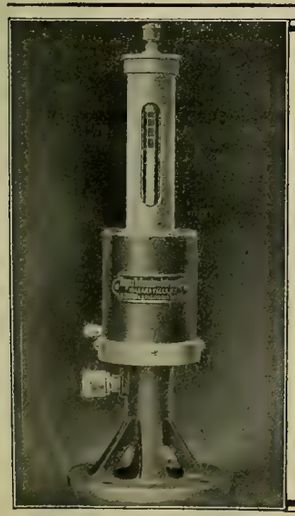

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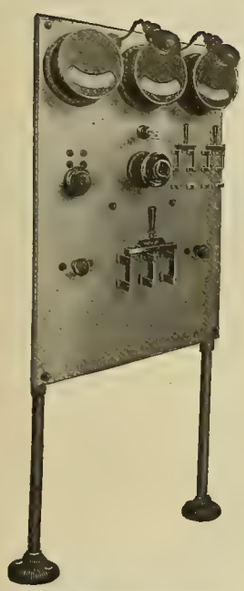
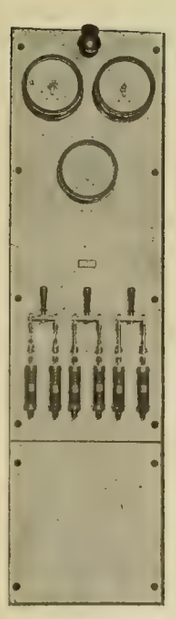


A. C. Generator Panel

Polished Blue Vermont Marble used for all excepting low voltage motor panels, which are made of the highest grade black, marine finished slate.

D. C. Generator Panel



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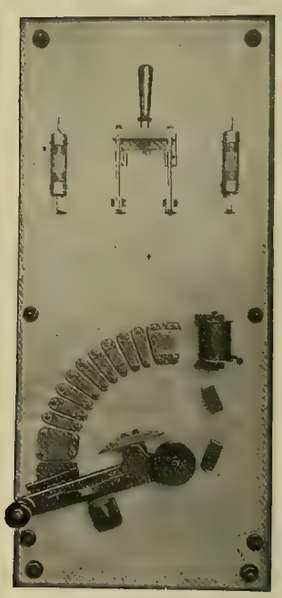
Shipment of any standard panel made in ten days after receipt of order. Reasonably quick delivery on special switchboards.



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Write our nearest district office for descriptive leaflets illustrating our standard panels.

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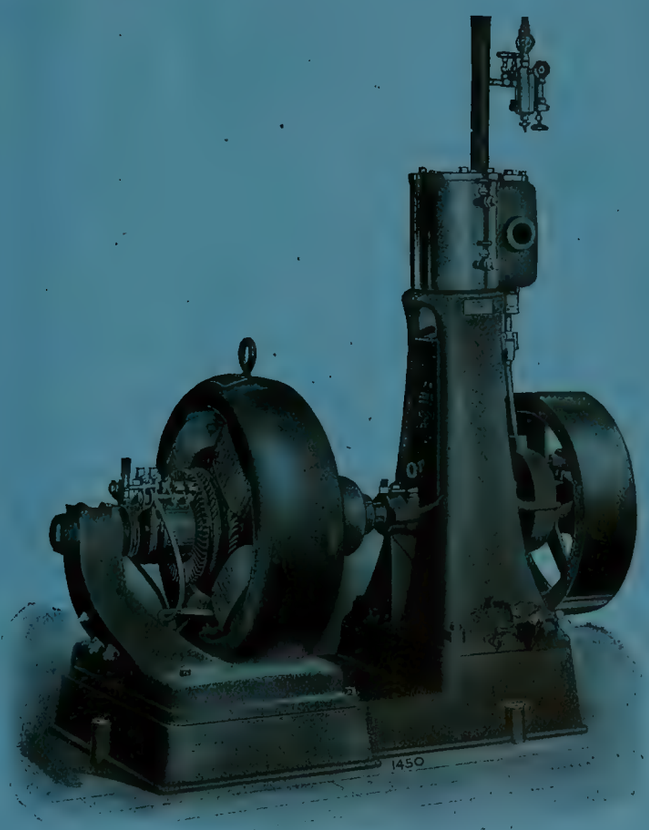

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We make a specialty of Fort Wayne generators direct connected to various types of engines

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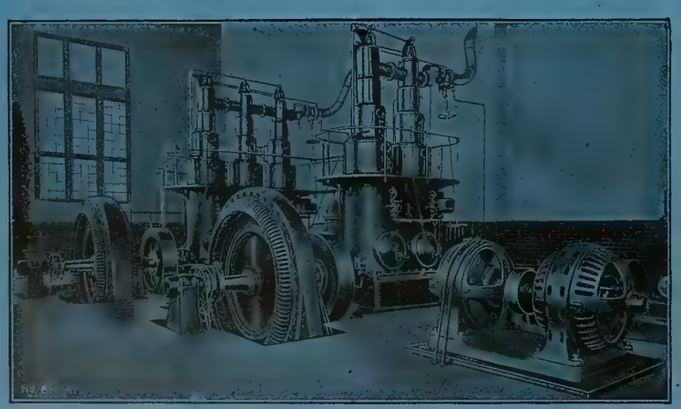

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Western Electrician

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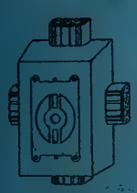

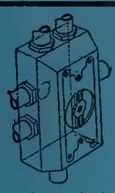

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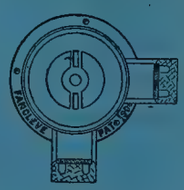

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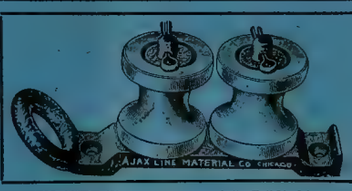

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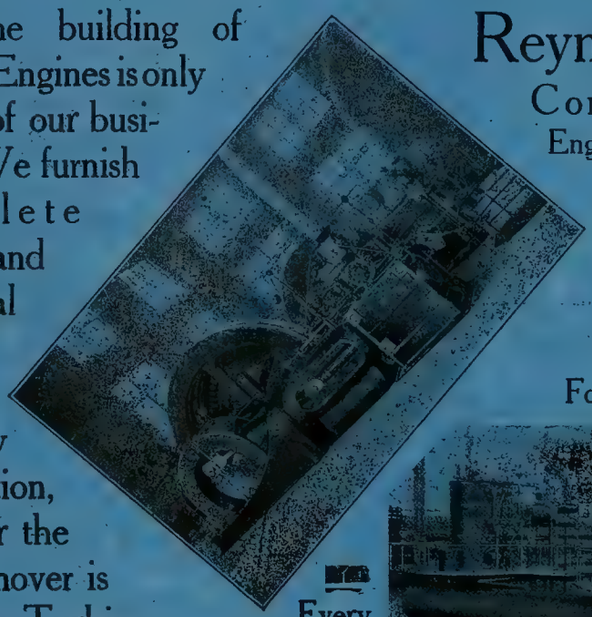

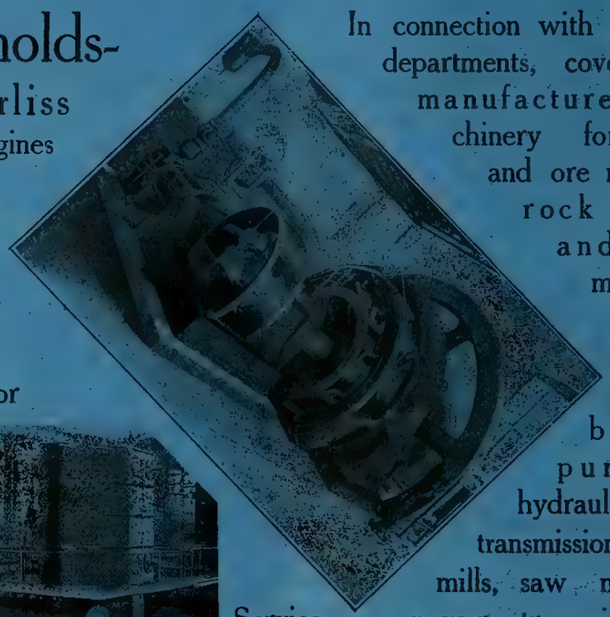

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The Duntley Air-Cooled Electric Drills

In The Best Shops

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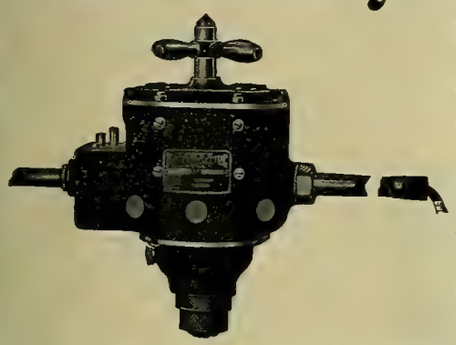

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PLATINUM All forms of electrical contacts. Grand Prize Universal Exposition ST. LOUIS, 1904

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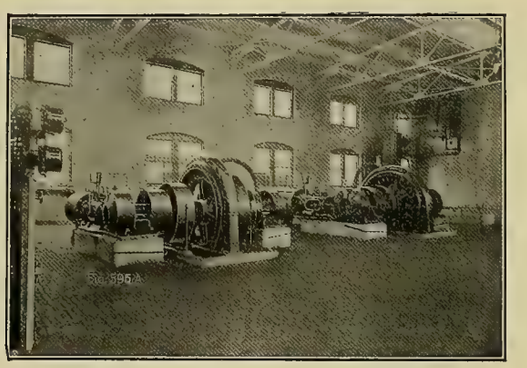

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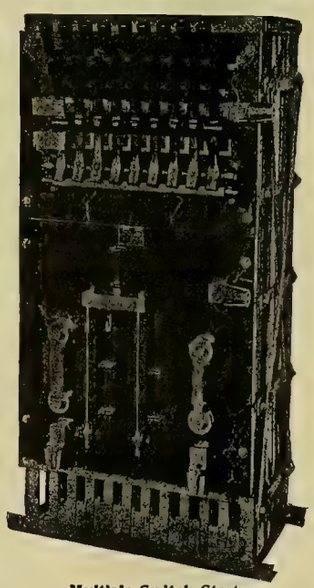

Multiple Switch Starter Universal Type

Sliding contact starters for large motors are objectionable because the contacts burn.

C & H multiple switch starters do not suffer from burning of the contacts and are therefore adapted for motor installations requiring heavy currents.

The multiple switch starter consists of a series of laminated switches mechanically interlocked to insure closure in the proper order.

Closure of a switch insures instantaneous contact over the entire contact surface.

Scraping action of the laminæ produces a smooth, bright contact surface.

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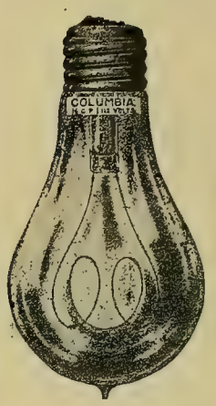

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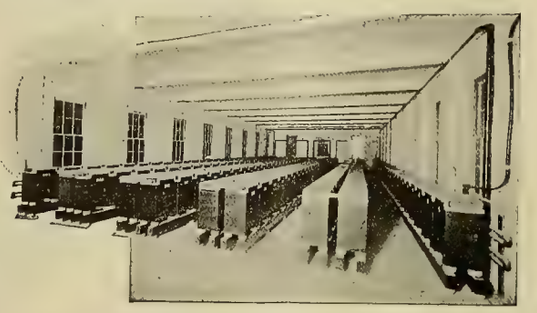

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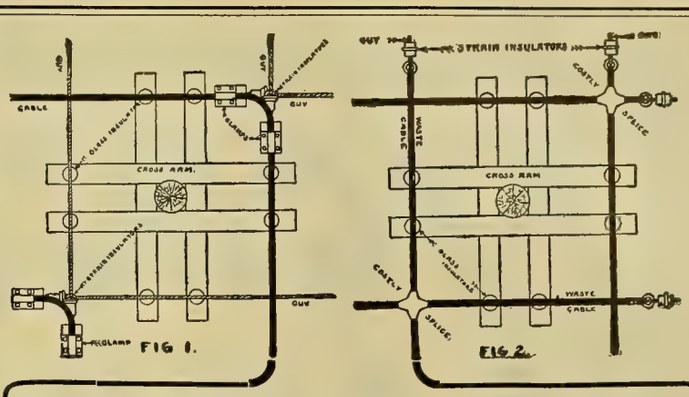

KEARNEY CABLE CLAMPS

Fig. 1 shows a bird's-eye view of a corner pole with two 600,000 C. M. cables turning a right angle with the aid of four Kearney Cable Clamps.

Fig. 2 shows the same conditions with the aid of spliced joints. Let us compare the two pieces of work.

The work on Fig. 1 can be done by two line men in 30 to 40 minutes without the services of a ground man. No cable is cut. No solder or blow-torches are used. All that is necessary is to clean off four inches of insulation for each clamp, and clamp them to the bare surface of the wire. There is no waste cable.

The work on Fig. 2 can be done by two line men, and a ground man to tend the blow-torches and keep the solder hot, in not less than two hours, maybe more. They must cut the cable in four places (maybe some saw blades will be broken doing this). From 10 to 12 feet of cable will be wasted at each splice (maybe more). Figure up this cost on 20 feet of 600,000 C. M. Cable. Then there is the solder and the extra tape and gasoline needed. (Think of the danger of gasoline, not only to the men but to property.) A splice creates line loss, and is never as good as the solid wire.

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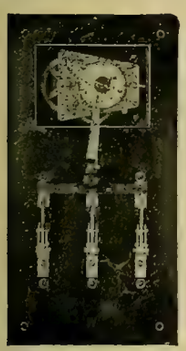

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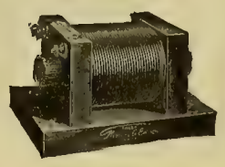

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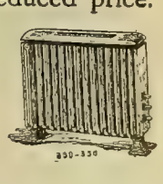

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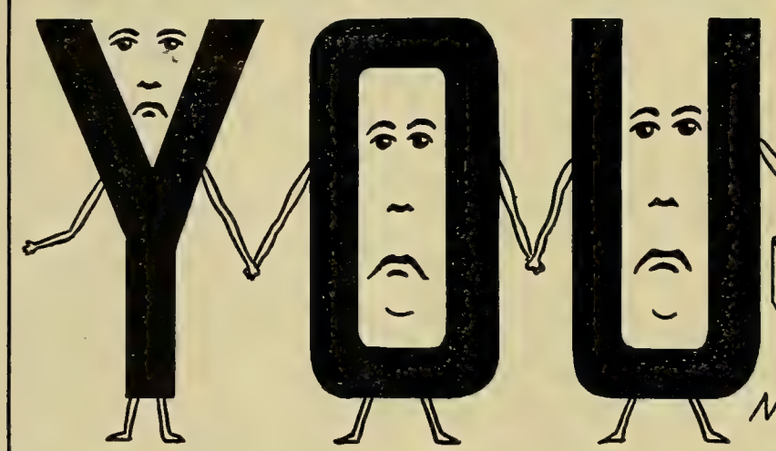

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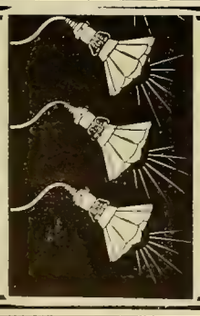

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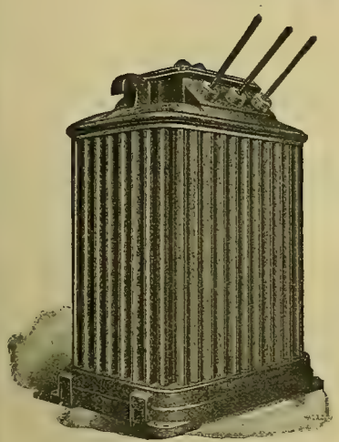

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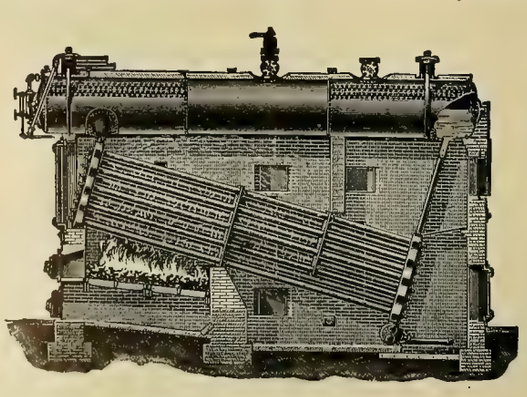

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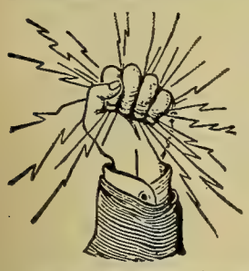

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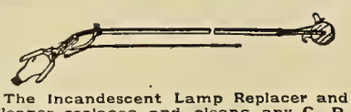

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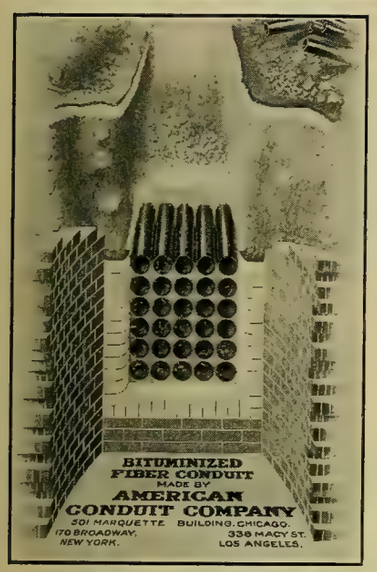

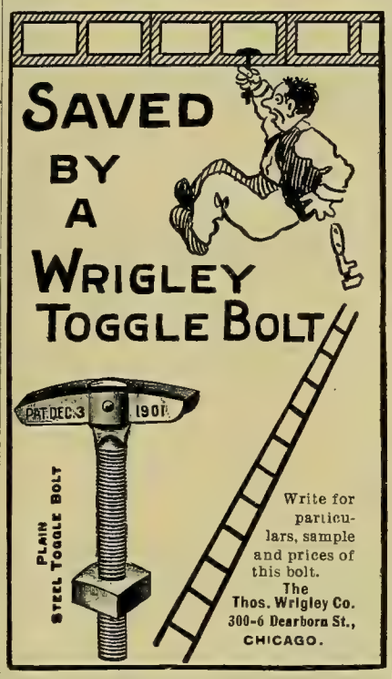

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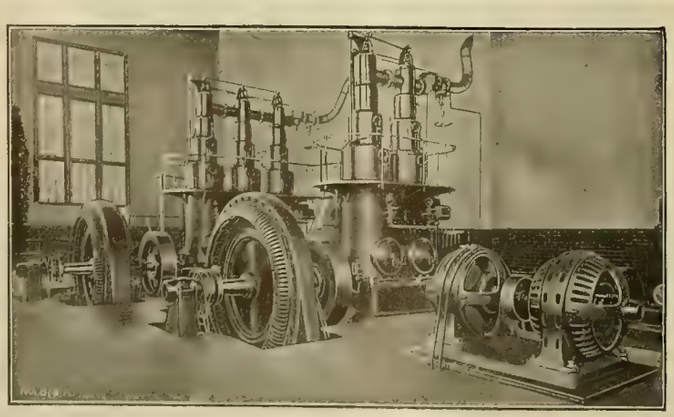
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39th ANNUAL STATEMENT

JANUARY 1, 1906

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SURPLUS	1,261,459.69
RESERVES	1,926,686.81
ASSETS	3,688,146.50

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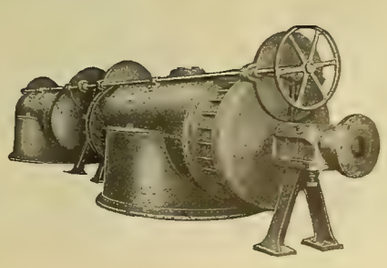

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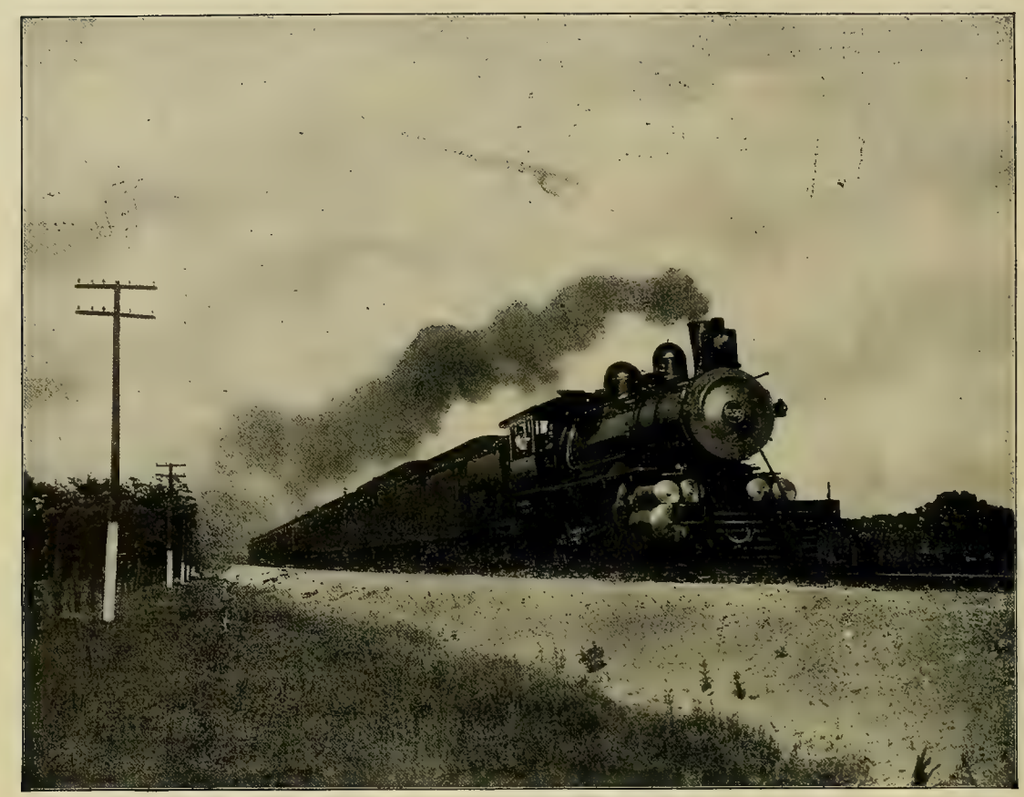

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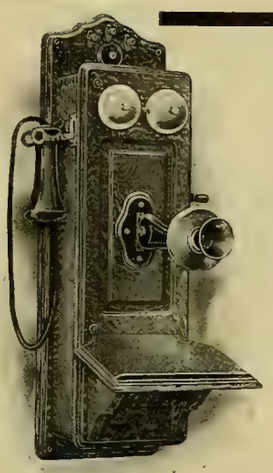

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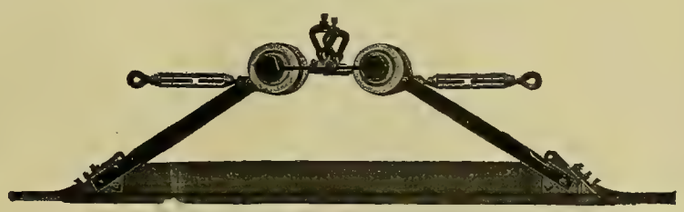

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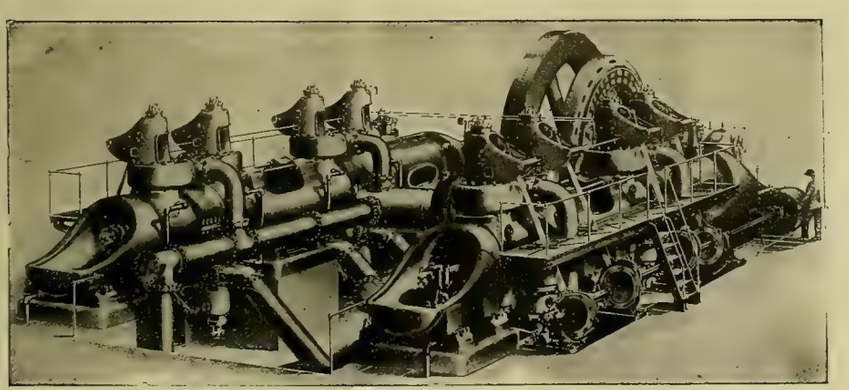

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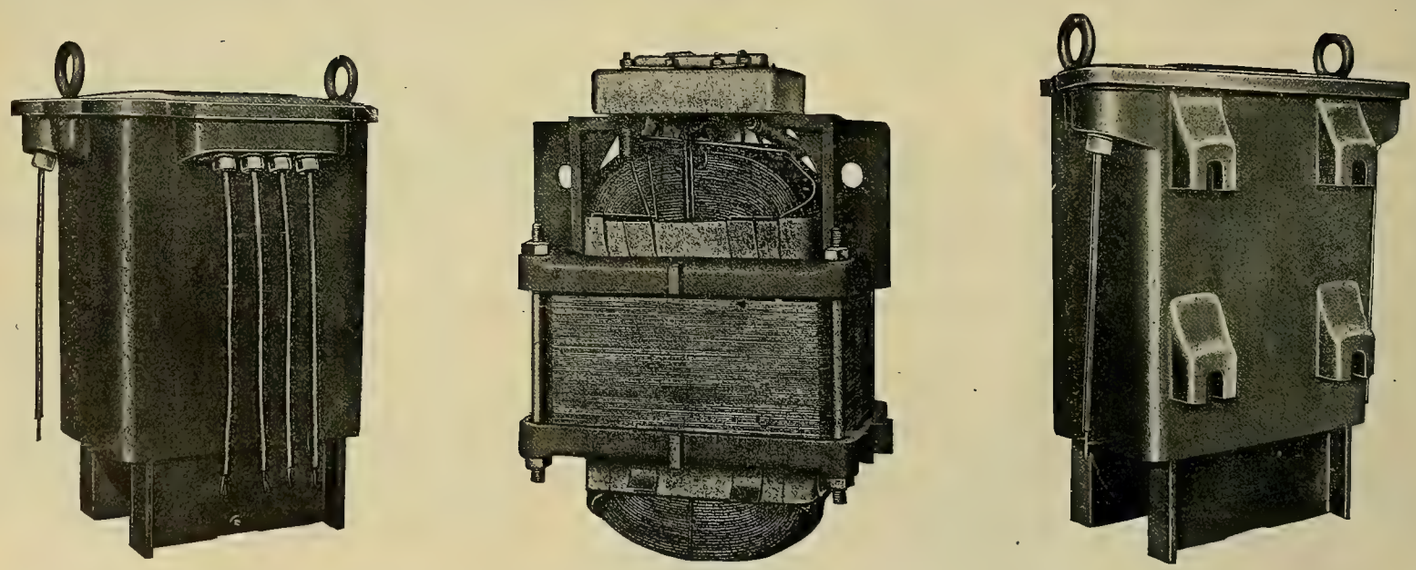

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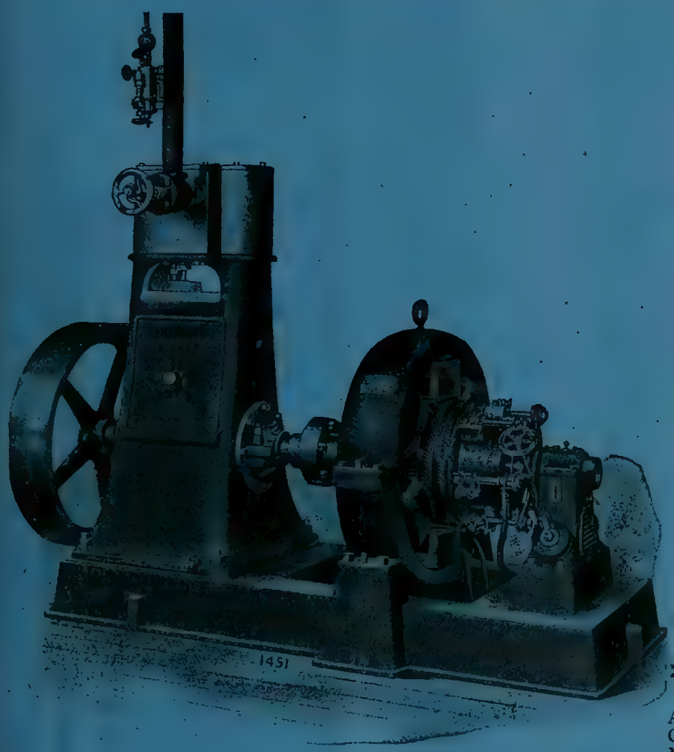

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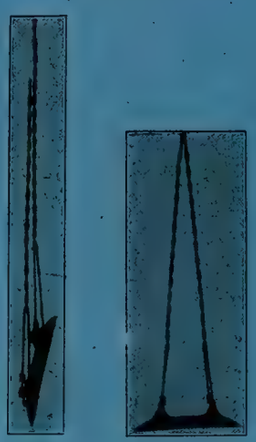

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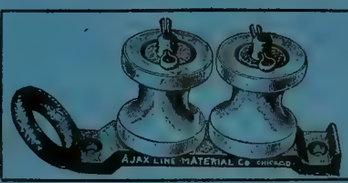

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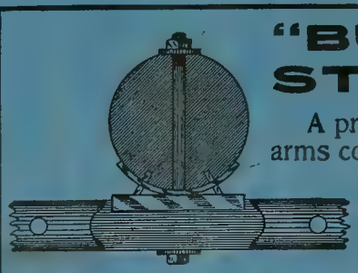

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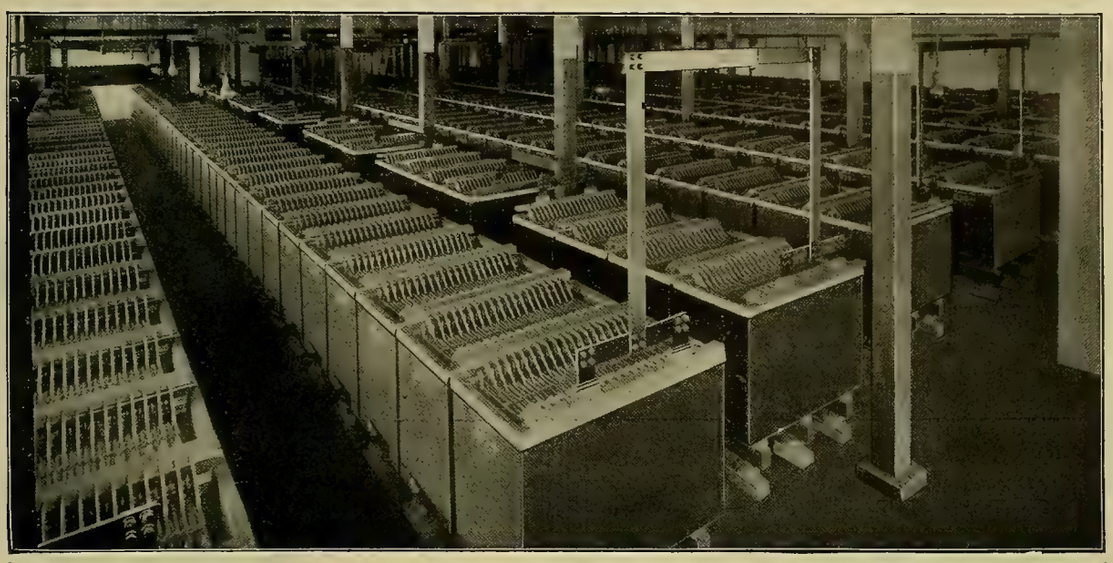

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These machines are in excellent operating condition and are offered at *very low prices*.
They consist of Motors of various makes, Generators, Direct Connected D. C. Units, Engines, etc.
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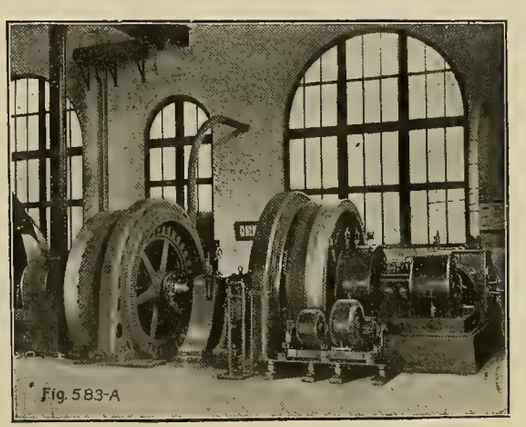

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by equipping your plant with **C-W** generators capable of excessive overloads.

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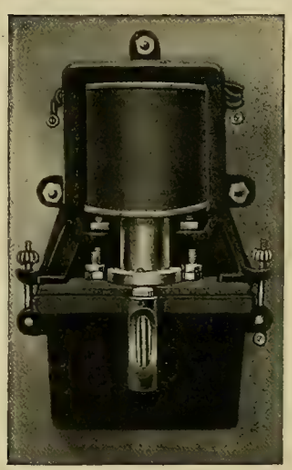
COMPANY

ALTERNATING AND DIRECT CURRENT MACHINERY
AMPERE, N. J.

C. & H. Self-Starters for A. C. Motors

For Single Two or Three Phase Motors



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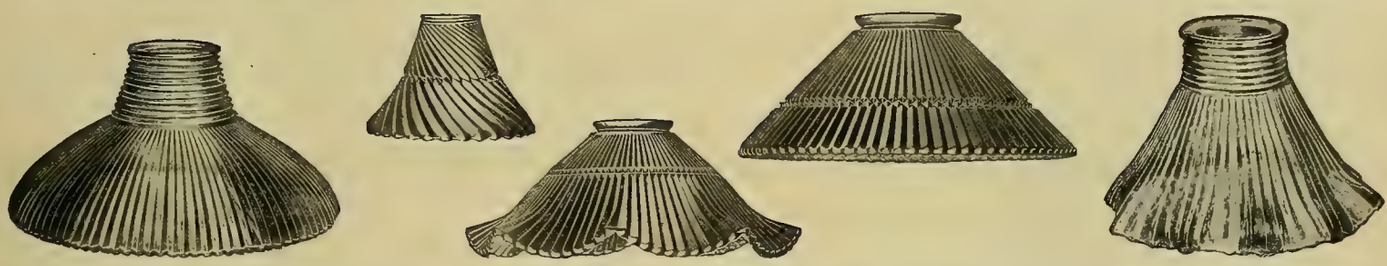

Above are illustrations of some of the types of Imitation Holophanes against which the Federal Courts have issued perpetual injunctions. Anyone manufacturing, selling or using prism reflectors similar to or resembling the above is liable to a suit for damages.

GENERAL NOTICE TO THE TRADE

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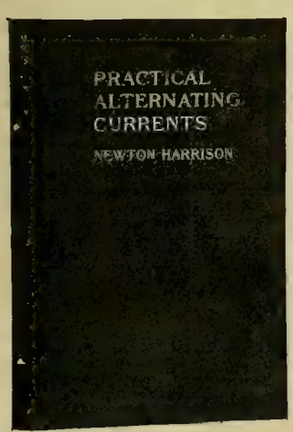

A book which deals with the subject of alternating currents in a clear, practical and simple way. Arithmetic only made use of as the basis of all calculations and comparisons.

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Does not become brittle by repeated heating and cooling.

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GENERAL WESTERN AGENTS

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REG. U.S. PATENT OFFICE

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Western Electric Co.

Anodes, Nickel and Copper
Seymour Mfg. Co.

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Central Electric Co.
Edison Mfg. Co.
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Rock Island Battery Co.
Wesco Supply Co.
Western Electric Co.

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Central Electric Co.
Manhattan Elec. Supply Co.
Ostrander & Co., W. R.
Wesco Supply Co.
Western Electric Co.

Belt Dressing.
Dixon Crucible Co., Jos.
Leather Preserver Mfg. Corp.

Belting.
Leather Preserver Mfg. Corp.

Boiler Compounds.
Dearborn Drug & Chem. Wks

Boilers.
Babcock & Wilcox Co.

Bolts, Expansion.
Star Expansion Bolt Co.

Bolts, Toggle.
Wrigley Co., Thos.

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Electrician Publishing Co
Hedenberg Pub. Co., W. L.
Spon & Chamberlain.

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Bossert Elect. Const. Co

Boxes, Moulding.
Gleason, John L.

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Plume & Atwood Mfg. Co

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Central Electric Co.
Holmes Fibre Graphite Co.
Speer Carbon Co.
Western Electric Company.

Cable Clamps.
Matthews & Bros., W. N.

Cable Hangers.
Bissell Co., B. F.
Wesco Supply Co.
Western Electric Co.

Cabling Machinery.
Alton Machine Co.

Cables (See Wires and Cables)

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Central Electric Co.
Chicago Edison Co.
National Carbon Co.
Reisinger, Hugo.
Speer Carbon Co.
Wesco Supply Co.

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Alton Machine Co.
National Brake & Elec. Co.

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Plume & Atwood Mfg. Co.

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Oneida Community, Ltd.

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Cutter Elec. & Mfg. Co.
Ft. Wayne Elec. Wks. Inc.
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Western Electric Company.
Westinghouse El. & Mfg. Co.

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Matthews & Bros., W. N.

Clamps, Ground.
Yonkers Specialty Co.

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Wesco Supply Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.

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Benjamin Elec. Mfg. Co.
Matthews & Bros., W. N.
Morse, Frank W.

Lamps, Incandescent.
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Boston Incan. Lamp Co., The
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Chicago Edison Co.
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(See Wires and Cables.)

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Allis-Chalmers Company.

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Hoffmann, Emil R.

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Nippers and Pliers.
Klein & Sons, Mathias.

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Bain, Foree & May.

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Wrigley Co., Thos.

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Sandwich Pole Changer Co.

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Fowler & Co., John H.
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Rossiter, MacGovern & Co.

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Jem Shade Holder Co., The

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Haller Machine Co.

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Belden Mfg. Co.

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Haller Machine Co.

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Weston Electrical Inst. Co.

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Century Electric Co.
Chicago Edison Co.
Manhattan Elect'l Supply Co
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Western Electric Co.

Switches.
(See Cut-outs and Switches.)

Tachometers and Tachographs.
Niagara Tachometer and Instrument Co.

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Automatic Electric Co.
Bissell Co., The F.
Central Electric Co.
International Tel. Mfg. Co.
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North Electric Co.
Stromberg-Carlson Tel. M. Co.
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Western Electric Co.

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Time Switches.
Bissell Co., The F.

Toggle Bolts.
(See Bolts, Toggle.)

Tools.
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Chicago Pneumatic Tool Co.

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Kuhlman Electric Co.
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Westinghouse El. & Mfg. Co.

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Westinghouse El. & Mfg. Co.

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General Electric Co.
Westinghouse Machine Co.

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Roebling's Sons Co., J. A
Runzel-Lenz Elec. Mfg. Co.
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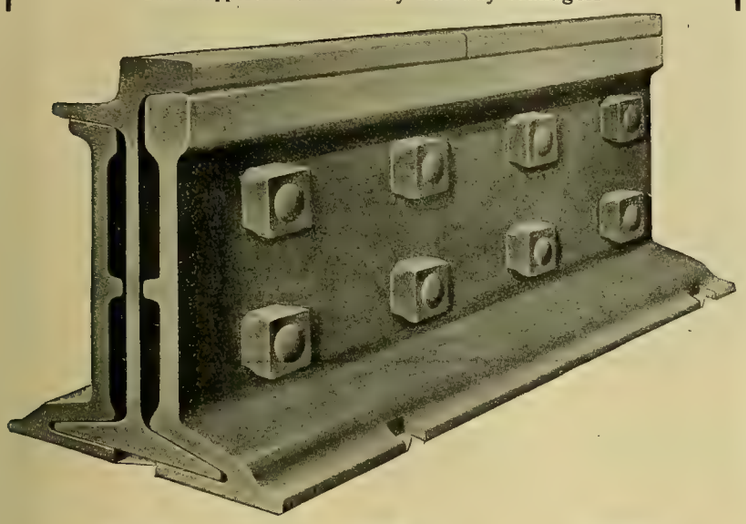

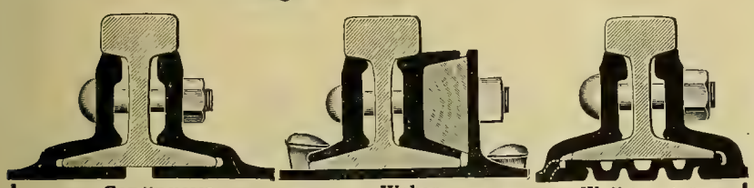

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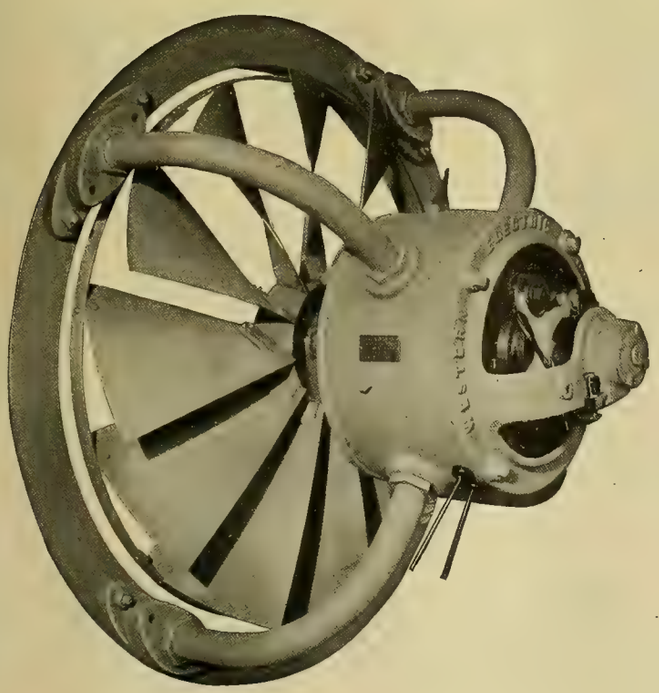

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All sizes in stock to 72-in.
Immediate Shipment

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Which is likewise furnished to read in Kilowatt Hours or Dollars and Cents.

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COLUMBIA LAMPS
GIVE MOST LIGHT

Full rated horizontal Candle Power.
Maximum tip or end Candle Power.
Maximum average or SPHERICAL Candle Power.
(The above applies particularly to lamps of 16 C. P., 75 to 130 volts.)

Buyers of INCANDESCENT LAMPS desire THE MOST LIGHT FOR LEAST CURRENT.

For the past seventeen years

COLUMBIA LAMPS

have met every requirement of most exacting station managers and operators of Isolated Plants, and are acknowledged to be

UNEQUALED IN QUALITY

Copy of our "Wallet Full of Wisdom" mailed on request. Order from any of our offices. LAMPS IN STOCK. Complete stock of Economical Turn Down Lamps enables us to make prompt shipments at all times.
If you are interested in Tantalum lamps and GEM high c. p. high efficiency units, please communicate with us for prices and other information.

The Columbia Incandescent Lamp Co.

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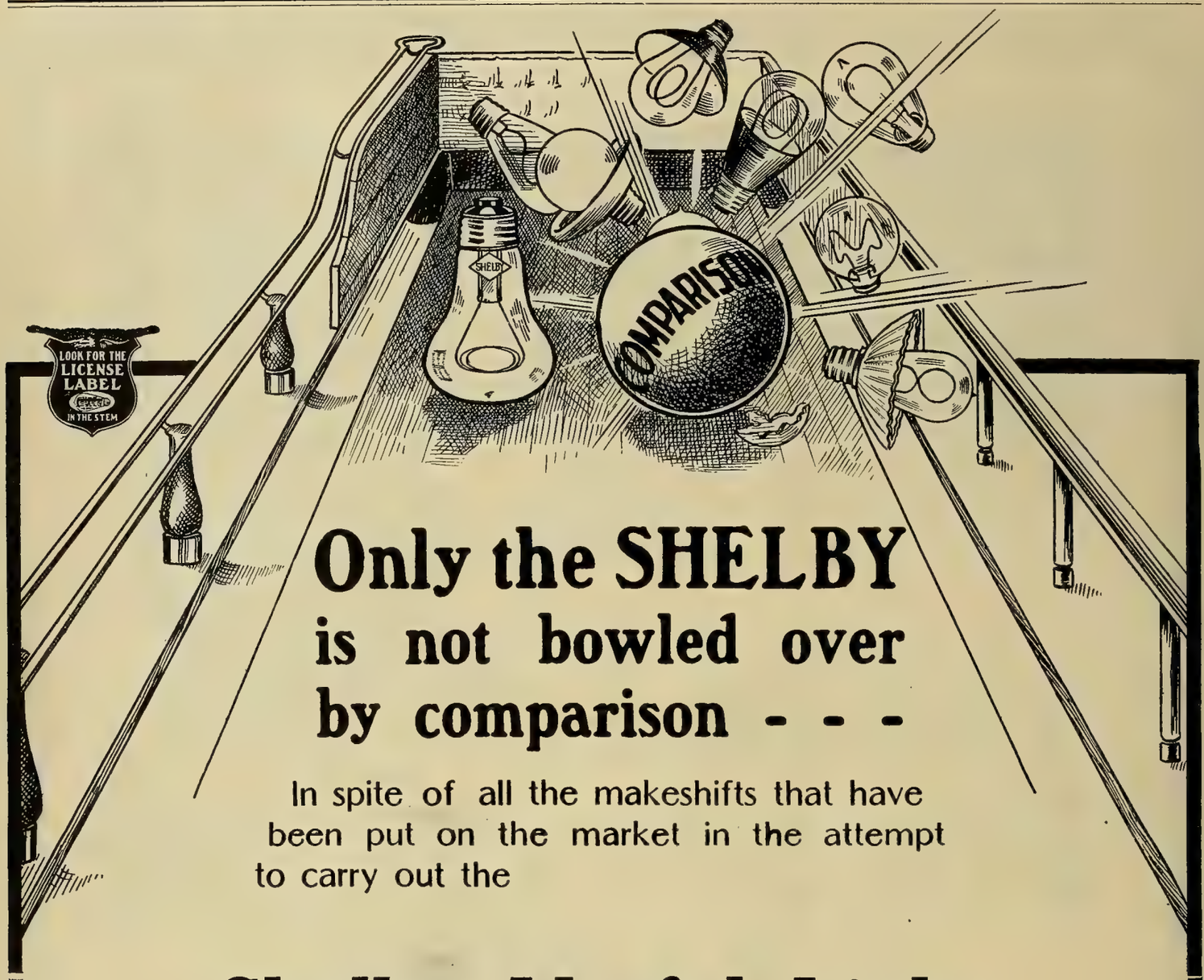
CHICAGO: 264-270 Fifth Avenue
MEMPHIS: 480 Randolph Building
MEXICO: Monterey—Van Voorhis Hnos



Only the SHELBY is not bowled over by comparison - - -

In spite of all the makeshifts that have been put on the market in the attempt to carry out the

Shelby Useful Light

idea—that of delivering the lamp's maximum light from its tipped end, the Shelby Useful Light Lamp still maintains its supremacy. Compare it with any of the freak-filament lamps under equal conditions, with or without reflectors, and you are bound to recognize the truth of this statement. The Shelby was the pioneer of the "Useful Light" coterie, and it is still far, far in the van. We'll send you samples for trial and comparison.

WE ALSO MAKE THE SHELBY TANTALUM LAMP AND METALIZED FILAMENT LAMPS OF STANDARD WATTAGES

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¶ P and S double pole construction renders better service by eliminating to a minimum liability of short circuits. ¶ Here's a feature exclusively belonging to the construction principles of P and S Sockets. ¶ It's a winner.

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Sales Offices: New York, Chicago, San Francisco.

A Splendid Opportunity —We've Seized it!

One of the "Napoleons," so called, in the lamp "organization" is reported to have remarked in effect, not very long ago:

"Oh, what a splendid opportunity now for the right man to start in as an independent lamp manufacturer!"

But he qualified this by saying that, unfortunately, the "right man," in his opinion, was now within the "organization."

He did not say that it was true, indeed, that one of the "right men" is perhaps now within the meshes of the net of the "ORGANIZATION" and is retained at a high salary BECAUSE THE "ORGANIZATION" FEARS THE BRAIN OF THIS MAN!

Of course it retained him---he is a magnificent investment. It would have paid the "ORGANIZATION" not only to have retained him but even to have allowed him to have remained in "masterly inactivity."

But he is not inactive. He is daily engaged in helping to "weave" the "red tape" of which the "net" is woven, that binds you to that "16 or 18 cents per."

The Napoleon within the "ORGANIZATION" forgot, however, that all the good ideas in the world cannot possibly come out of one head. He forgot that homely but trite expression---"there are others"(!) who can have an idea or two.

WE, TOO, SAW THAT OPPORTUNITY AND IT'S UP TO YOU TO HELP US MAKE THE MOST OF IT.

WE CAN GIVE YOU AS GOOD LAMPS AS THE "ORGANIZATION" AND WE CAN SAVE YOU MONEY. WHAT MORE DO YOU WANT?

St. Mary's Incandescent Lamp Company

Wm. M. Rothschild - Pres

St. Mary's, Pa.

— Let us quote you —

P.S. 6000 Lamps daily capacity -
We protect buyers against litigation -
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CHICAGO NEW YORK

Manufacturers of Air Compressors, Pneumatic Hammers, Drills, Appliances, Motor Hoists, Electric Drills, Etc.

DUNTLEY 500-VOLT ELECTRIC DRILL

SINGLE MOTOR TYPE IN OPERATION REBONDING TRACK

Built in single and two motor types, ranging in capacities from 5/8 inch to 2 inches diameter in steel.

We also manufacture a portable electric grinder, carrying an emery wheel 8 inches diameter by 1 inch face, to be operated from 550-volt direct current circuits.

These drills and grinders have been designed for Street Railway service. The electrical parts are built to operate at 500 to 650 volts, without external resistance. The insulation is of the very highest type throughout and the tools are made to withstand the conditions of severe service on Street Railway Construction and Maintenance. SEE OUR PNEUMATIC AND ELECTRIC TOOLS IN OPERATION at the Convention of the

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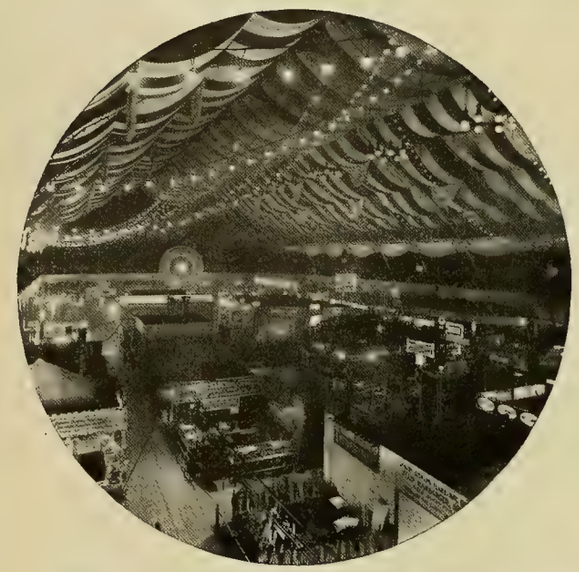
Second Annual Electrical Show

COLISEUM, CHICAGO, JANUARY 14-26, 1907



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Spaces are being taken up rapidly, and there are only a few choice ones left. Apply now. The 1906 Electrical Show was the best trade show ever held, and the 1907 show will be still larger and better. Will you come in?

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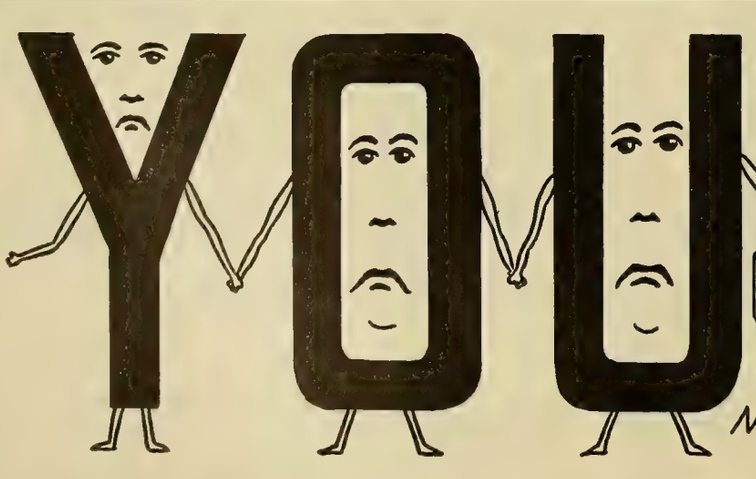

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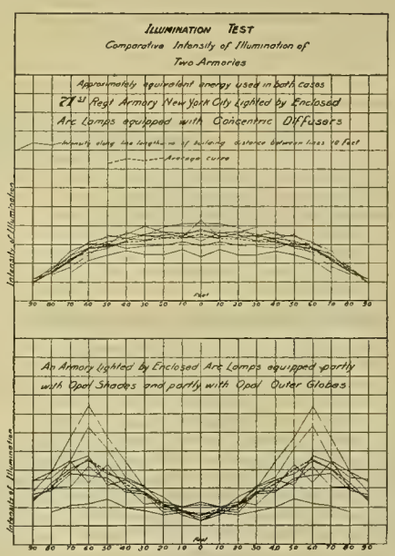
An Example and a Comparison

INTERIOR OF 71st REGIMENT ARMORY, N. Y. N. G., NEW YORK CITY



A striking example of the results obtained by the proper use of the right lighting outfit is well shown in this illustration.

The photograph from which this engraving was made was taken at night by the artificial illumination given by General Electric arc lamps equipped with concentric diffusers shown in the five lamp clusters.

This installation emphasizes the fact that by proper location of arc lamps and the use of concentric diffusers, the variation in intensity of light is comparatively small.

The uniform distribution and thorough diffusion of light in this armory is the result of General Electric Illuminating Engineering.

This graphical comparison of curves shows the results of actual tests made with the candle-foot photometer in two armories differently lighted but using the same energy per square foot of floor area.

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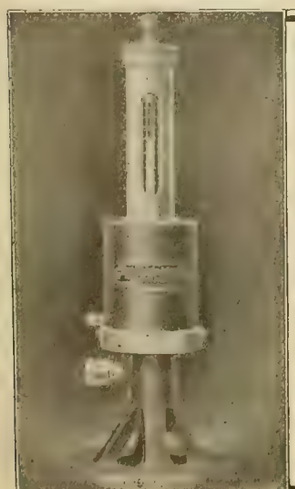

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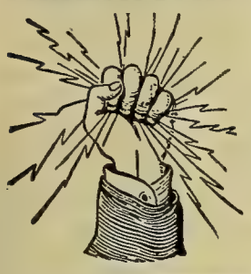

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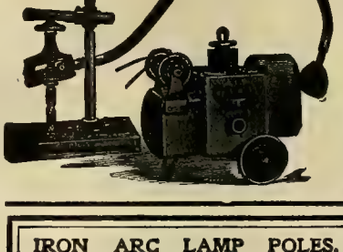
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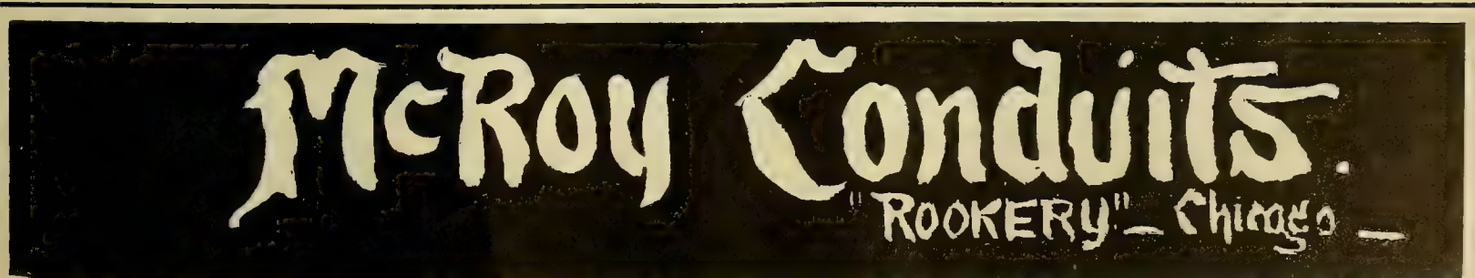

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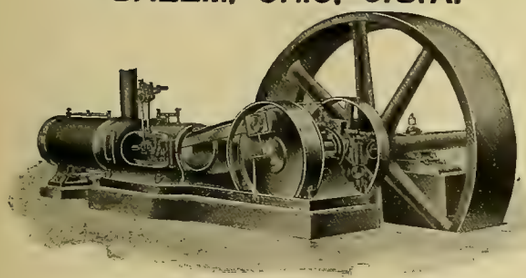

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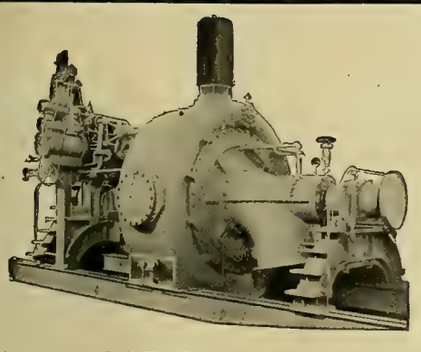

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213 ft.	½	257 r. p. m.	1750	95 per cent	73.00 per cent
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These results have never been equaled by any turbine of the Horizontal Shaft Design, operating under equally HIGH HEADS. The test was made AFTER TURBINES WERE INSTALLED, direct coupled to generators. Francis' weirs and formulæ for discharge were used. The original test reports on file at our offices. These turbines are all fitted with our SAMSON BALANCED GATES. Note especially the UNIFORM SPEED at ALL GATEAGES.

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An Excellent Opportunity to Obtain PRACTICAL Information on

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The Small Central Station

Practical Hints on Its Construction and Operation

The scope of this eminently practical work, written by experienced authorities on the subject, is well indicated by the list of chapter headings:

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II. Building and Foundations.
III. Fuel and Waterpower.
IV. Boilers and Setting.
V. Operation of Boilers.
VI. Engines.
VII. Steam Turbines.
VIII. Belting and Shafting.
IX. Electrical Equipment—Generators—Switchboard.
X. Arc and Incandescent Lamps.
XI. Instruments.
XII. Transformers.
XIII. Line Construction.
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The articles supply data relating to small and medium-sized stations using overhead construction, and are especially adapted for intending purchasers of electric-light plants and practical men. Within this field the ground is thoroughly covered in view of the requirements of the best modern practice. Operations and construction are dealt with at length, and the information given has been compiled from the experiences reported by central station managers operating in all parts of the United States, handling various types and sizes of machinery. The series will be enriched with **numerous illustrations, diagrams and tables.**

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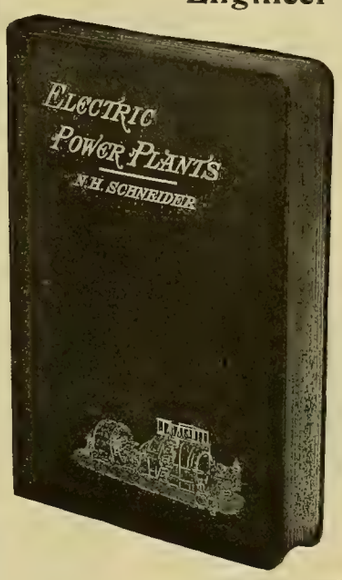

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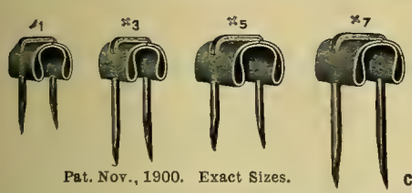

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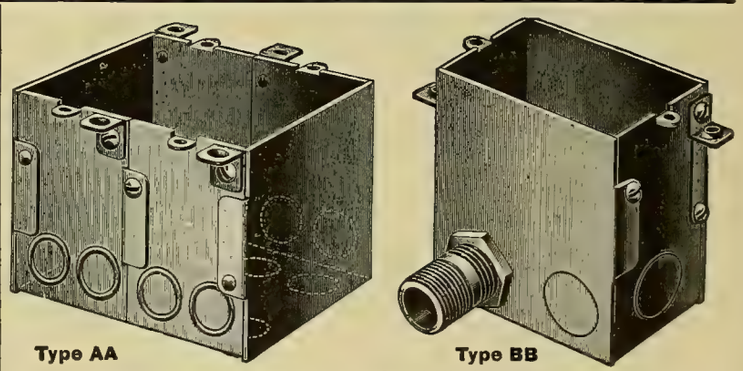

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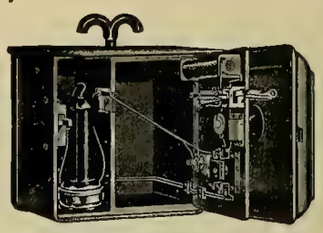
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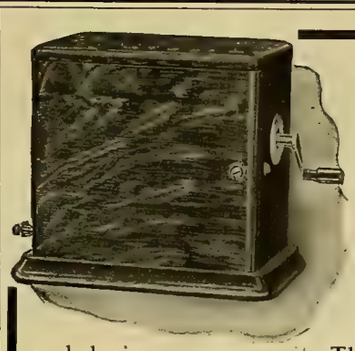

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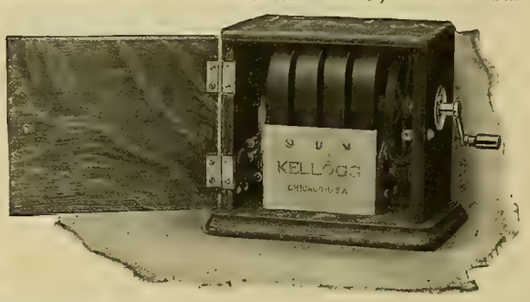

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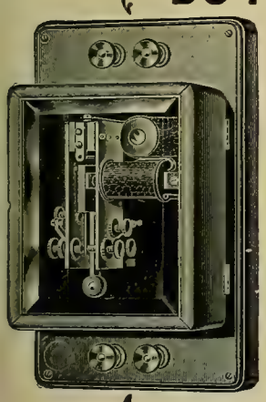

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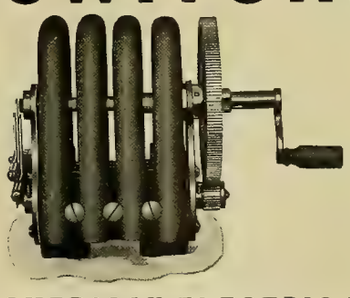

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Made 4, 5 or 6 Bar

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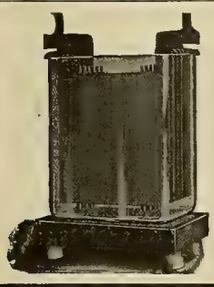

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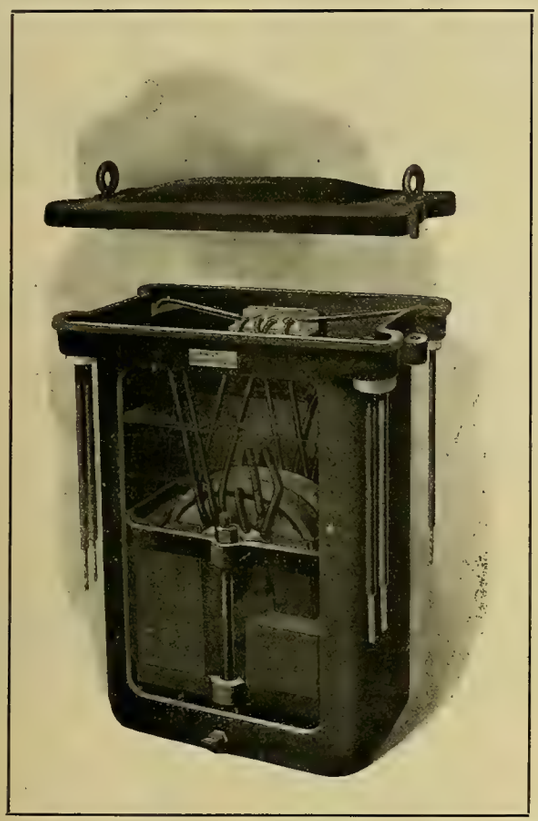

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We have succeeded in completely eliminating their transformer troubles.

Wagner Transformers are put out under a guarantee which is in effect an insurance policy in your favor, guaranteeing their good behavior and long lasting qualities. Our bulletin No. 72-H will tell you more about this, and any of our District Managers will be glad to call upon you.

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One of Our Ordinary Train Shipments of Cedar Poles. This Train Has Nineteen Cars.

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TIES Oak Cypress and Chestnut — Cypress Trolley **POLES**

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Also 5 Inch Thick 8 Foot Ties. Write for Delivered Prices

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In Stock for Quick Shipment

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NONE BETTER

The rods are of one piece
No welds nor threads to weaken them

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A 15-inch Anchor squares up in a 6-inch hole, over 55 square inches in solid earth

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Catalog "R" on Electric Heating FREE.

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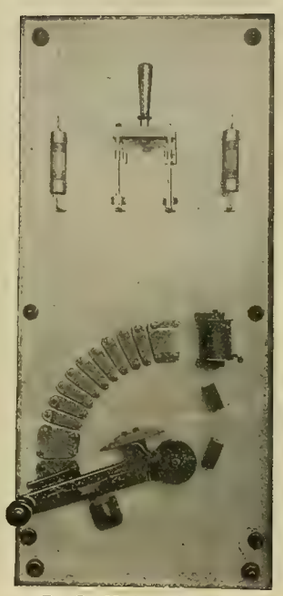

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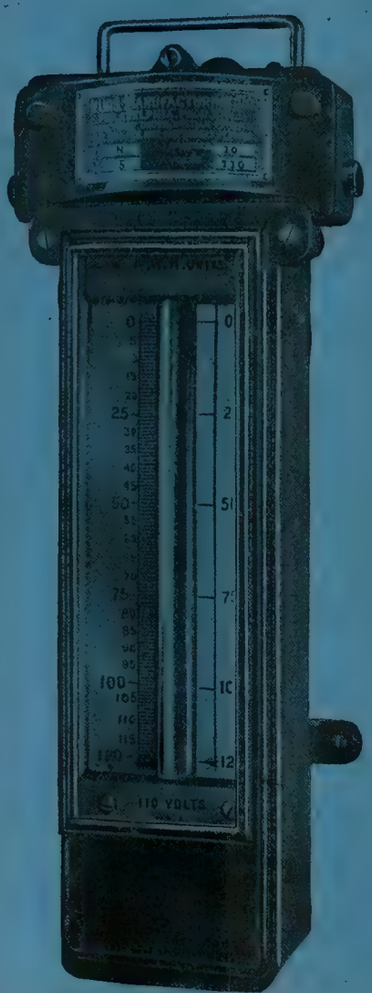

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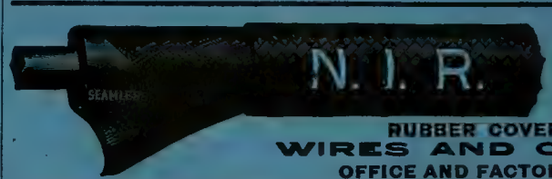

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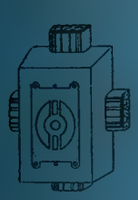

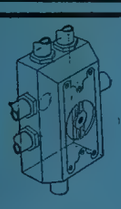

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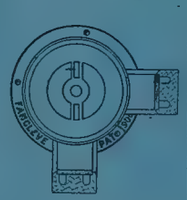

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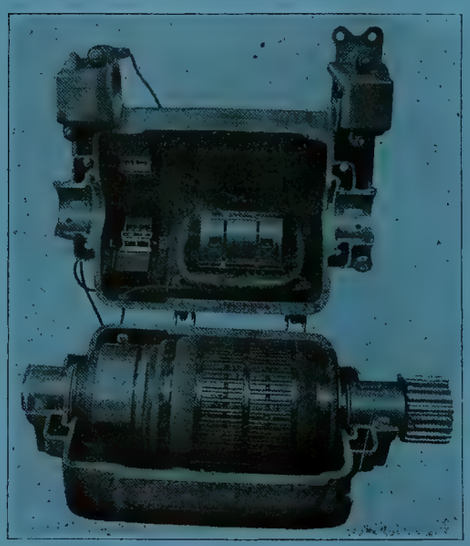

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These machines are in excellent operating condition and are offered at *very low prices.*
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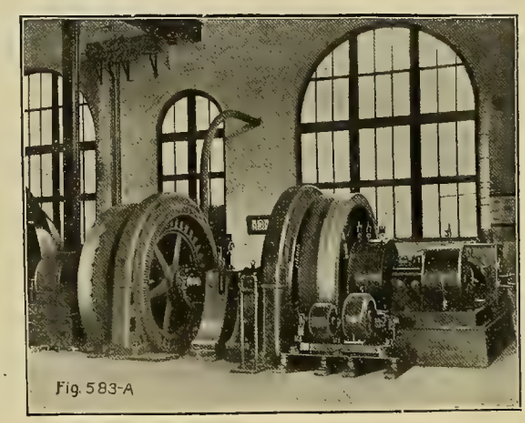

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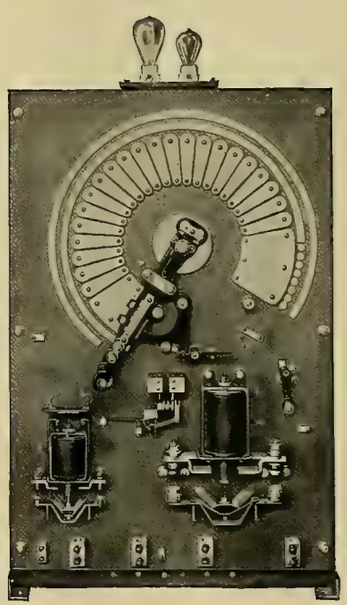

In setting the plates on the rolls of a rotary printing press it is necessary to turn the rolls slowly and positively through a very small number of degrees with provision for a positive stop.

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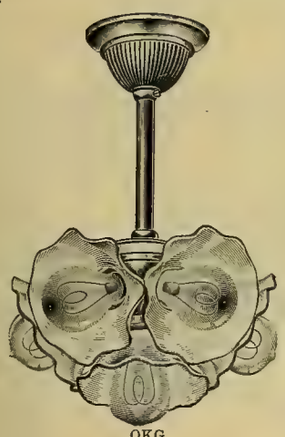
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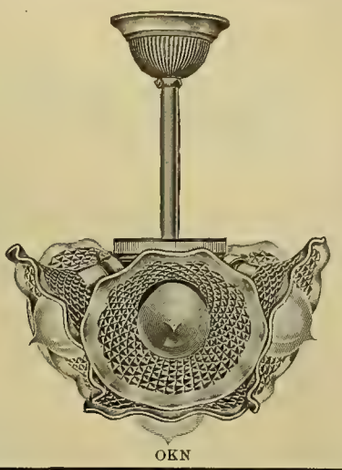
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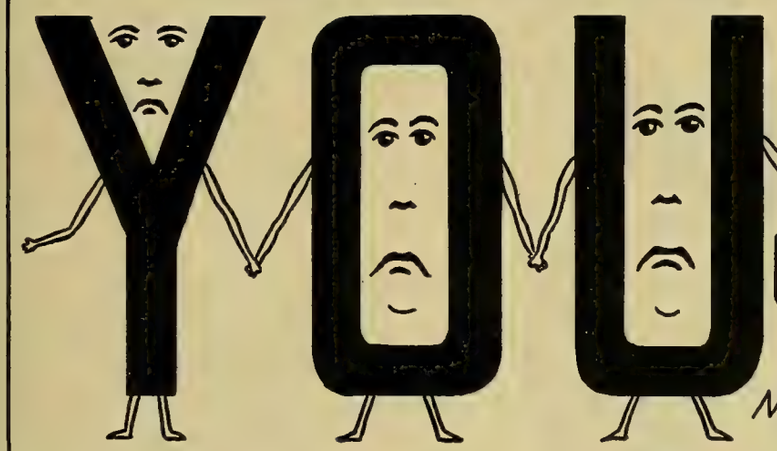

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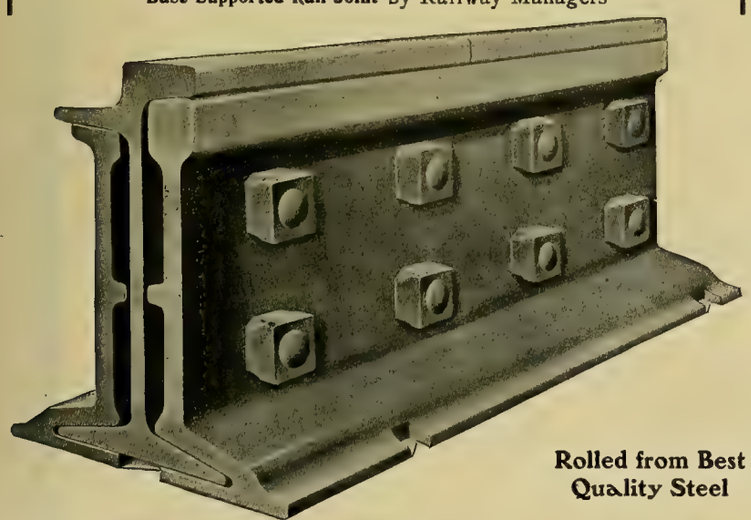

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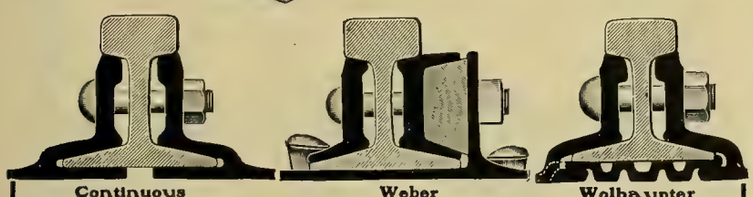
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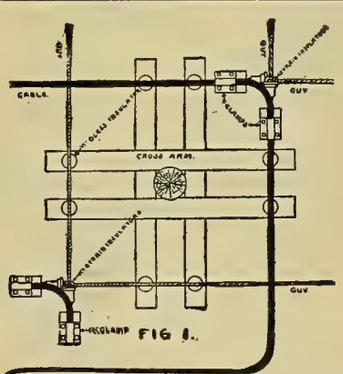

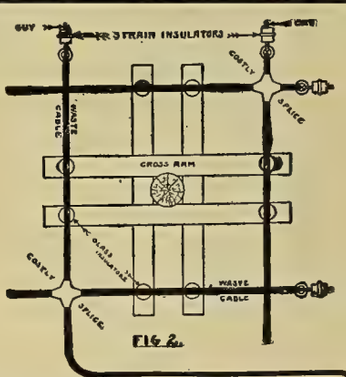

KEARNEY CABLE CLAMPS

Fig. 1 shows a bird's-eye view of a corner pole with two 600,000 C. M. cables turning a right angle with the aid of four Kearney Cable Clamps.

Fig. 2 shows the same conditions with the aid of spliced joints. Let us compare the two pieces of work.

The work on Fig. 1 can be done by two line men in 30 to 40 minutes without the services of a ground man. No cable is cut. No solder or blow-torches are used. All that is necessary is to clean off four inches of insulation for each clamp, and clamp them to the bare surface of the wire. There is no waste cable.

The work on Fig. 2 can be done by two line men, and a ground man to tend the blow-torches and keep the solder hot, in not less than two hours, maybe more. They must cut the cable in four places (maybe some saw blades will be broken doing this). From 10 to 12 feet of cable will be wasted at each splice (maybe more). Figure up this cost on 20 feet of 600,000 C. M. Cable. Then there is the solder and the extra tape and gasoline needed. (Think of the danger of gasoline, not only to the men but to property.) A splice creates line loss, and is never as good as the solid wire.

Kearney Cable Clamps are much cheaper, more durable, stronger, save time, labor and material. Increase value of scrap cable. 25 or more will be shipped on 30 days' trial, freight prepaid. Ship them back if unsatisfactory. Pay for them otherwise.

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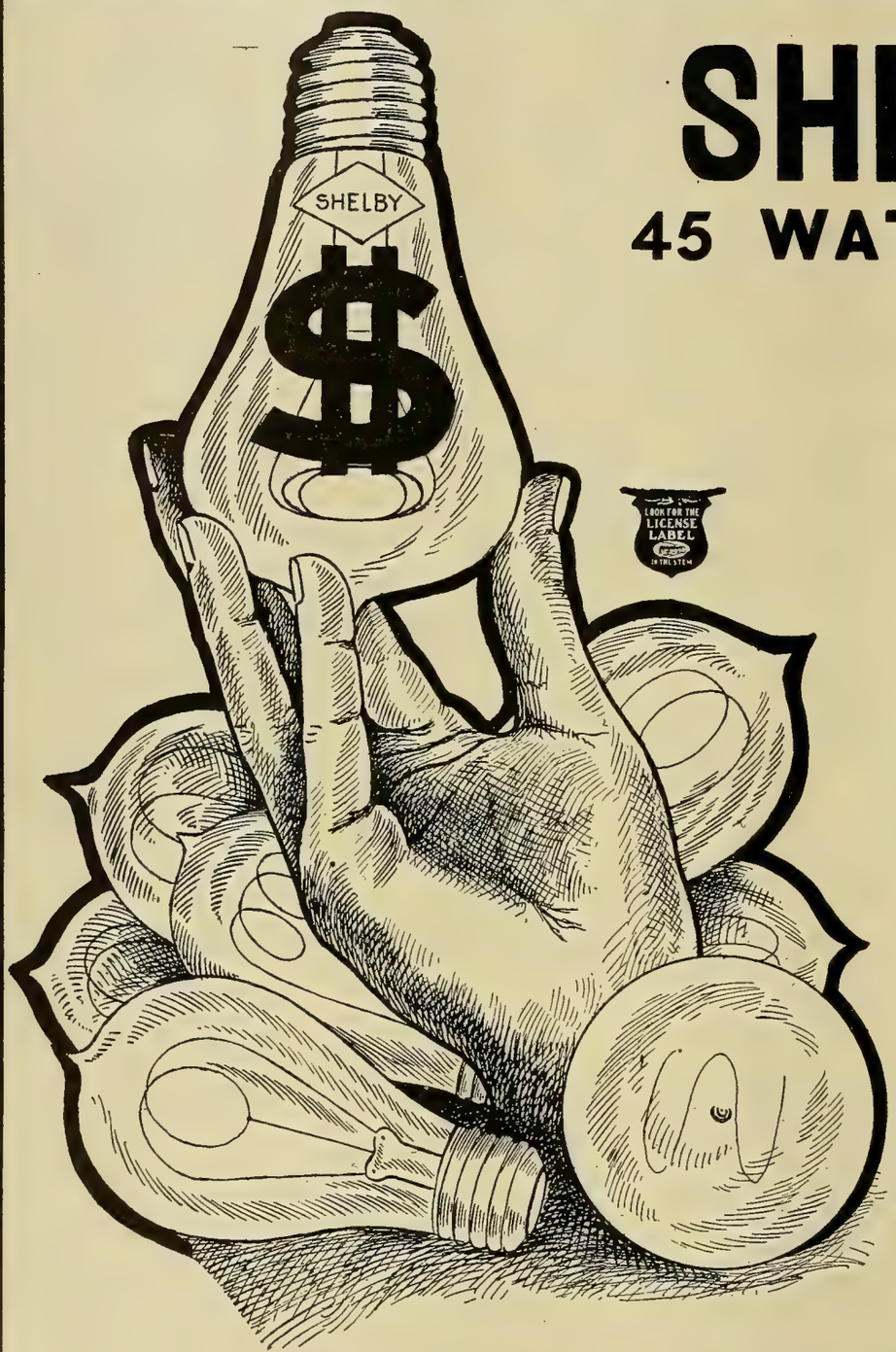

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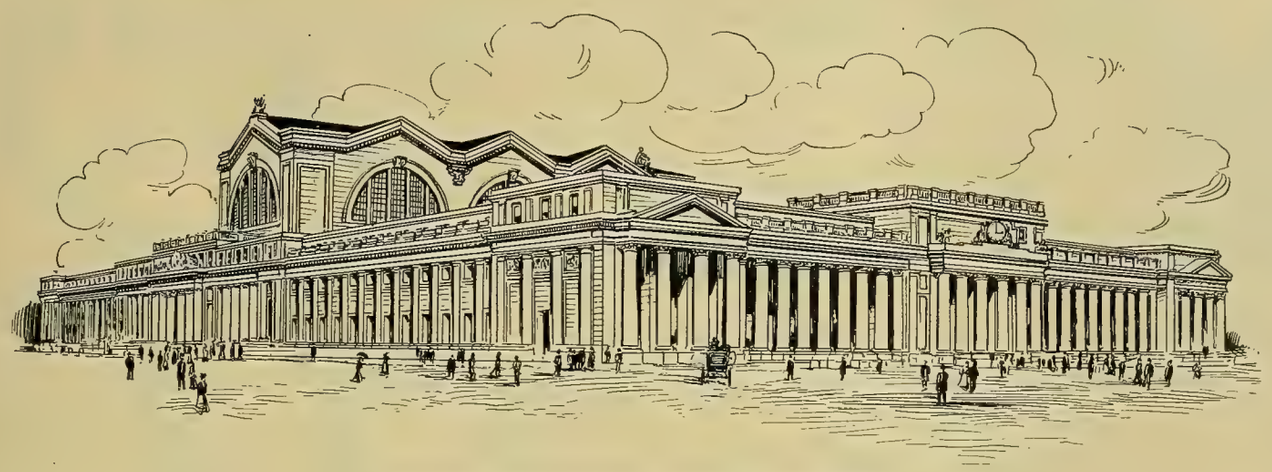

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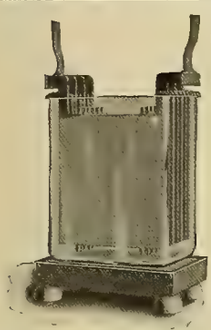

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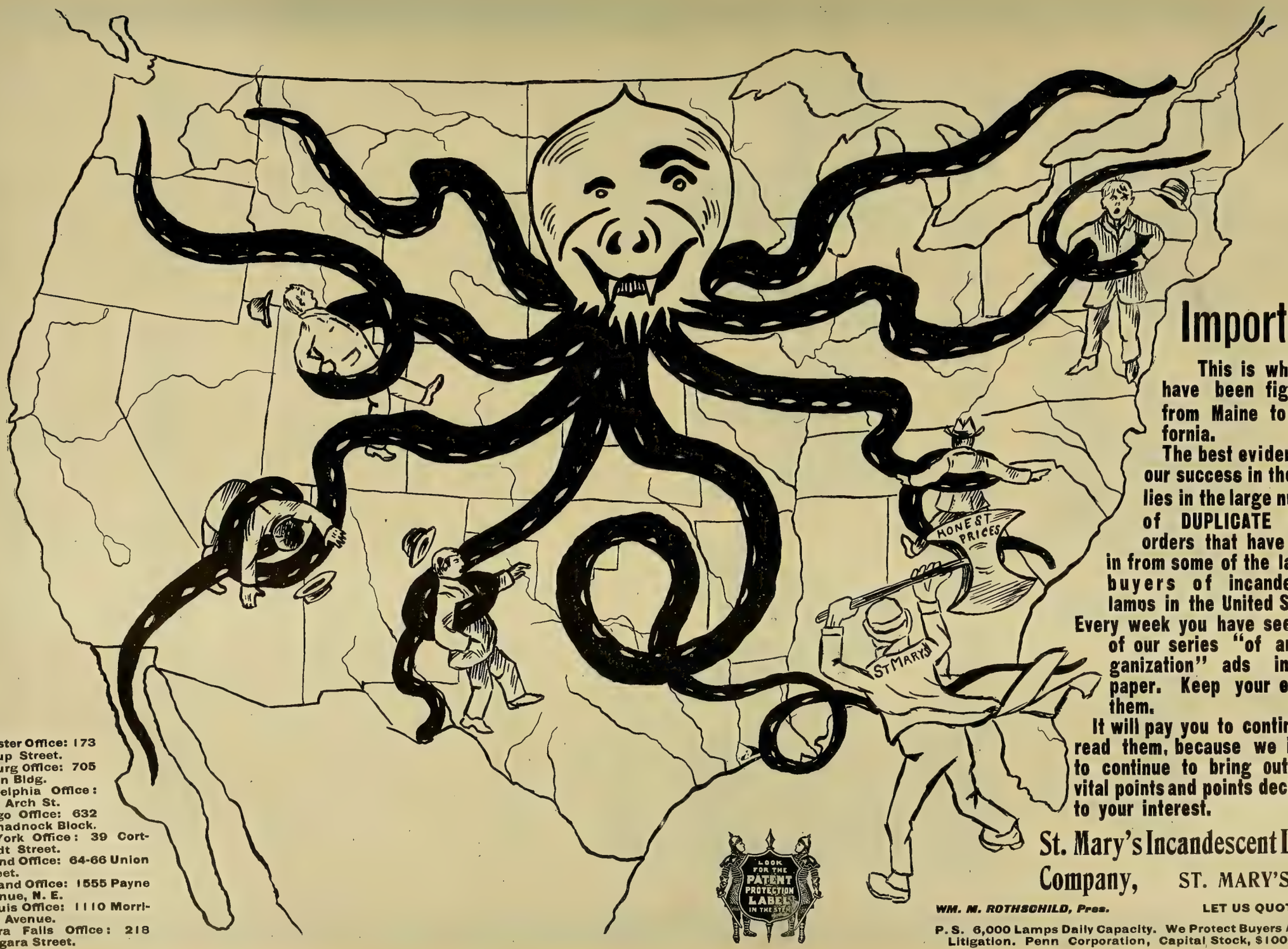

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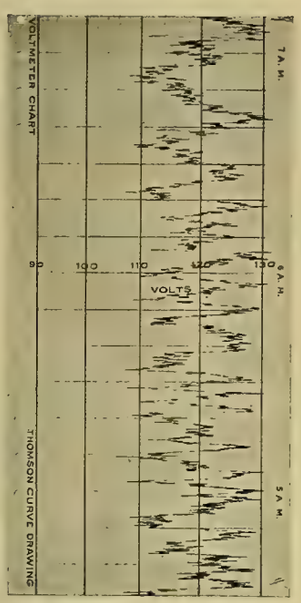

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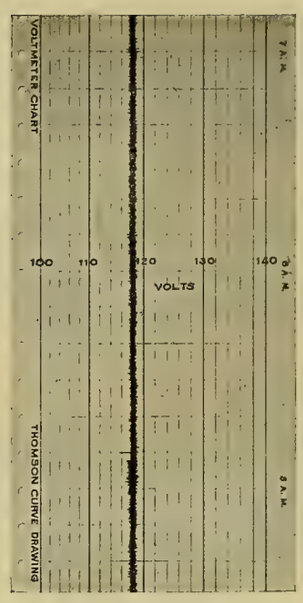

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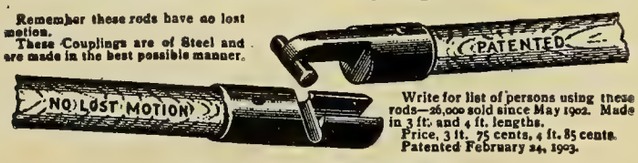

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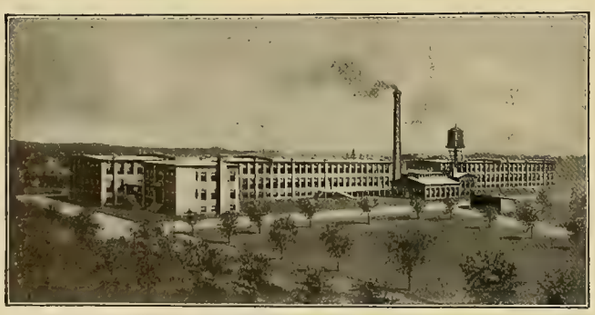

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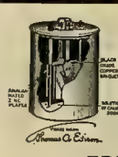

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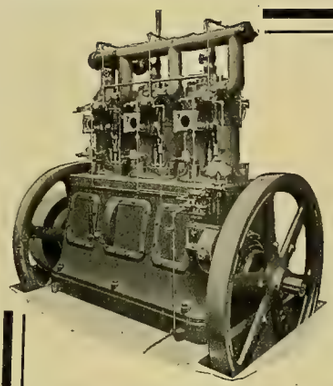

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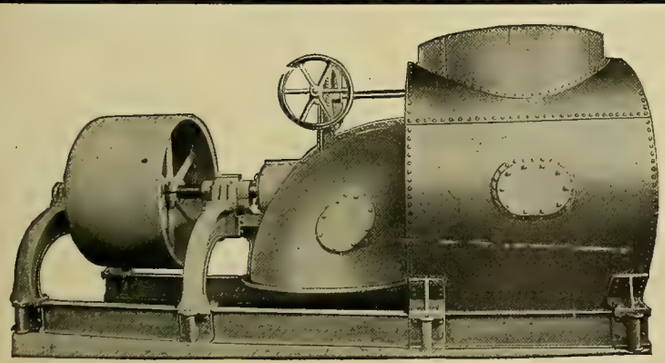

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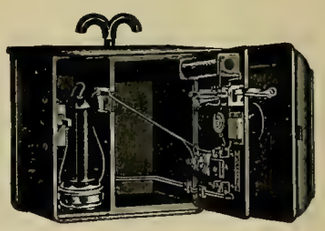
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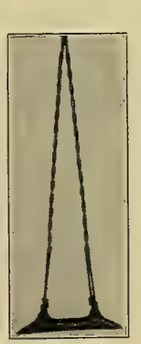

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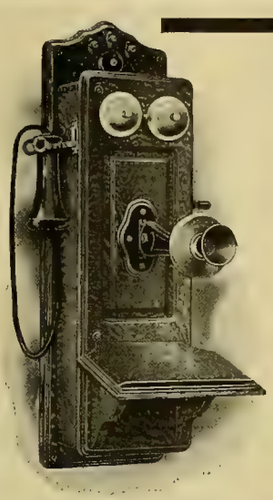

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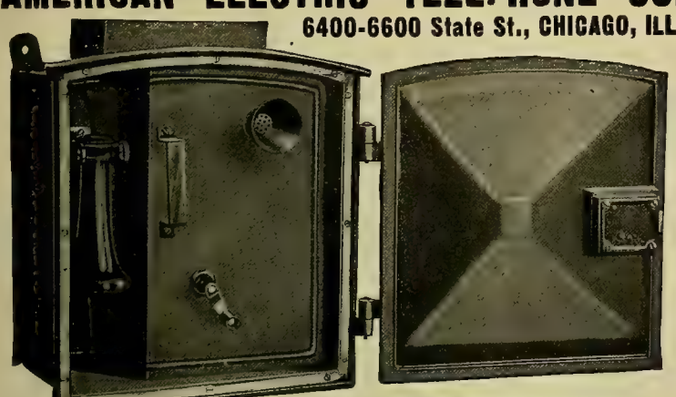

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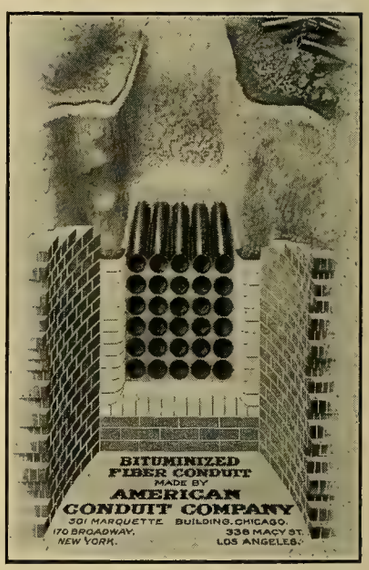

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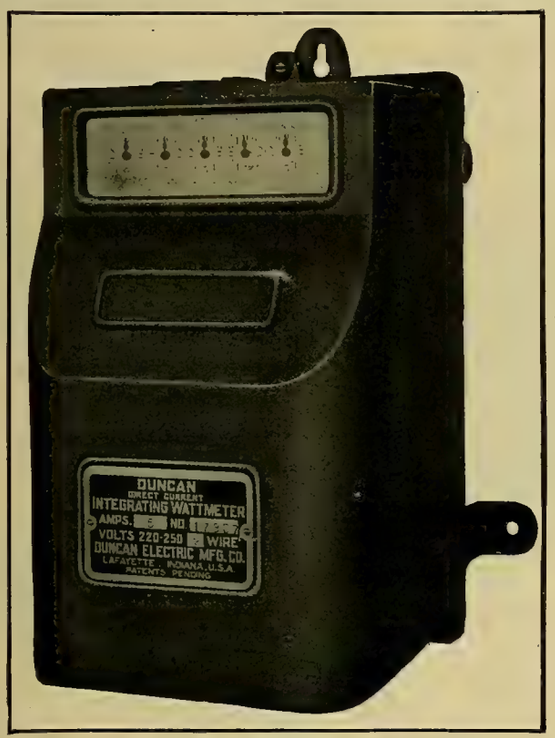

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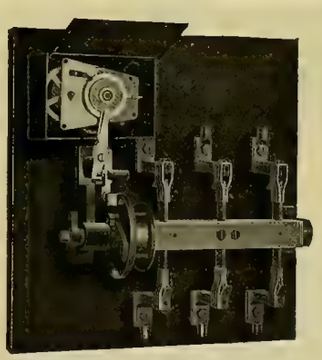

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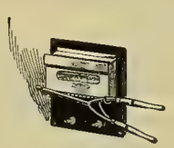

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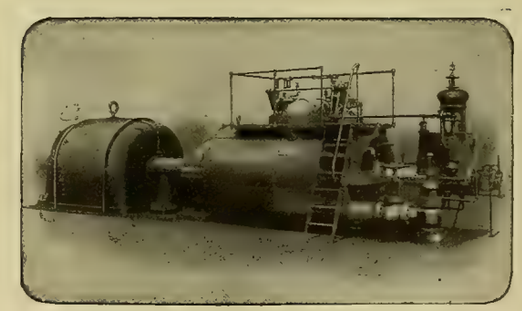

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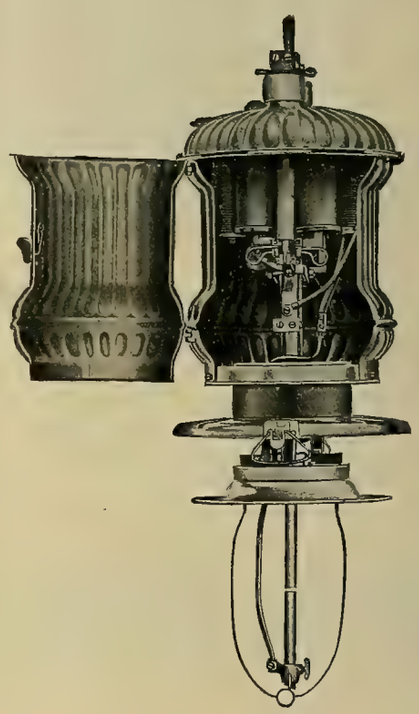

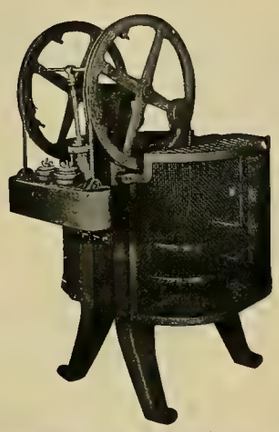

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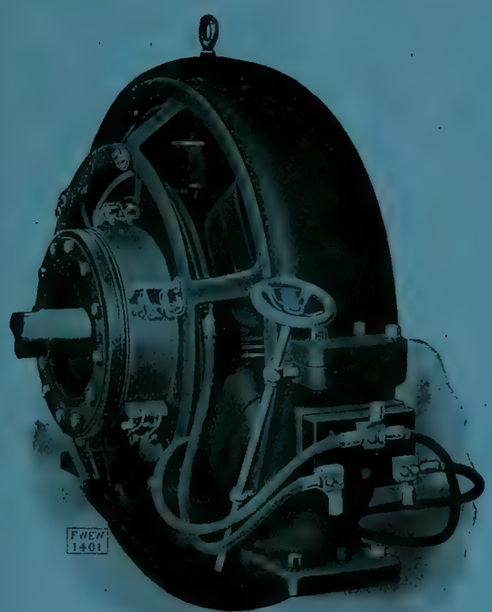

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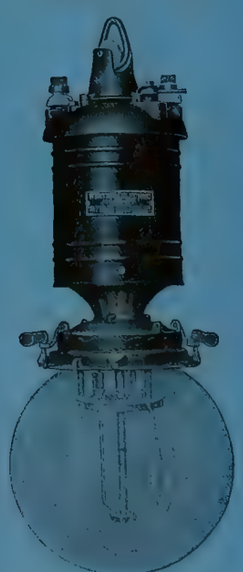

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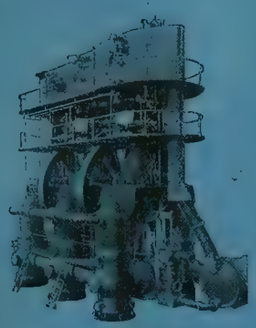

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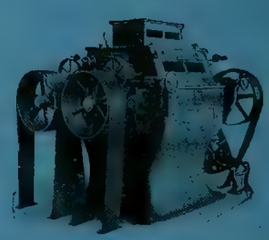

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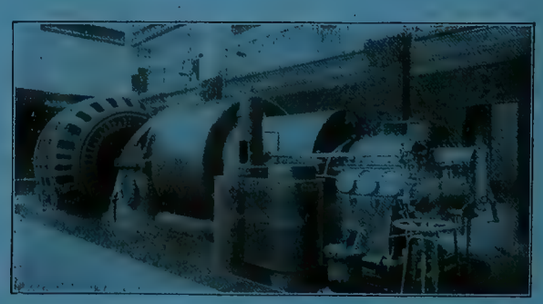

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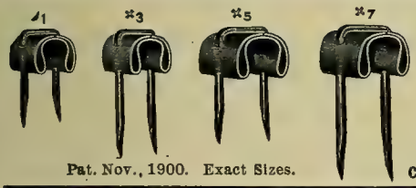

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As a result of the installation of our Central Station Service in buildings which formerly operated their own plants, we find it necessary to market large quantities of

ELECTRIC SECOND-HAND MACHINERY STEAM

These machines are in excellent operating condition and are offered at *very low prices*.
They consist of Motors of various makes, Generators, Direct Connected D. C. Units, Engines, etc.
Prices and all necessary information will be promptly given on request.

CHICAGO EDISON COMPANY

Telephone Main 1280. **Edison Building, 139 Adams Street, CHICAGO**

WE HAVE CAUSE
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MOTORS AND GENERATORS

Three **C-W** *Alternating Current Generators, at Elgin National Watch Co. Plant, Elgin, Ill.*

Let us send you a list of users in the Chicago territory. It is an eloquent proof of the confidence our customers have in **C-W** apparatus.

Bulletin No. 63 T gives list of **C-W** *users.*

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COMPANY
ALTERNATING AND DIRECT CURRENT MACHINERY
AMPERE, N. J.
CHICAGO OFFICE, OLD COLONY BLDG.

Reversible Drum Controllers
FOR FOUNDRY WORK

Lifting castings and other heavy material in a foundry requires the full capacity of the foundry crane—the ordinary crane motor controller provides for this condition.

You must have in addition, however, perfect control of the motor when moving flasks, lifting patterns from the sand or raising copes. The ordinary controller does not provide for this.

C. & H. bulletin 66-A controllers are ideal for foundry work, for they provide a slow speed, light load control on the first point, which gives approximately constant speed to the motor and eliminates the jerk which breaks the sand.

Full load conditions are also fully provided for.

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FOR ELECTRIC RAILWAY MOTORS

Field and armatures withstand extremes of temperature without injury when wound with Deltabeston Magnet Wire.

Especially adapted for use on arc lamp magnets. Send for new prices and samples. Sizes 3 to 18, B. & S. Gauge.

OKONITE IT NEVER DISAPPOINTS

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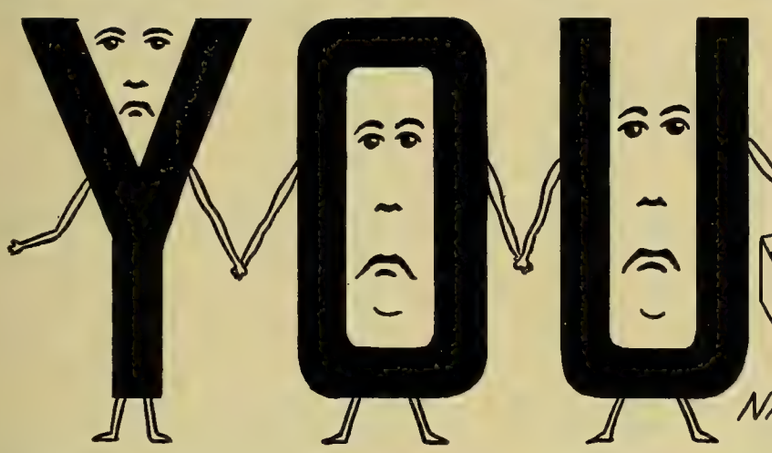
An Asbestos Covered Wire That Will Not Burn Out



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COLUMBIA

Lighting Troubles

and you will wear SMILES instead of FROWNS. They ALWAYS SATISFY

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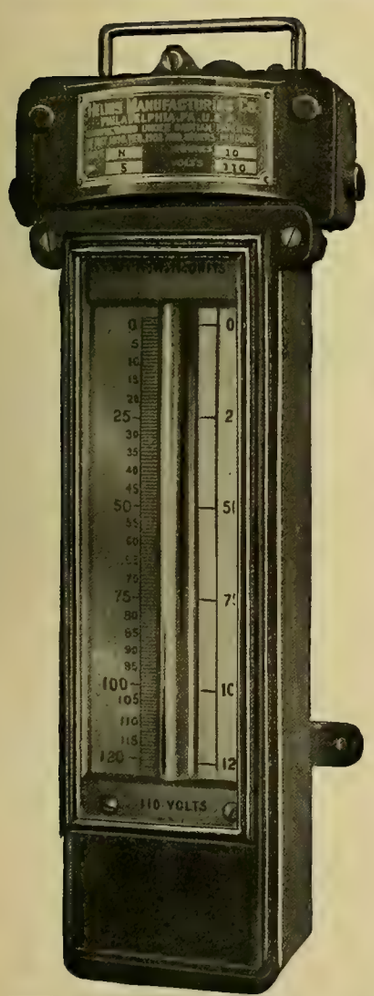

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Owing to the entire absence of moving parts, coils, magnets, etc., this meter has met with the immediate approval of Direct Current Central Stations.

It is well known that small meters are liable to burn-outs, particularly on 220 and 550 volt circuits. THE BASTIAN HAS NOTHING TO BURN OUT. Even lightning proof.

The accuracy is equal to any; the price so small that managers have a revelation in store. Postal brings it.

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"CLIMAX" RESISTANCE WIRE

Has the highest specific resistance of any wire on the market.

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Wagner transformers are built right, not because we say so, but because we make them so. It is the inside history that tells the story, and their "insides" are right.

We do not sacrifice good insulation in order to get good regulation, but our form of coil winding permits good insulation with good regulation.

Our transformers are put out with a guarantee, which is in effect an insurance policy in your favor, guaranteeing their good behavior.

Our bulletin No. 72-H will give more detailed information regarding the construction of these transformers, and we would appreciate the opportunity of sending it to you.

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Over 25,000 Miles in Use

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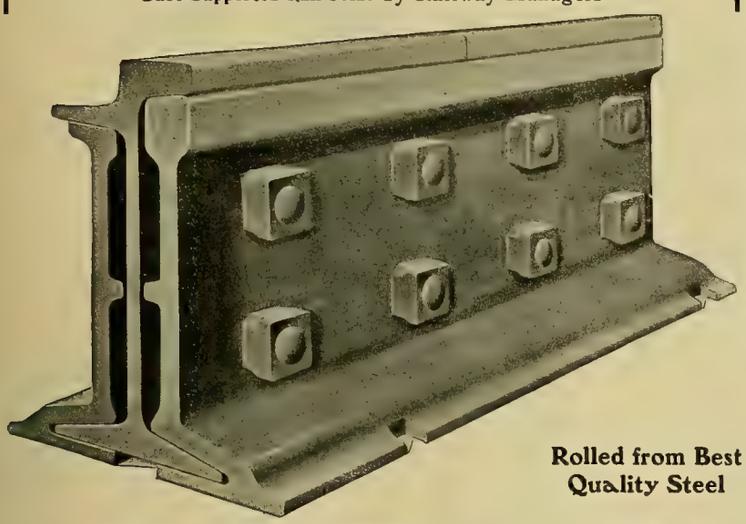

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Continuous Weber Wolhaupter

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Habirshaw Red Core Wire Installed Throughout

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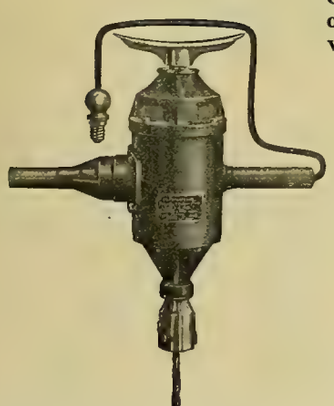
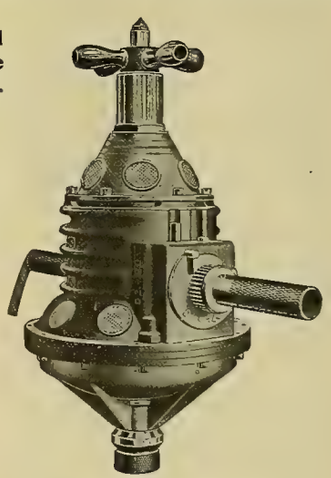
AIR-COOLED DUNTLEY ELECTRIC DRILLS

Give 60% efficiency, and on account of their economical operation are becoming extensively used. They are wound for 110, 220 and 550 volts d. c., capacities 3-8 in. to 2 1-2 in. in iron or steel.



Breast Drill Cap, 3-8 in., Weight 13 lbs.

Duntley Electric Drills Drilling and Reaming at Cramps Ship Yard, Philadelphia, Pa.



550-Volt Drill for Rail Bonding

Write for prices and full information. Drills sent on trial anywhere.

All Drills furnished with Grip Handle for operating switch when desired, also reversible or non-reversible.

CHICAGO **CHICAGO PNEUMATIC TOOL COMPANY** NEW YORK

Manufacturers of Air Compressors, Pneumatic Hammers, Drills, Appliances, Motor Hoists, Electric Drills, Etc.

Every P and S Socket is a unit of parts of equal endurance.
P and S are well balanced.
All current carrying parts are heavy enough to prevent heating at 100 per cent. overload for any indefinite period.
This is one of many good P and S points.

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Solvay, N. Y., U. S. A.
Sales Offices: New York, Chicago, San Francisco

Bell Type.....12 to 15 amperes
Telephone Type...22 to 25 "
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ELECTRICAL JOBBER ARRESTED

Every electrical jobber in this country who shall refuse to handle our new "FLEUR DE LIS" DRY CELLS will be prosecuted by us to the fullest extent of the business law. COMMON SENSE will tell you that it is to your advantage to handle the NEWEST ADVANCED DRY CELL. We allow you the largest possible margin in handling our cells and we guarantee them. The success we have met is the best test of the MERIT of our dry batteries.

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NEW YORK: E. E. Cary Co., 59 Park Place CHICAGO: A. J. Cox Co., Stock Exchange Bldg.

Important

This is what we have been fighting, from Maine to California.

The best evidence of our success in the fight lies in the large number of DUPLICATE lamp orders that have come in from some of the largest buyers of incandescent lamps in the United States. Every week you have seen one of our series "of anti-organization" ads in this paper. Keep your eye on them.

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WM. M. ROTHSCHILD, Pres. LET US QUOTE YOU

P. S. 6,000 Lamps Daily Capacity. We Protect Buyers Against Litigation. Penn. Corporation, Capital Stock, $100,000.

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Philadelphia Office: 632 Arch St.
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IS THE WAY TO MORE REVENUE

To all lamp users who have been using lamps that consume 56 watts, we offer this 45-watt lamp and guarantee it to give equal illumination, and, furthermore—to produce it in useful directions.

Why should you pay for more current than you need to produce a given illumination?

Let us send you a few testimonials from prominent engineers as to the comparative values of the different lamps.

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Nos. 6 to 30 High Street, SHELBY, OHIO

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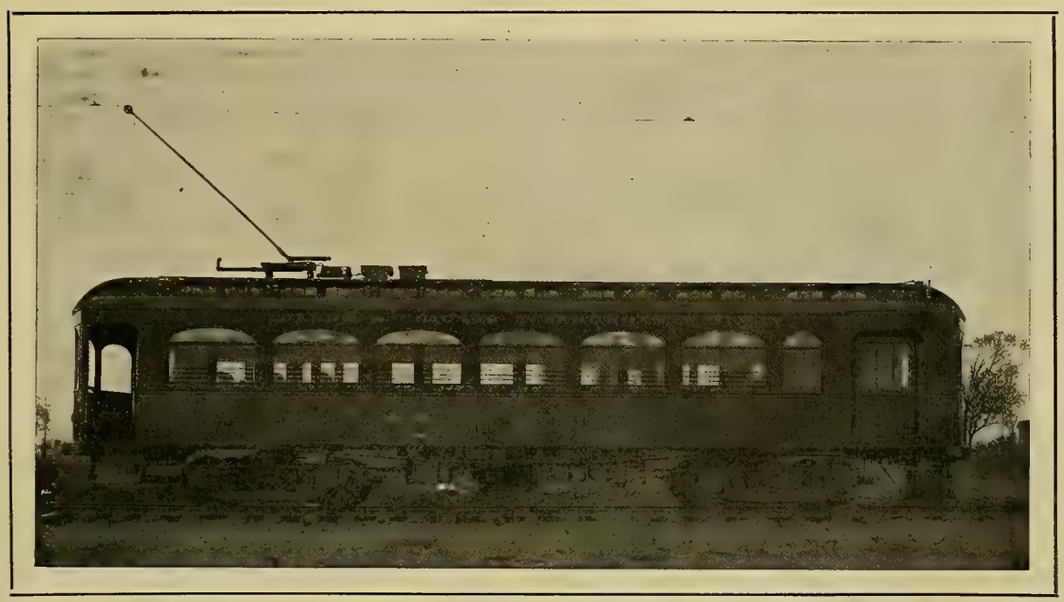
General Electric Company

Single-Phase Railway Apparatus



Interurban Car with General Electric Single-Phase Equipment for A. C. and D. C. Operation.

Every argument advanced for single-phase traction needs General Electric apparatus for its successful demonstration

Curtis Turbine Generator reliability is assurance of unfailing current supply.

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The simplicity of the General Electric Company's electric railway apparatus reinforces every economy of single-phase railway operation

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Because they are reliable. Cost less than any other make in the end. . . . . .

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HARRISON, N. J.
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MICABOND will save you money in your repair work as well as in your new machines. It is good insulation—made out of the best materials and is sold at reasonable prices.
CHICAGO MICA CO. VALPARAISO, IND.

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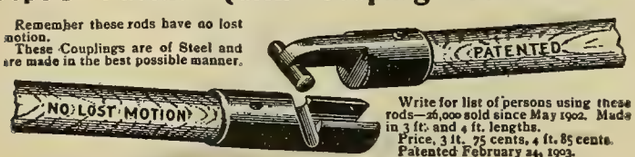
Remember these rods have no lost motion.
These Couplings are of Steel and are made in the best possible manner.



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Price, 3 ft. 75 cents, 4 ft. 85 cents.
Patented February 24, 1903.

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Cale's Commutator Compound.
The Only Article That Will Prevent Sparking.
Will keep the Commutator in good condition and prevent cutting. Absolutely will not gum the brushes.
50c. per stick. $5.00 per dozen. Send 50c. for trial stick.
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DOES QUALITY DOES PRICE } Interest YOU?
For Pot-Heads, Wire Joints, Armatures, Field Coils, etc.
Write for Particulars.
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Installed in isolated plants will ensure satisfactory, economical operation.

Write for estimates and information on the reliable **Unit Accumulator.**

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SAMSON SPOT CORD FOR ARC LAMP AND TROLLEY CORD
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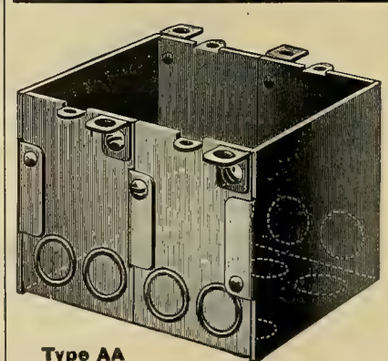

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PATENTS PENDING
Approved by the Underwriters National Electrical Association. Takes all Standard Switches and Receptacles
Designed so that a **two-gang** box can be converted into any number of gangs by releasing the clamping screws and inserting "Spacers." These gangs are easily assembled with the aid of a screwdriver, and fit together snugly, making a perfect and solid gang box for any required number of switches.
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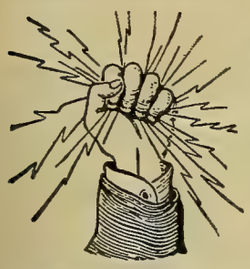

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Popular with Street Railway, Electric Light and Telephone Companies.

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HAVE NO WELDS

The full rod is cast into the helix. Our experience has shown that welds are dangerous in rods of less than one inch in diameter.

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When in at the proper depth they are set. The strain can then be put on without fear of any back give. You are sure. An anchor is as strong as its weakest part. Stombaugh Guy Anchors have no weak parts.

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Slow-Burning Weatherproof and Ideal Wire.

Prices and Samples on Application.

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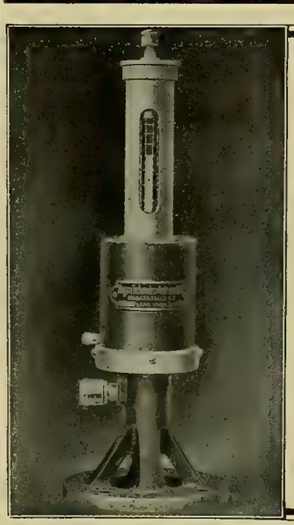

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The type "C" instrument shown is for direct connection to vertical shafts adapted to apparatus having high rotary speed where belt drive is not practical. We make instruments that will exactly meet your requirements. Write for catalogue.

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We offer you a strictly first class lamp at a reasonable price — **and that price is less than the "association price."**

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In the school of Electrical Experience, subjected to the most exhaustive competitive tests, the

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DRY BATTERY

passed muster with an average of 100 per cent as the BEST for ACTUAL SERVICE.

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Give us a chance to DEMONSTRATE that claim and we'll add YOU to the big list of our regulars who have found to their advantage that there IS a difference in Dry Cells.

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½	900	Westinghouse, 45 K.W., single phase.
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125 TO 133 CYCLES

Lights		
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1	3000	Stanley, inductor type 150 K.W., two-phase.

We are now located in our new shops, the largest Repair Shops in this country. Send for our Monthly Bargain Sheet showing complete stock with net prices.

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ELECTRICAL AND STEAM MACHINERY, GUARANTEED, and at a PRICE considerably lower than for the same apparatus purchased from the manufacturers.

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25-cycle, 60-cycle, 133-cycle, single-phase, 2-phase and 3-phase of various sizes and makes. Write for prices. Let us know your needs and we will quote you low prices.

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Something Electrical for Everybody

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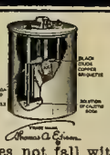

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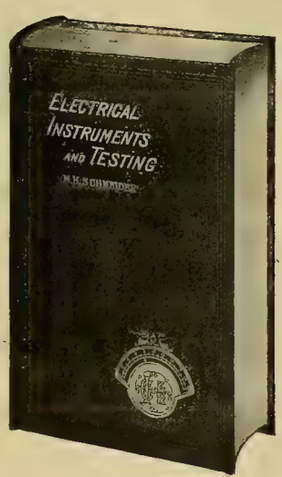

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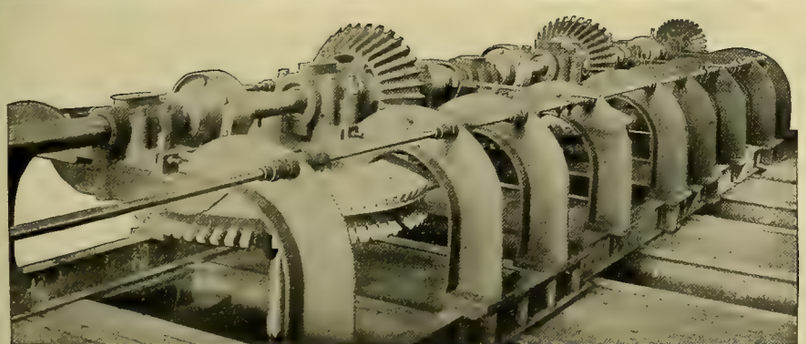

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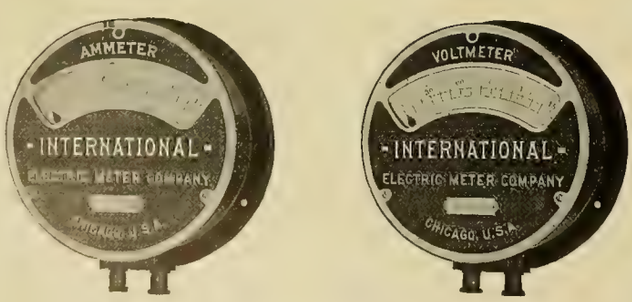

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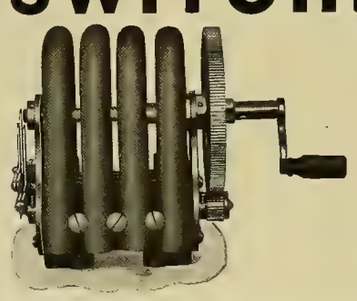

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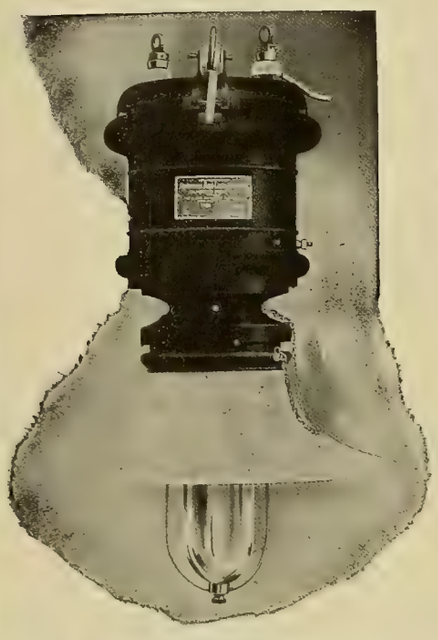

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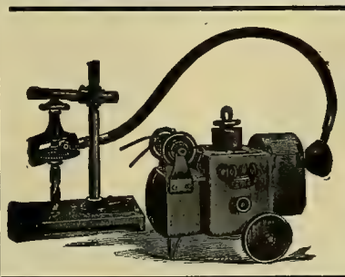

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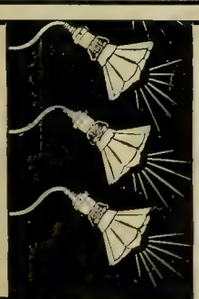

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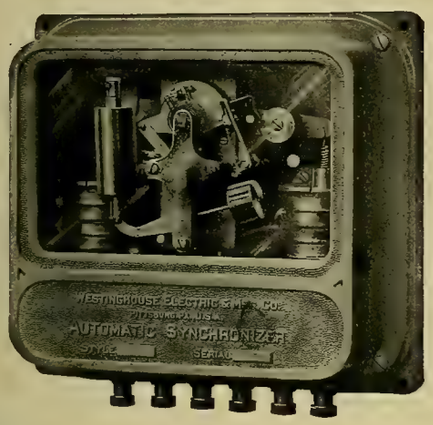

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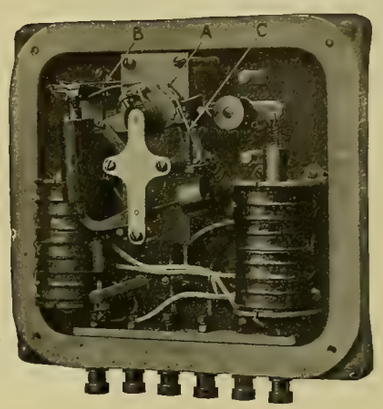

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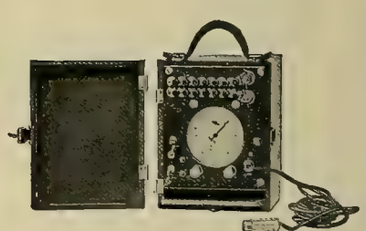

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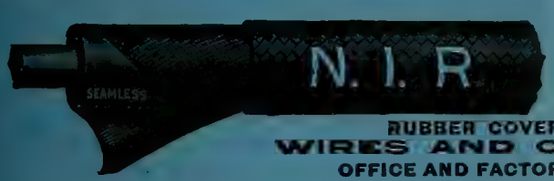

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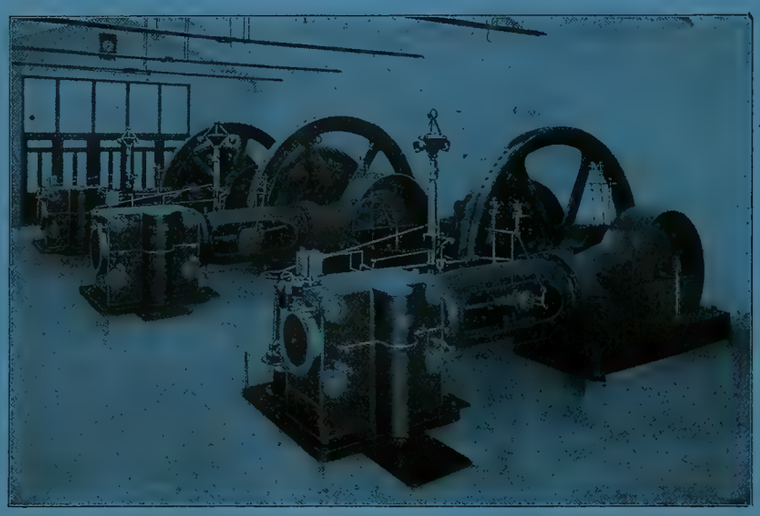

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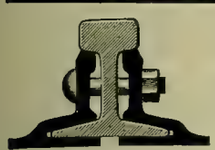

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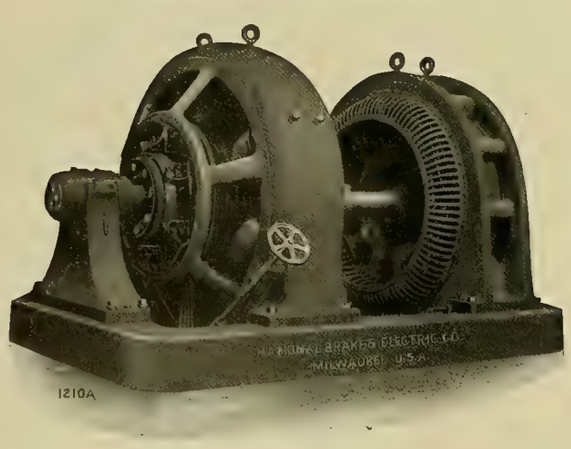

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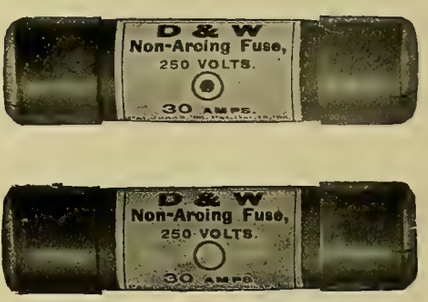

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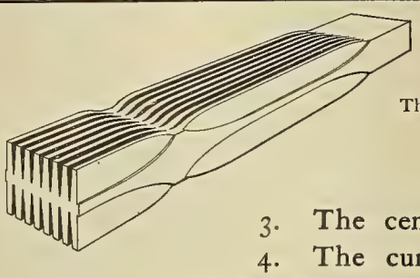

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Manhattan Elec. Supply Co
Rock Island Battery Co.
Wesco Supply Co.
Western Electric Co.

Bells, Buzzers, Etc.
Central Electric Co.
Manhattan Elec. Supply Co.
Ostrander & Co., W. R.
Wesco Supply Co.
Western Electric Co.

Belt Dressing.
Dixon Crucible Co., Jos.
Leather Preserver Mfg. Corp.

Belting.
Leather Preserver Mfg. Corp.

Boiler Compounds.
Dearborn Drug & Chem. Wks

Boilers.
Babcock & Wilcox Co.

Bolts, Expansion.
Star Expansion Bolt Co.

Bolts, Toggle.
Wrigley Co., Thos.

Books, Electrical.
Electrician Publishing Co
Hedenberg Pub. Co., W. L.
Spon & Chamberlain.

Boxes, Junction.
Bossert Elect. Const. Co

Boxes, Moulding.
Gleason, John L.

Brass, Sheet and Rod.
Plume & Atwood Mfg. Co

Brushes.
Central Electric Co.
Holmes Fibre Graphite Co.
Speer Carbon Co.
Western Electric Company.

Cable Clamps.
Matthews & Bros., W. N.

Cable Hangers.
Bissell Co., B. F.
Wesco Supply Co.
Western Electric Co.

Cabling Machinery.
Alton Machine Co.

Cables (See Wires and Cables)

Carbons, Points and Plates.
Central Electric Co.
Chicago Edison Co.
National Carbon Co.
Reisinger, Hugo.
Speer Carbon Co.
Wesco Supply Co.

Castings.
Alton Machine Co.
National Brake & Elec. Co.

Chains.
Jeffrey Mfg. Co.
Plume & Atwood Mfg. Co.

Chains, Galvanized.
Oneida Community, Ltd.

Circuit Breakers.
Cutler-Hammer Mfg. Co.
Cutter Elec. & Mfg. Co.
Ft. Wayne Elec. Wks. Inc.
Wesco Supply Co.
Western Electric Company.
Westinghouse El. & Mfg. Co.

Clamps, Cable.
Cook, Frank B.
Matthews & Bros., W. N.

Cleats.
Blake Signal & Mfg. Co.

Clusters.
Benjamin Elec. Mfg. Co.
Plume & Atwood Mfg. Co.

Coal and Ashes Handling Machinery.
Jeffrey Mfg. Co.

Coal Mining Machinery.
Allis-Chalmers Company.

Coils and Magnets.
Acme Wire Co.
Western Electric Co.

Commutator Compound.
Crolius & Son, E. R.
McLennan & Co., K.

Compound, Insulating and Splicing.
Anti Volt Mfg. Co.
Massachusetts Chemical Co.

Condensers, Electric.
Stanley—G. I. Elec. Mfg. Co.

Conduits.
American Circular Loom Co.
American Conduit Company.
Central Electric Co.
Crouse Hinds Co.
Fibre Conduit Co., The
Gest, G. M.
McRoy Clay Works.
Nat'l Metal Molding Co.
Wesco Supply Co.

Conduit Rods.
Cope, T. J.

Contractor, Electric Subway.
Gest, G. M.

Contractors and Electric Light Plants.
Allis-Chalmers Company.
Crocker-Wheeler Co.
Ft. Wayne Elec. Wks., Inc.
General Electric Co.
National Brake & Elec. Co.
Northern Electrical Mfg. Co.
Wagner Electric Mfg. Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.

Controllers.
Cutler-Hammer Mfg. Co.
Schureman Co., J. L.

Cord.
Ajax Line Material Co.
Belden Mfg. Co.
Runzel-Lenz Elec. Mfg. Co.
Samson Cordage Wks.

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Berthold & Jennings.
Central Electric Co.
Lindsley Bros. Co., The
Maine Hub Mfg. Co.
Manhattan Elec. Supply Co.
Wesco Supply Co.
Western Electric Company.

Cut-Outs and Switches.
Bissell Co., The F.
Bossert Elec. Const. Co.
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Chicago Edison Co.
Crouse-Hinds Co.
Cutter Elec. & Mfg. Co.
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Sorensen, P.
Switchboard Equipment Co.
Wesco Supply Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.

Dies.
Multi-Vending Co.

Drills, Electric.
Chicago Pneumatic Tool Co.

Drying Machinery.
Alton Machine Co.
Devine Co., Joseph P.

Dynamos and Motors.
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Bissell Co., The F.
Central Electric Co.
Century Electric Co.
Crocker-Wheeler Co.
Ft. Wayne Elec. Wks. Inc.
General Elec. Co.
Gregory Electric Co.
National Brake & Elec. Co.
Northern Electrical Mfg. Co.
Robbins & Myers Co.
Stanley—G. I. Elec. Mfg. Co.
Stow Manufacturing Co.
Wagner Electric Mfg. Co.
Wesco Supply Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.

Electric Heating Appl.
Prometheus Elec. Co., The
Simplex Elec. Heating Co.
Vanderman Plbg. & Htg. Co.
Western Electric Co.

Electric Railways.
Allis-Chalmers Co.
General Electric Co.
Westinghouse El. & Mfg. Co.

Electrical and Mechanical Engineers.
Arnold Co., The.
Badt, F. B.
Baker & Co., W. E.
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Wesco Supply Co.
Western Electric Co.
Westinghouse El. & Mfg. Co
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Whitney Elec. Inst. Co.

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Acme Wire Co.

Electro-Plating Mach'y
Crocker-Wheeler Co.
General Electric Co.

Elevators—Conveyors.
Jeffrey Mfg. Co.

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Star Expansion Bolt Co.

Engines, Gas, Gasoline and Oil.
Allis-Chalmers Company.
American Diesel Engine Co.
Otto Gas Engine Works.
Westinghouse Machine Co.

Engines, Steam.
Allis-Chalmers Company.
Buckeye Engine Co.
Westinghouse Machine Co.

Fans and Fan Motors.
Central Electric Co.
Century Electric Co.
Crocker-Wheeler Co.
Edison Mfg. Co.
General Electric Co.
Robbins & Myers Co.
Wesco Supply Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.

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Kartavert Mfg. Co.
Vulcanized Fibre Co.

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Acme Wire Co.

Fittings.
Plume & Atwood Mfg. Co.

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Eureka Exten. Fixture Co.
Morse, Frank W.

Fixtures, Gas and Elec.
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Bissell Co., The F.
Haller Machine Co.
Reynolds El. Flasher Mfg. Co.
Wesco Supply Co.

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Stow Mfg. Co.

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Chicago Fuse Wire & Mfg. Co.
D. & W. Fuse Company.
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Wesco Supply Co.
Western Electric Company.

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Holophane Glass Co.
Phenix Glass Co.
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Western Electric Co.

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Allis-Chalmers Co.
Ludlow Valve Co.

Graphite Specialties.
Dixon Crucible Co., Jos.
Holmes Fibre-Graphite Co.

Heating (Exhaust Steam).
Amer. District Steam Co.

Holders, Inc. Lamps.
Morse, Frank W.

Hydraulic Machinery.
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Allis-Chalmers Company.

Indicators.
Robertson & Sons, Jas. L.

Induction Coils.
Acme Wire Co.

Inspection & Insurance
Hartford Steam Boiler Inspection & Insurance Co.

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Alton Machine Co.

Insulators and Insulating Materials
American Electrical Works.
Central Electric Co.
Chicago Edison Co.
Indiana Rub. & Ins. Wire Co.
Kartavert Mfg. Co.
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Mica Insulator Co.
Munsell & Co., Eugene.
National India Rubber Co.
New York Insulated Wire Co
Okonite Co., The.
Phillips Insulated Wire Co
Simplex Electrical Co.
Standard Underground C. Co.
Vulcanized Fibre Co.
Wesco Supply Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.

Joints, Wire.
Cook, Frank B.

Lamps, Arc.
American Arc Lamp Co.
Bissell Co., The F.
Central Electric Co.
Ft. Wayne Elec. Wks. Inc.
General Electric Co.
Gregory Electric Co.
Manhattan Elec. Supply Co.
Stanley—G. I. Elec. Mfg. Co.
Wesco Supply Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.

Lamp Guards.
Benjamin Elec. Mfg. Co.
Matthews & Bros., W. N.
Morse, Frank W.

Lamps, Incandescent.
Bissell Co., The F.
Boston Incan. Lamp Co., The
Buckeye Electric Company.
Central Electric Co.
Chicago Edison Co.
Columbia Incan. Lamp Co.
Edison Decorative & Miniature Lamp Dept.
General Electric Co.
McCandless, H. W
Monarch Elec. Mfg. Co.
Novelty Incan. Lamp Co
Sawyer-Man Elec. Co.
Shelby Electric Co., The
St. Marys Incand. Lamp Co.
Standard Elect'l. Mfg. Co.
Wesco Supply Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.

Lamps, Incandescent—Replacers & Cleaners.
Morse, Frank W

Letters, Sign.
Haller Machine Co.
Matthews & Bros. W. N.

Lightning Arresters.
Central Electric Co.
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Manhattan Elec. Supply Co.
Stanley—G. I. Elec. Mfg. Co.
Wesco Supply Co.
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Ajax Line Material Co.

Linemen's Climbers.
Klein & Sons, Mathias.

Machine Construction.
Multi Vending Co.

Magnets, Autom. Wound
Acme Wire Co.

Magnet Wires.
(See Wires and Cables.)

Mica.
Chicago Mica Co.
Mica Insulator Co.
Munsell & Co., Eugene.

Mining Apparatus, Elec.
Allis-Chalmers Company.
Crocker-Wheeler Co.
General Electric Co.
Jeffrey Mfg. Co.
Wesco Supply Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.

Mining Machinery.
Allis-Chalmers Company.

Model and Machine Shop.
Hoffmann, Emil R.

Motors (See Dynamos and Motors)

Nippers and Pliers.
Klein & Sons, Mathias.

Novelty Construction.
Multi-Vending Co.

Paints, Insulating.
Massachusetts Chemical Co.

Patent Attorneys.
Bain, Foree & May.

Phosphor Bronze.
Phosphor Bronze Sm. Co. Ltd.
Seymour Mfg Co.

Pipe Bending Machines.
Chicago Pneumatic Tool Co.
Wrigley Co., Thos.

Platinum, Wire and Sheet.
Baker & Co. Inc.

Plumbing.
Vanderman Plbg. & Htg. Co.

Poles, Arc Lamp.
Mott Iron Works, J. L.

Pole Changers,
Sandwich Pole Changer Co.

Poles and Ties.
Berthold & Jennings.
Bissell Co., F. The
Bruer, Will F.
Fowler & Co., John H.
Kellogg Switch. & Sup. Co.
Lindsley Bros. Co., The
Loud's Sons Co., H. M.
Moss Tie Co.
Mueller Company, William.
Pacific Coast Pole Co.
Perrizo & Sons.
Porter Cedar Company.
Sterling & Son, W. C.
Torrey Cedar Co.
Valentine-Clark Co., The
Western Lumber & Pole Co.
Worcester Co., C. H.

Polish (Metal).
Hoffman, Geo W.

Porcelain, Specialties.
Artistic Porcelain Co.

Portables.
Plume & Atwood Mfg. Co.

Power Transmission Machinery.
Allis-Chalmers Company.
Jeffrey Mfg. Co.

Rail Joints.
Rail Joint Company, The

Re-Winding—Repairs.
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Gregory Electric Co.

Rheostats.
Cutler-Hammer Mfg. Co.
General Electric Co.
Wesco Supply Co.
Western Electric Co.
Westinghouse El. & Mfg. Co

Rosettes.
Pass & Seymour.

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Alton Machine Co.

Schools and Colleges.
Highland Park College.
Michigan College of Mines

Second-Hand Machin'y.
Bissell Co., The F.
Gregory Electric Co.
Rossiter, MacGovern & Co.

Shade Holders.
Jem Shade Holder Co., The

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Haller Machine Co.

Sleeving, Braided.
Belden Mfg. Co.

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Belden Mfg. Co.

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Crolius & Son, E. R.
Western Electric Co.

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Acme Wire Co.
Schureman Co., J. L.

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Acme Wire Co.

Speaking Tubes.
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Manhattan Elec. Supply Co.
Ostrander & Co., W. R.
Wesco Supply Co.
Western Electric Co.

Specialties, Electrical Mfrs. and Designers.
Haller Machine Co.

Speed Indicators.
Niagara Tachometer & Instrument Co.
Weston Electrical Inst. Co.

Speed Recorders.
Niagara Tachometer & Instrument Co.

Springs.
Manross, F. N.

Staples.
Blake Signal & Mfg. Co.

Steel Gains.
Steel Gain Mfg. Co.

Stokers.
Westinghouse Machine Co.

Storage Batteries.
American Battery Co.
Chicago Pneumatic Tool Co
Electric Storage Battery Co.
General Storage Battery Co.
Gould Storage Battery Co.
Hensel & Co., John A.
National Battery Co.
Willard Storage Bat. Co.

Supplies, General Elec.
Bissell Co., The F.
Central Electric Co.
Century Electric Co.
Chicago Edison Co.
Manhattan Elect'l Supply Co
Wesco Supply Co.
Western Electric Co.

Switches.
(See Cut-outs and Switches.)

Tachometers and Tachographs.
Niagara Tachometer and Instrument Co.

Tapes,
Massachusetts Chemical Co.

Telephones, Telephone Material and Switchboards.
American El. Telephone Co
Automatic Electric Co.
Bissell Co., The F.
Central Electric Co.
Cook, Frank B.
International Tel. Mfg. Co.
Kellogg Switchb. & Sup. Co.
Manhattan Elec. Supply Co.
North Electric Co.
Stromberg-Carlson Tel. M. Co.
Wesco Supply Co.
Western Electric Co.

Telephone Service.
Chicago Telephone Co

Time Switches.
Bissell Co., The F.

Toggle Bolts.
(See Bolts, Toggle.)

Tools.
Klein & Sons, Mathias.

Tools, Pneumatic.
Chicago Pneumatic Tool Co.

Transformers.
Allis-Chalmers Company.
Central Electric Co.
Crocker-Wheeler Co.
Ft. Wayne Elec. Works, Inc.
General Electric Co.
Kuhlman Electric Co.
La Fayette Elect'l. Mfg. Co.
National Brake & Elec. Co.
Stanley—G. I. Elec. Mfg. Co.
Wagner Electric Mfg. Co.
Wesco Supply Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.

Trucks, Electric Car.
General Electric Co.
Westinghouse El. & Mfg. Co.

Turbines, Steam.
Allis-Chalmers Co.
General Electric Co.
Westinghouse Machine Co.

Turbine Water Wheels.
Allis-Chalmers Co.
Leffel & Co., Jas.

Vacuum Drying.
Devine Co., Joseph P.

Varnishes, Insulating.
Massachusetts Chemical Co.

Vulcanized Fibre.
Vulcanized Fibre Co.

Wattmeters.
Duncan Elec. Mfg. Co.
Wesco Supply Co.

Wire Rope Machinery.
Alton Machine Co.

Wires and Cables—Magnet Wires.
Acme Wire Co.
American Electrical Works.
Belden Mfg. Co.
Bissell Co., The F.
Central Electric Co.
Chicago Ins. Wire & Mfg. Co.
Crescent Ins. Wire & Cble. Co.
Driver-Harris Wire Co.
General Electric Co.
Hazard Manufacturing Co.
Indiana Rub. & Ins. Wire Co
India Rubber & Gutta Percha Insulating Co.
Kellogg Switch. & Sup. Co.
Manhattan Elec. Supply Co.
Marion Ins. Wire & Rub. Co.
National India Rubber Co
New York Insulated Wire Co.
Okonite Co., The.
Phillips, Eugene F.
Phillips Insulated Wire Co
Roebling's Sons Co., J. A.
Runzel-Lenz Elec. Mfg. Co.
Safety Ins. Wire & Cable C
Simplex Electrical Co.
Standard Underground Cable Co,
Wesco Supply Co.
Western Electric Company.

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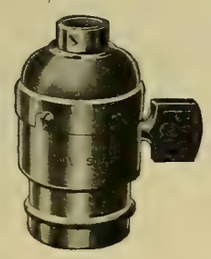

In P and S Sockets there is positive action of cam on make and break

You'll recognize that as a strong feature

Also, P and S have a large knot space in cap

This insures both an easy and firm connection

P and S have no weak points

Not one

They're Permanent and Substantial — Perfect and Sure

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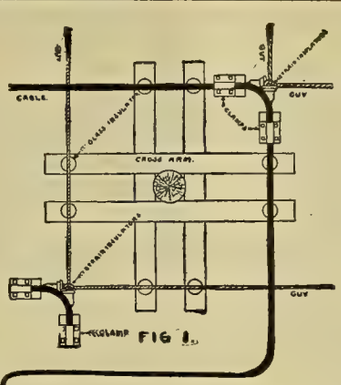
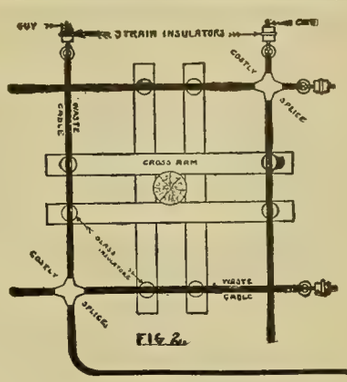




KEARNEY CABLE CLAMPS

Fig. 1 shows a bird's-eye view of a corner pole with two 600,000 C. M. cables turning a right angle with the aid of four Kearney Cable Clamps.

Fig. 2 shows the same conditions with the aid of spliced joints. Let us compare the two pieces of work.

The work on Fig. 1 can be done by two line men in 30 to 40 minutes without the services of a ground man. No cable is cut. No solder or blow-torches are used. All that is necessary is to clean off four inches of insulation for each clamp, and clamp them to the bare surface of the wire. There is no waste cable.

The work on Fig. 2 can be done by two line men, and a ground man to tend the blow-torches and keep the solder hot, in not less than two hours, maybe more. They must cut the cable in four places (maybe some saw blades will be broken doing this). From 10 to 12 feet of cable will be wasted at each splice (maybe more). Figure up this cost on 20 feet of 600,000 C. M. Cable. Then there is the solder and the extra tape and gasoline needed. (Think of the danger of gasoline, not only to the men but to property.) A splice creates line loss, and is never as good as the solid wire.

Kearney Cable Clamps are much cheaper, more durable, stronger, save time, labor and material. Increase value of scrap cable. 25 or more will be shipped on 30 days' trial, freight prepaid. Ship them back if unsatisfactory. Pay for them otherwise.

W. N. MATTHEWS & BRO., Manufacturers, 203 N. 2d St., St. Louis, Mo.

Also Manufacturers of
Stombaugh Guy Anchors
O-K Steel Cutters
Hold Fast Lamp Guards
Hargis Splicing Joints
Callahan Cable Rollers
ALL PATENTED

International Voltmeters and Ammeters ARE BEST

Write for reasons and prices

International Electric Meter Co.

330 W. Randolph St.

CHICAGO

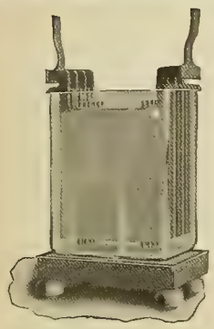
WILLARD STORAGE BATTERIES

FOR ALL PURPOSES

Manufactured by

THE WILLARD STORAGE BATTERY CO.

CLEVELAND, OHIO



Storage Batteries

for Central Stations, Electric Railways, Isolated Lighting, Power Stations, Signal Service, Train Lighting, Telephone and Telegraph.

Write for estimates and information on the reliable **"Unit Accumulators."**

National Battery Company

ELECTRIC STORAGE BATTERIES

NEW YORK, 1606 Broadway BUFFALO, N. Y. CHICAGO, 450 Old Colony Bldg.
SAN FRANCISCO, 623 Sansome Street

When a man's electrical ideas flow freely; when he discusses electrical subjects intelligently and glibly, you will be pretty safe in assuming that he keeps in touch with electrical progress by perusing the Western Electrician 52 times a year.

"AMERICAN" STORAGE CELLS

ARE THE BEST. Send for descriptive Circular.

AMERICAN BATTERY CO.,

ESTD 1888. 171 S. Clinton St., Chicago.

"THE STANDARD"

MOTORS-DYNAMOS-FANS

ARE WELL MADE AND YOU'LL LIKE THEM FOR ALL DIRECT CURRENT CIRCUITS

THE ROBBINS & MYERS CO.

SPRINGFIELD, OHIO.

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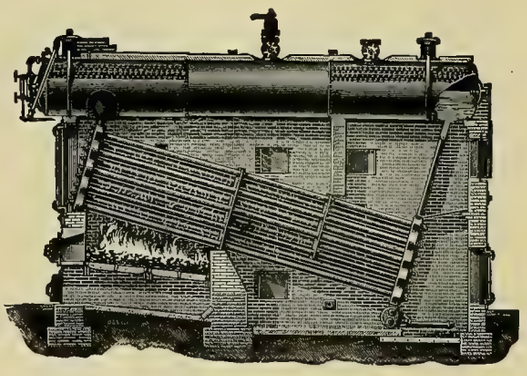
SAN FRANCISCO, 63 FIRST STREET.
PITTSBURG, 1218 FRICK BUILDING.
NEW ORLEANS, 339 CARONDELET STREET.
CHICAGO, 1215 MARQUETTE BLDG.
ATLANTA, EMPIRE BLDG.
CLEVELAND, 706 NEW ENGLAND BLDG.
MEXICO CITY, 7 AVENIDA JUAREZ.
HAVANA, CUBA, 116 1-2 CALLE DE LA HABANA



200 Pounds Working Pressure

WATER TUBE STEAM BOILERS

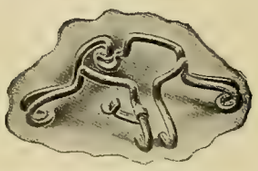
STEAM SUPERHEATERS

Our Book, STEAM, mailed free on application.

FITTED WITH JEM SHADE HOLDER

JEM SHADE HOLDERS

Applied in a second
Self-centering
Four points of support
No loosening from shock

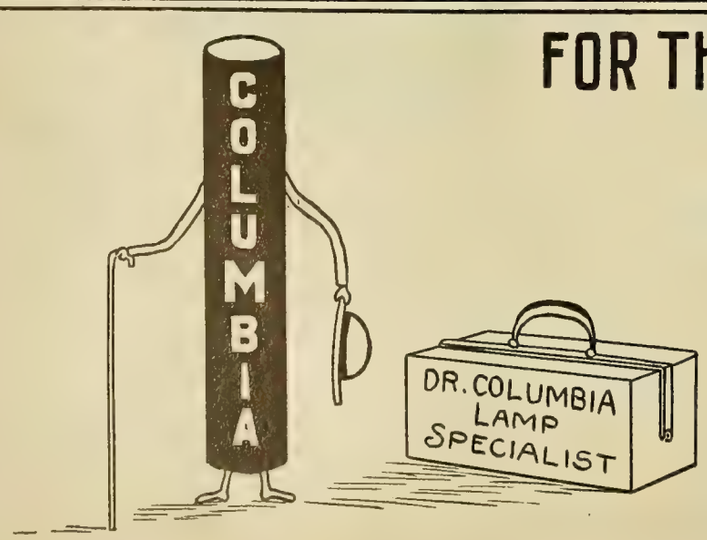


Rigid at any angle
No screws to lose
No tools required
Simple, Strong, Secure

(SEND FOR SAMPLES; 1⅝ in., 2¼ in., 3¼ in).

JEM SHADE HOLDER CO., 13 East 30th St., New York City.

FITTED WITH ANY OTHER SHADE HOLDER



FOR THOSE SICK LOOKING ARC LAMPS

Whose Inner Globes are covered with a BLACK DEPOSIT due to poor Carbons we would advise you to try

COLUMBIA

You will note an IMMEDIATE improvement.

NATIONAL CARBON COMPANY
CLEVELAND, O.

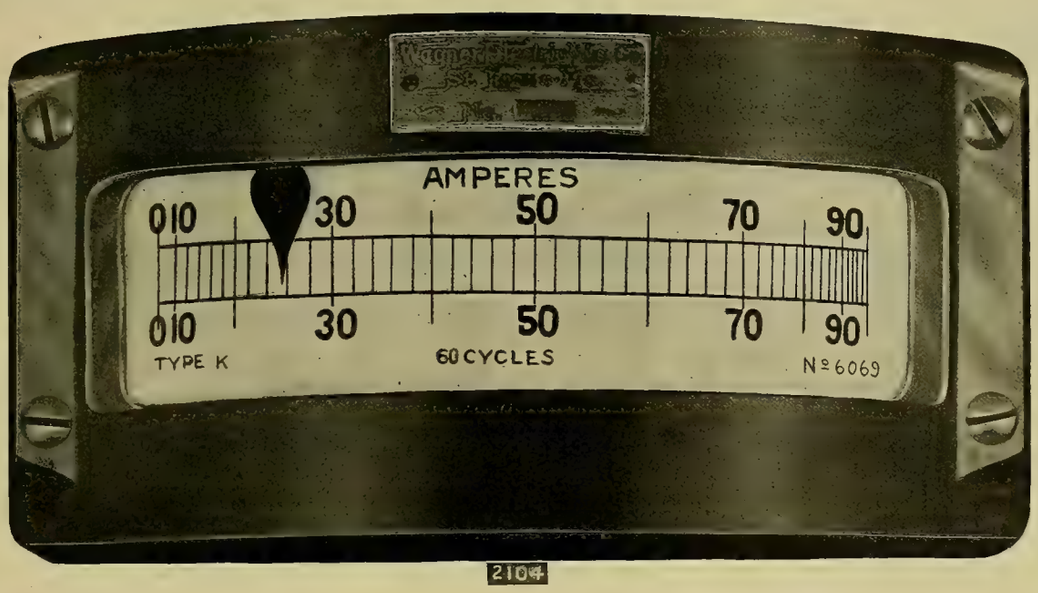
COLUMBIA CARBON PRODUCTS

Wagner Electric Mfg. Company

Main office and Factory, St. Louis, U. S. A.

Switchboard Instruments

OF PRECISION



TYPES

Horizontal Edgewise
Flush or Back of Board Mounting
Vertical Edgewise
Illuminated
Non-Illuminated
Fan Shape
Large and Small Round Type

Our line of Switchboard Instruments is complete. They fill in every respect the requirements of the most exacting engineers.

Switchboard builders will find these Instruments handsome in appearance, absolutely accurate. We are carrying a large stock of standard Instruments ready for immediate shipment.

Every Contractor should have a copy of our Bulletin 67-D

GREAT FORTUNES

FROM LITTLE SAVINGS GROW

SHELBY LAMPS

Are Current Savers and Current Saved is Money Saved

$1.10 saved on one lamp, burned for 1000 hours, doesn't seem to be much money, but did you ever stop to consider what this means on a circuit of a great number of lamps in the course of a year?

The saving on lamps alone may mean the difference between *profit* and *loss*.

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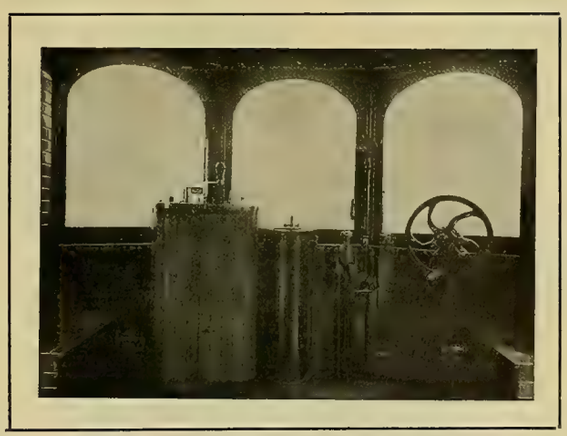

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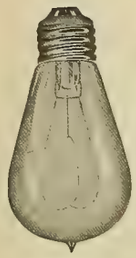

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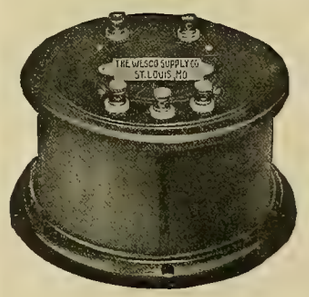

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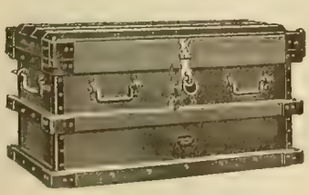

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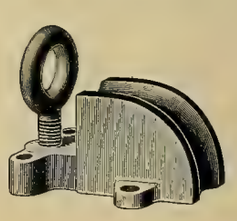

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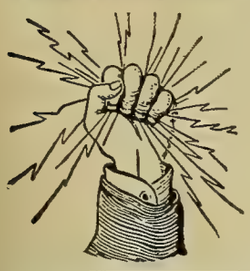

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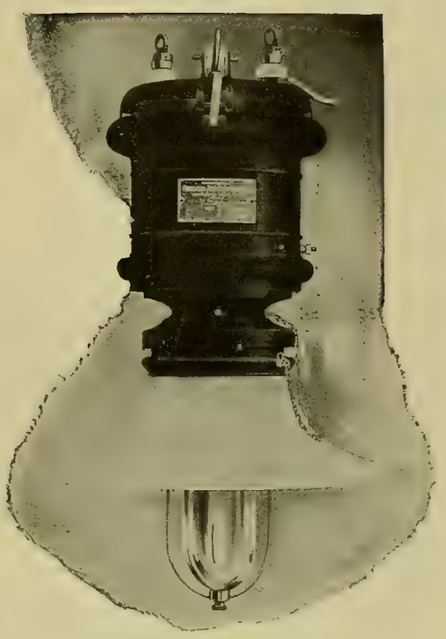

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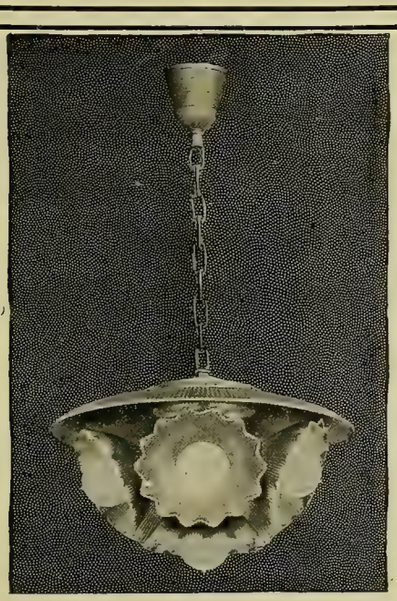

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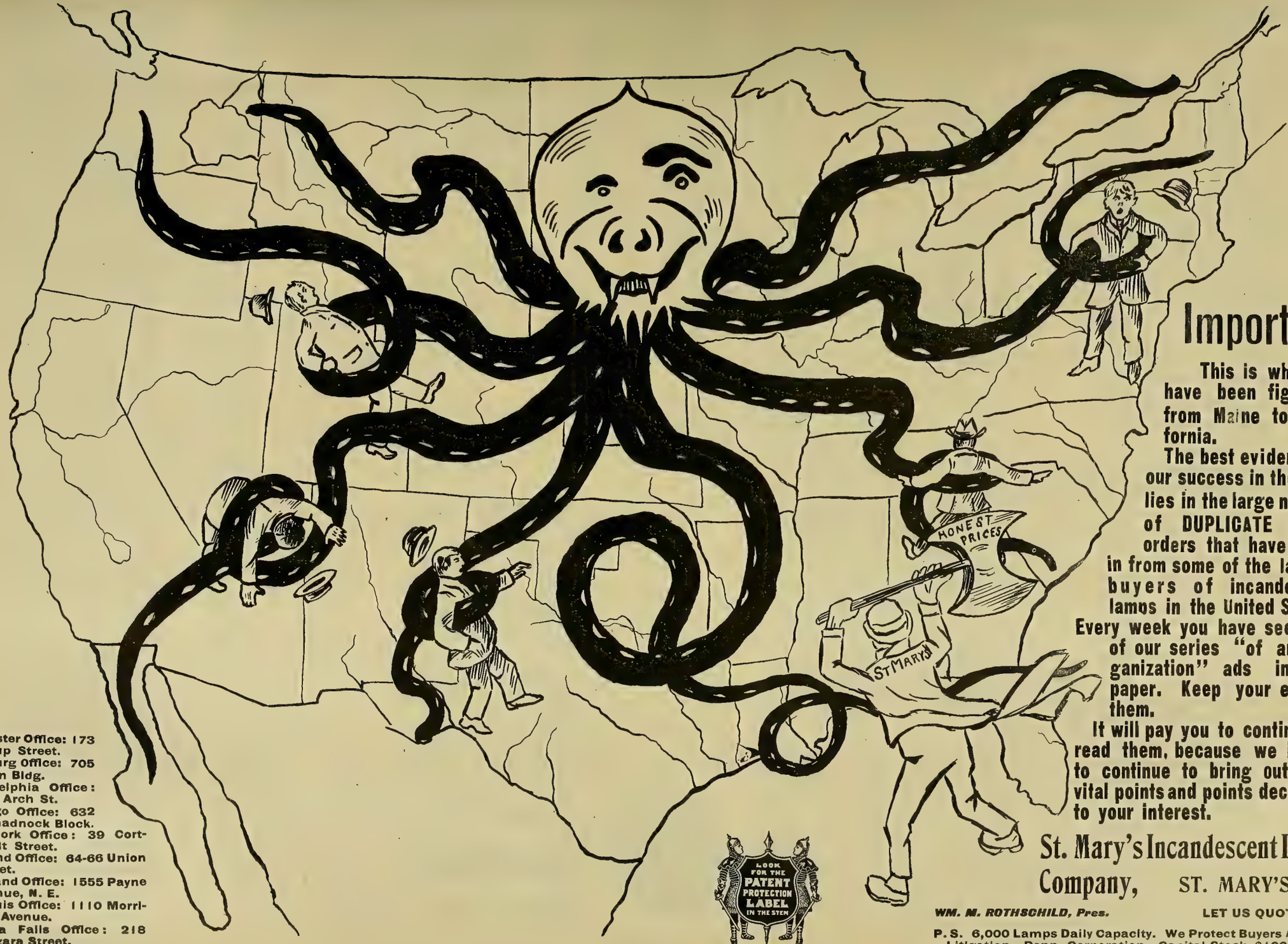

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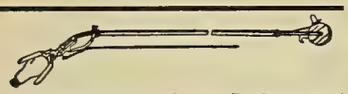

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Drawn steel. One blow of a hammer gives clean round hole. No filing.
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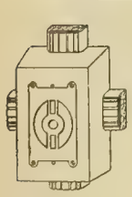

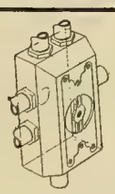

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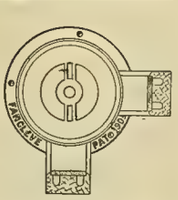

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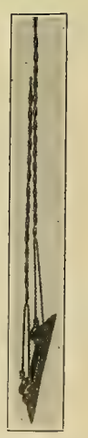

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The Holden Guy-Anchor
NONE BETTER
The rods are of one piece
No welds nor threads to weaken them
Greatest surface in ground
A 15-inch Anchor squares up in a 6-inch hole, over 55 square inches in solid earth
MOST INEXPENSIVE AND BEST ANCHOR MADE
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THE HOLDEN ANCHOR CO.
Manufacturers
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Chicago Insulated Wire & Mfg. Co.
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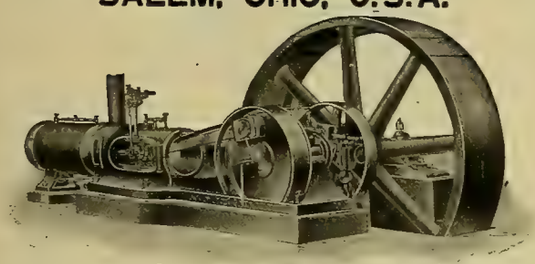

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ORIGINAL AND SOLE MAKERS IN THE U.S.

1866 1906

HARTFORD STEAM BOILER INSPECTION & INSURANCE COMPANY

39th ANNUAL STATEMENT

JANUARY 1, 1906

CAPITAL	$ 500,000.00
SURPLUS	1,261,459.69
RESERVES	1,926,686.81
ASSETS	3,688,146.50

The **Hartford** is the only company which makes a specialty of, and does exclusively, a steam boiler inspection and insurance business.

The **Hartford** is the only company whose entire talent and energies are applied to the study of steam, to the scientific construction and installation of boilers, and to their periodical inspection by expert mechanics.

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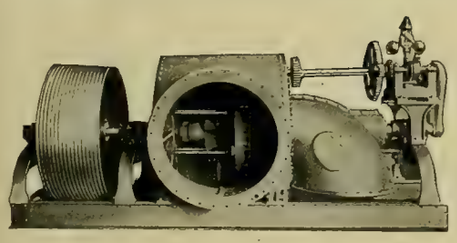

SAMSON TURBINE

We show below record of tests of a 45-inch **Samson Turbine** installed in the official testing flume at Holyoke. This turbine was built from the same patterns as those we sell to our customers.

Gateage.	Head.	R. P. M.	Cu. Ft. per Sec.	H. P.	Efficiency
Full	15.00	144	173	241	82.03%
⅞	15.04	138	155	224	84.55%
¾	15.11	128	133	191	83.68%
⅝	15.88	131	113	163	80.25%

THE JAMES LEFFEL & CO., 307 Lagonda Street, SPRINGFIELD, OHIO, U. S. A.

There are a THOUSAND THINGS in conduit work that can be done CHEAPER and BETTER with

CONDULETS

than you are now doing them.

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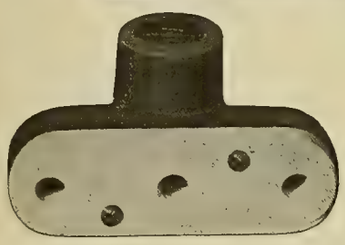
Condulet
2-Wire Cover



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COVERS INTERCHANGEABLE

Wires come out as you want them to come out—straight to the cleat, motor, meter or anything else that you wish to run to.

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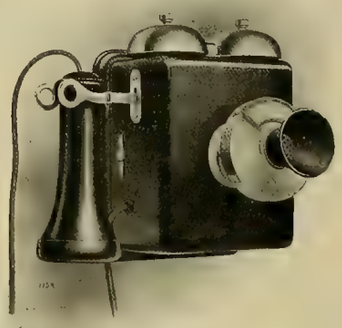

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Results are what Count

Everybody connected in any way with a telephone exchange—subscribers, management, and stockholders—demands results.

The subscribers demand results in the shape of good service; the management demands results in the shape of good service and economy of operation and maintenance; the stockholders demand results in the shape of profits, regular and substantial dividends and stable stock values.

The Automatic is producing results that satisfy everybody. The telephone equipment that will satisfy everybody is the kind you want.

Our Automatic system has been adopted in the following cities:

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Columbus, Ga.
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Dayton, Ohio.
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Grand Rapids, Mich.
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Havana, Cuba.
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Hopkinsville, Ky.
Jonesboro, Ark.
Lake Benton, Minn.
Lewiston, Me.
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Los Angeles, Cal.
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We make a large variety of these small switchboards for use in Factories, Department stores, Hotels, Apartment buildings, Hospitals, Railroad offices, and all similar places where good service is required.

Our "Bulletin No. 11-F" gives a complete description of all our cabinets of this class.

Do not delay. Write today for our bulletins and estimates.

THE BEST IS THE CHEAPEST

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No. 2210 Cabinet

Capacity for 320 Common Battery lines and 10 Common Battery cords (minor relays), 5 Common Battery Trunks (major relays), 1 operator's telephone set complete, 1 battery switch.

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Reduced Telephone Rates
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Next additional 50 calls in the month	5 cents each
Third 50 calls in the month : :	4 cents each
All calls in the month beyond 150 :	3 cents each

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Single line : : : :	$75.00 per annum
Two-party line : : :	60.00 per annum

NICKEL SERVICE:

Direct line, 20 cents per day, including 4 calls
Direct line, 15 cents per day, including 2 calls
Two-party line, 15 cents per day, including 3 calls
Two-party line, 10 cents per day, including 1 call
Two-party line, residences only, 10 cents per day
Four-party line, residences only, 5 cents per day
Extension telephones : : : $1.00 per month

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THE FIBRE CONDUIT COMPANY
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Bulletin No. 63 T gives list of **C-W** *users.*

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ALTERNATING AND DIRECT CURRENT MACHINERY
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"Flexduct" the National Code Standard. It does not deteriorate, always usable to highest degree

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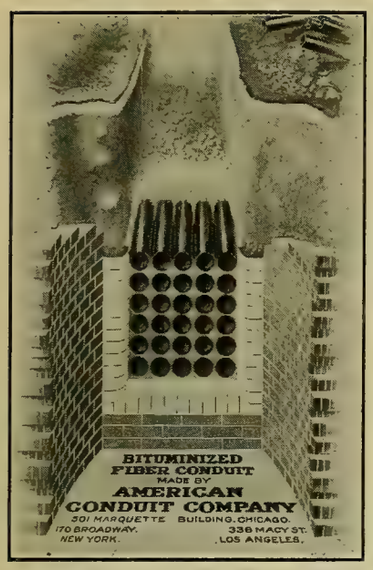

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for public buildings, hotels, etc
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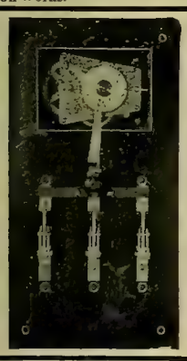

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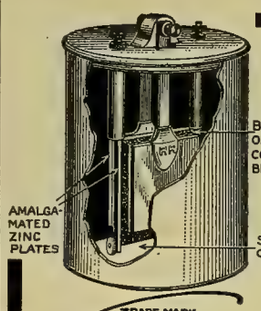

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A Good Sailor

The Edison Primary Battery is a good salt-water sailor, as appears by the following letter:

"In connection with your Batteries, and the perfect work thereof, I simply wish to say that we have used these batteries for four years on ships running to the far East (and it takes these steamers from six to seven months to complete a voyage), we find that when properly installed, according to your very simple directions, they will give a very much longer and better service than any batteries we have ever tried, or known.

"Thanking you for your prompt attention to our last order, we remain

Yours very truly,
The Rich Marine Fire Indc. System Co.
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Electric Cooking
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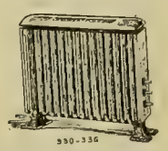

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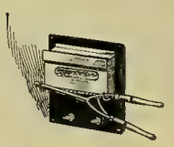

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Renewals are Cheap

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Manufacturers Of

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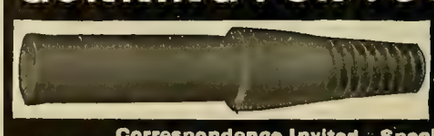

Hunters from all parts of the world are now in Maine gunning for large game, but we are here always and gunning for large orders --- and we are getting them. Strictly Winter-cut Black Birch Insulator Pins and Brackets go from where the hunters came. Give us your order and realize what promptness means.

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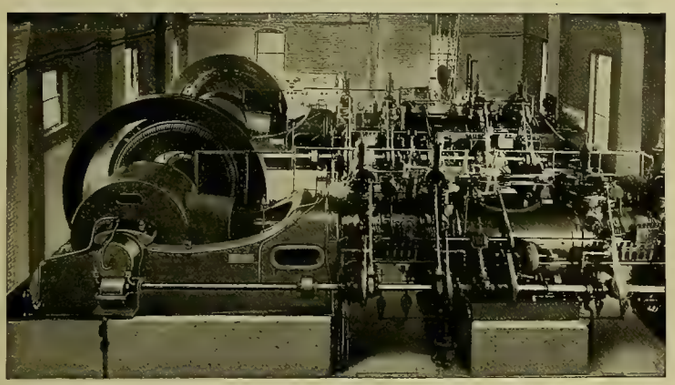

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Have demonstrated their efficiency and reliability under the most trying conditions.

Westinghouse Gas Engine Alternating Units operate in perfect parallel on the most fluctuating railway loads.

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Type "F" Indicating Switchboard
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"F"

You are using "Westinghouse" instruments, you can do no better.

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Type C Transformers

"Core Type"

40 and 50 K. W.
Single Phase

25 and 30 K. W.
Single Phase

7.5 to 20 K. W.
Single Phase

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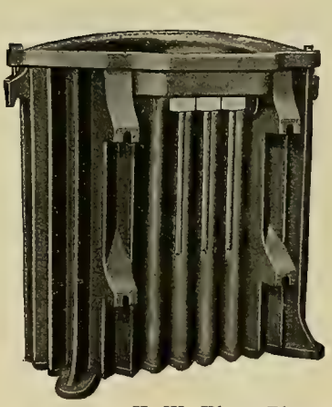
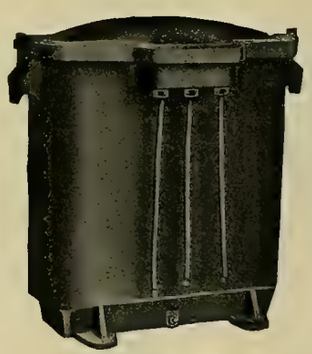
40 and 50 K. W.
Three Phase



30 K. W. Three Phase



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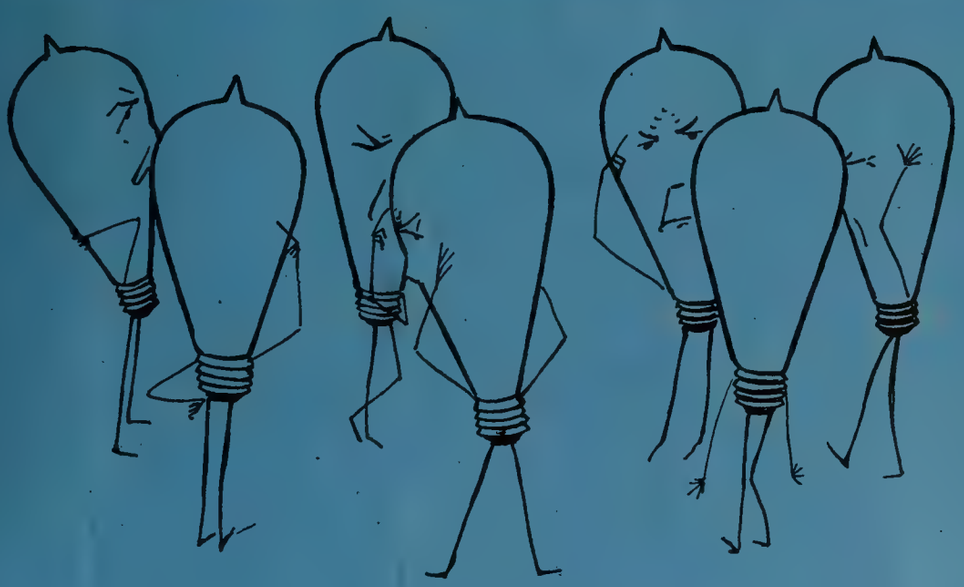
489

You Can Think, and Think, and Think



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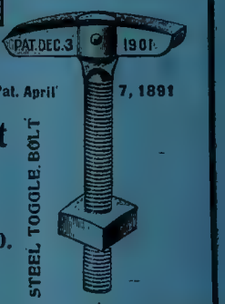

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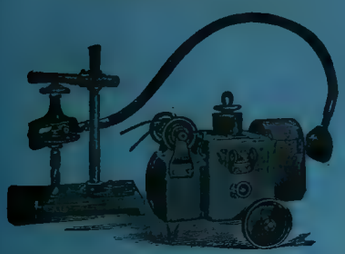

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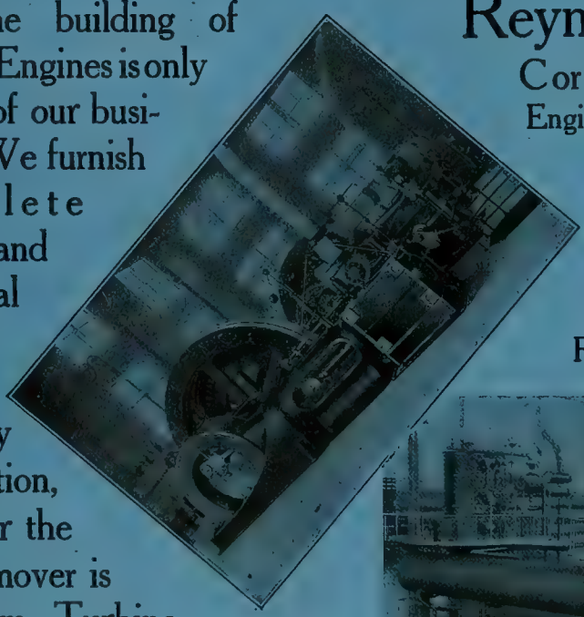

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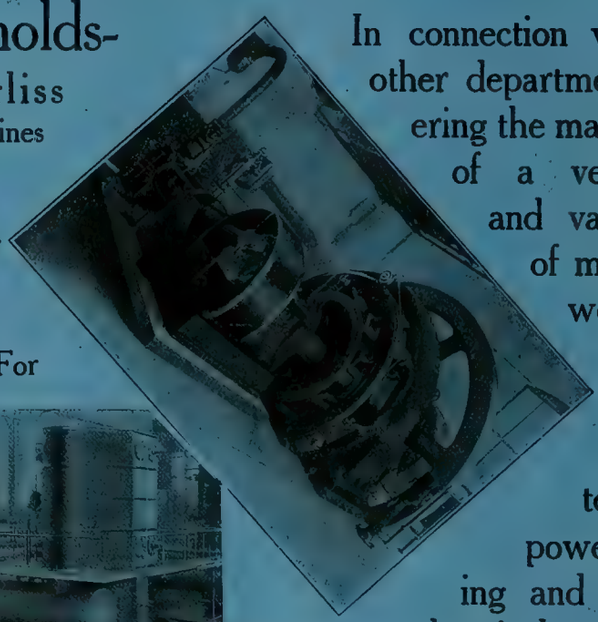

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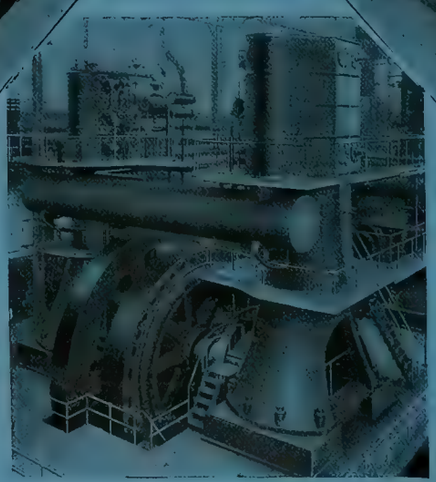

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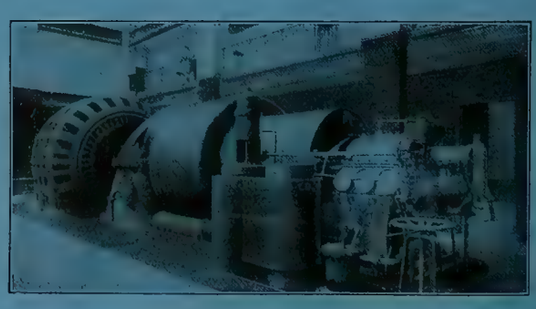

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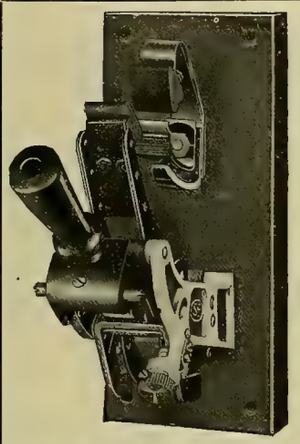

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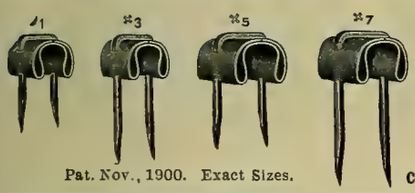

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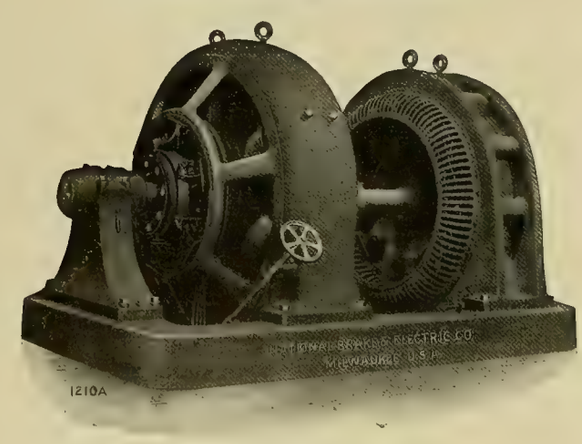
National Motor Generator Sets

Built in all capacities



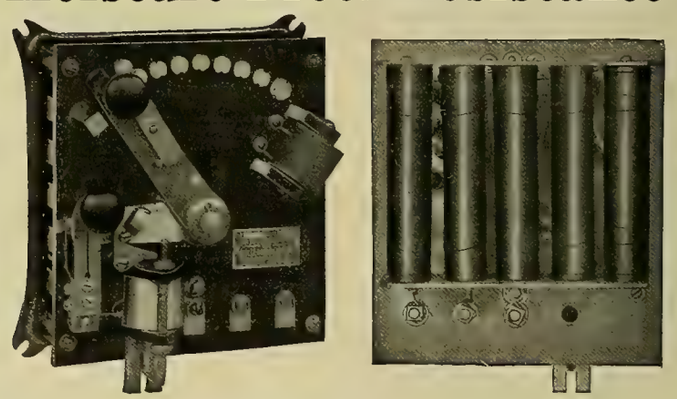
500 Kw. Motor Generator Set

National Brake & Electric Co.

Milwaukee

General Sales Office
519 First National Bank Bldg., Chicago

Double Lever Starting Rheostats With Moisture Proof Resistance



C. & H. double lever rheostats are provided with automatic release and an interlocked circuit-breaker arm which fulfills the overload release function.

The circuit-breaker arm is independent of the starting arm and protects the motor from overload during the period of starting as well as when operating at full speed.

Where conditions demand the installation of a starter in a damp place the moisture-proof unit-type resistance will meet the most severe requirements.

The wire of each unit is wound on an insulating base and enclosed in a thin iron casing with a thin layer of insulating material between the casing and the resistance.

This construction gives positive moisture proofing and excellent heat radiating qualities.

The result is an enclosed resistance possessing time overload and intermittent overload capacity to a marked degree.

Bulletins 13 and 17 give prices.

The Cutler-Hammer Mfg. Co.

MILWAUKEE

NEW YORK BOSTON CHICAGO PITTSBURG

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STANDARD ELECTRICAL MFG. CO., NILES, O.

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INSULATING, CABLING, RUBBER AND HYDRAULIC MACHINERY.

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More Profits—Better Service

If Your System is Wired With

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when you begin using

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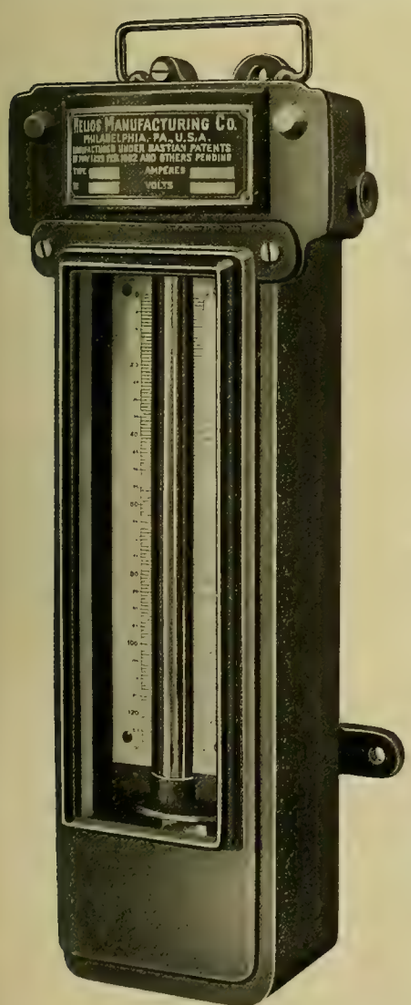

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Prices are for 110, 220 or 550 volts.

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Francis Raymond
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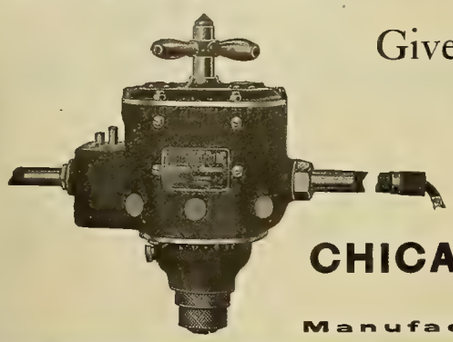

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UNION

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FUSES

BEST by TEST

Their operation is PERFECT and their superiority lies in the fact that they are absolutely safe and reliable

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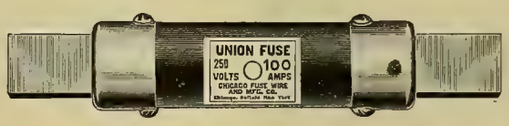

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For efficiency they are unequaled. Approved and listed by Underwriters National Electric Association.

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CHICAGO NEW YORK

Stanley-G.I.

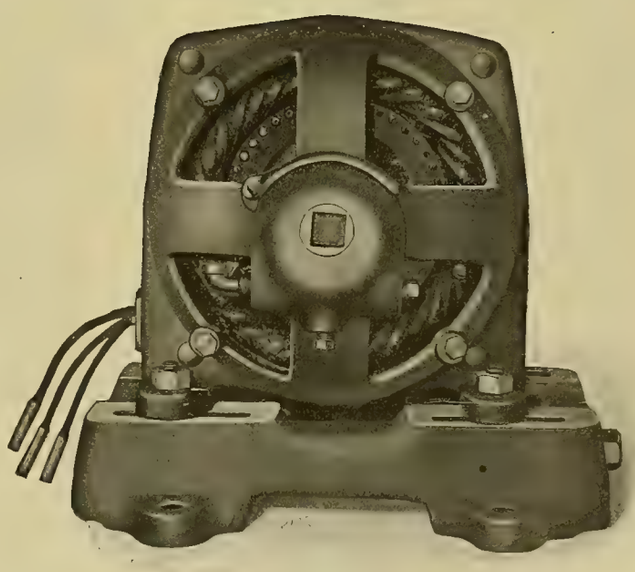
Great Reduction

in dimensions and weight of small polyphase induction motors has been effected by unique design and construction.

At the Same Time

efficiency, regulation, starting torque, heat radiation, rigidity of frame and mechanical construction throughout has been greatly improved in this type of motor.

Bulletin 149 gladly sent upon request.



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CLEVELAND, Citizens Building
DETROIT, Chamber of Commerce
INDIANAPOLIS, State Life Bldg.
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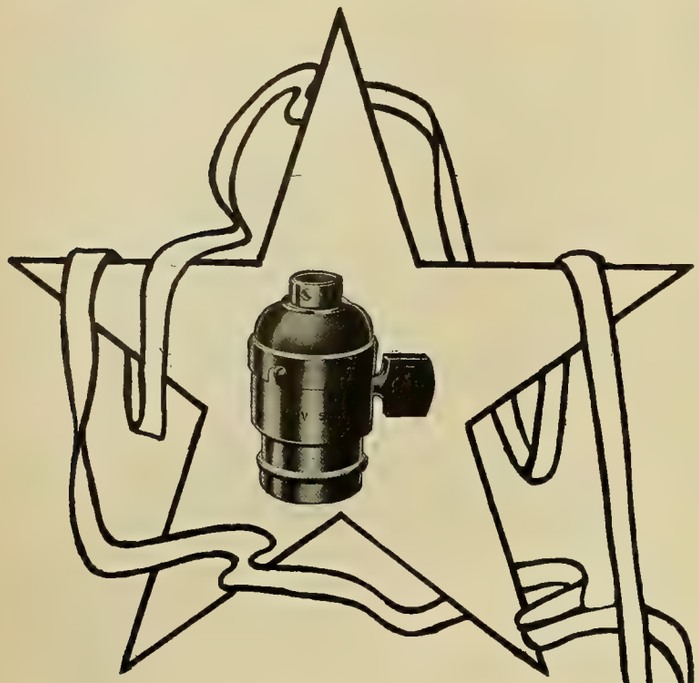

As a chain is as strong as its weakest link, so a socket's as strong as its weakest point.

Bear in mind: P & S has not one weak point.

See the point?

Pass & Seymour

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56 Boyd Ave., Solvay, N.Y., U.S.A.

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Habirshaw Red Core Wire Installed Throughout

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President and General Manager

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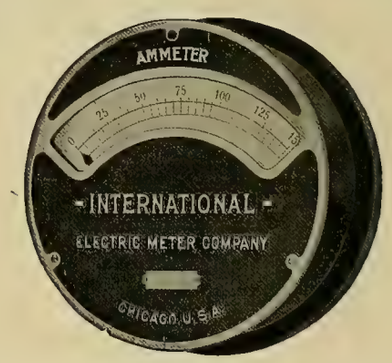
The Appearance of the Instrument Shown Below



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So thoroughly that should **VOLTMETER OR AMMETER** be mentioned in your presence, its impression will be the first to flash accross your "mind's eye" as representative of the **"BEST."**

Write for prices.

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WITHIN YOUR REACH

DO YOU WANT TO SAVE $1.10 ON EVERY LAMP YOU BURN FOR 1,000 HOURS?

CAN YOU USE THE MONEY?

THOUSANDS CAN AND DO

Is your plant overloaded ?
Do you want better illumination ?
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45 Watts

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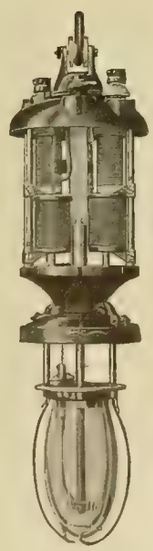

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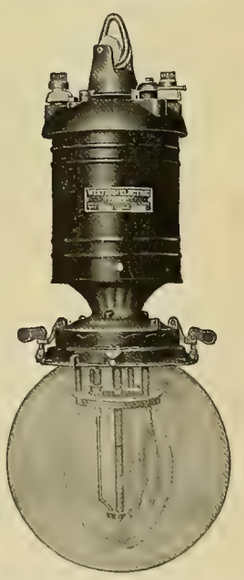

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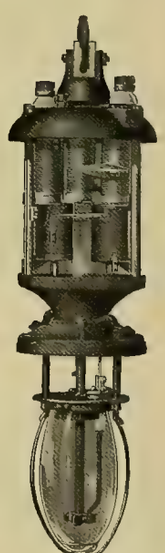

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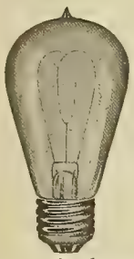

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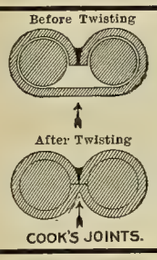

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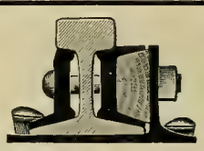
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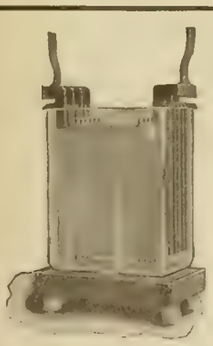

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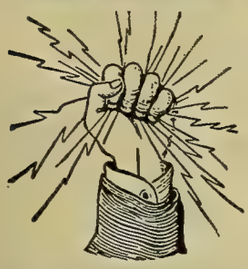

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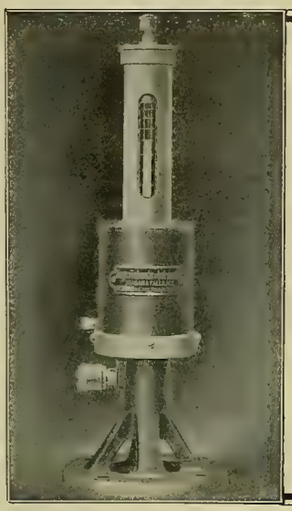

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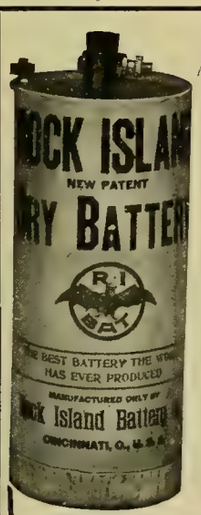

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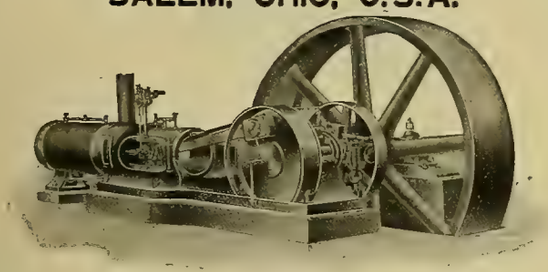

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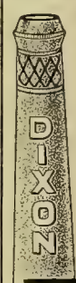

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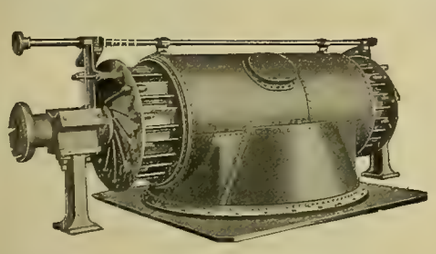

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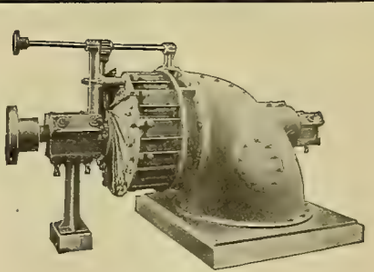

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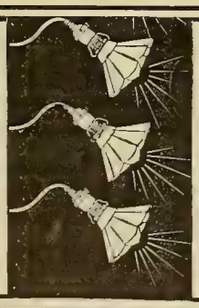

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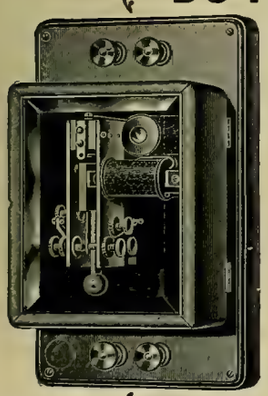

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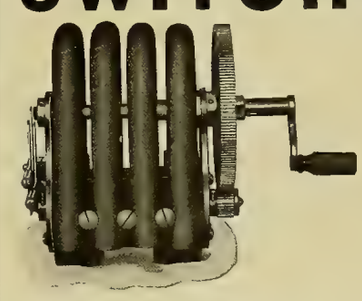

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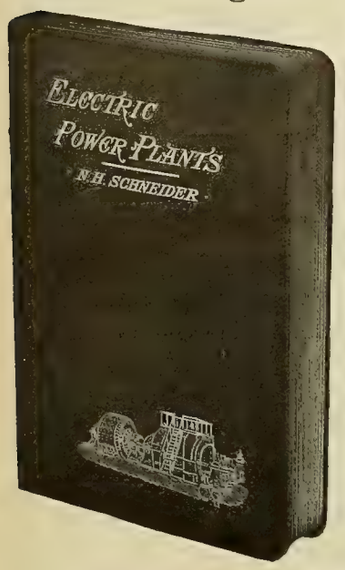

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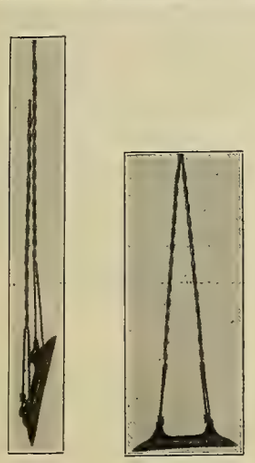

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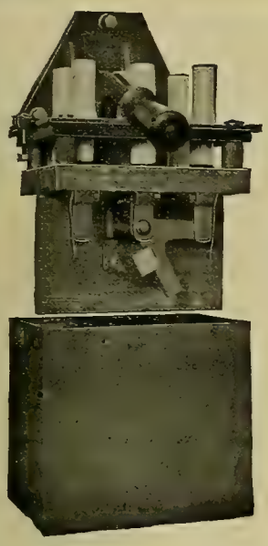

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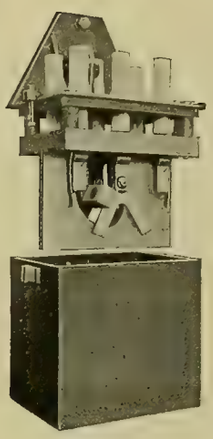

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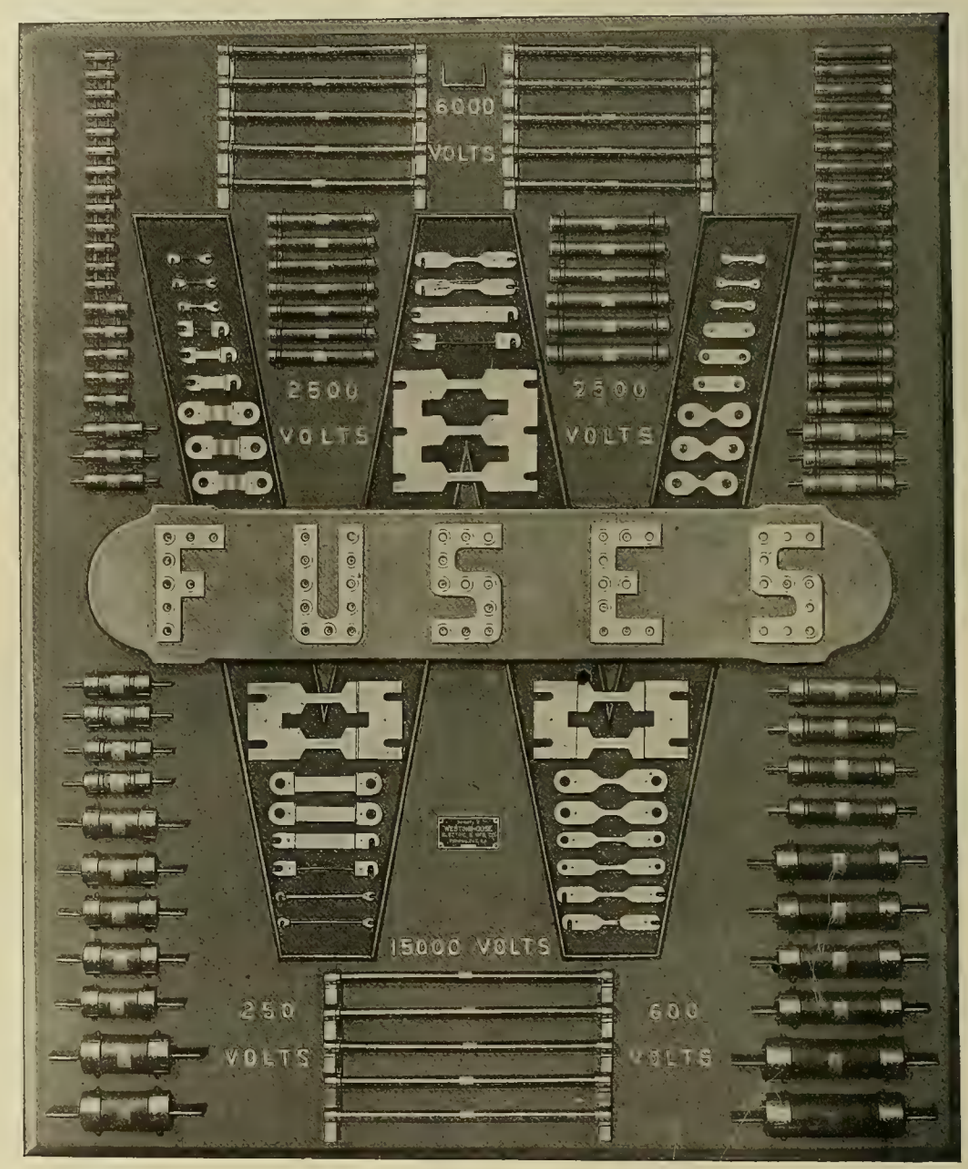

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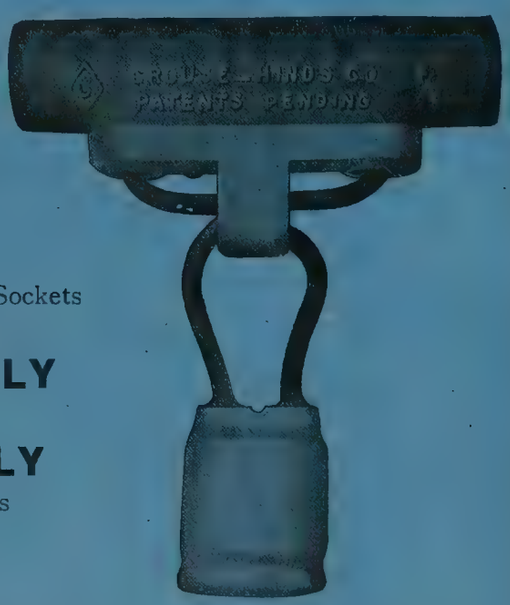

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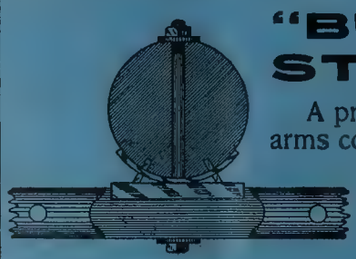

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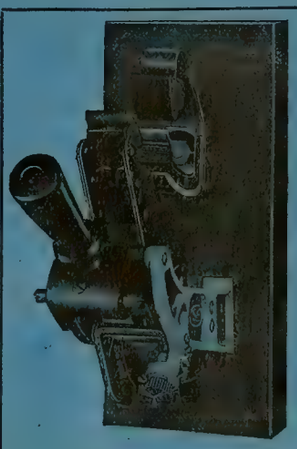

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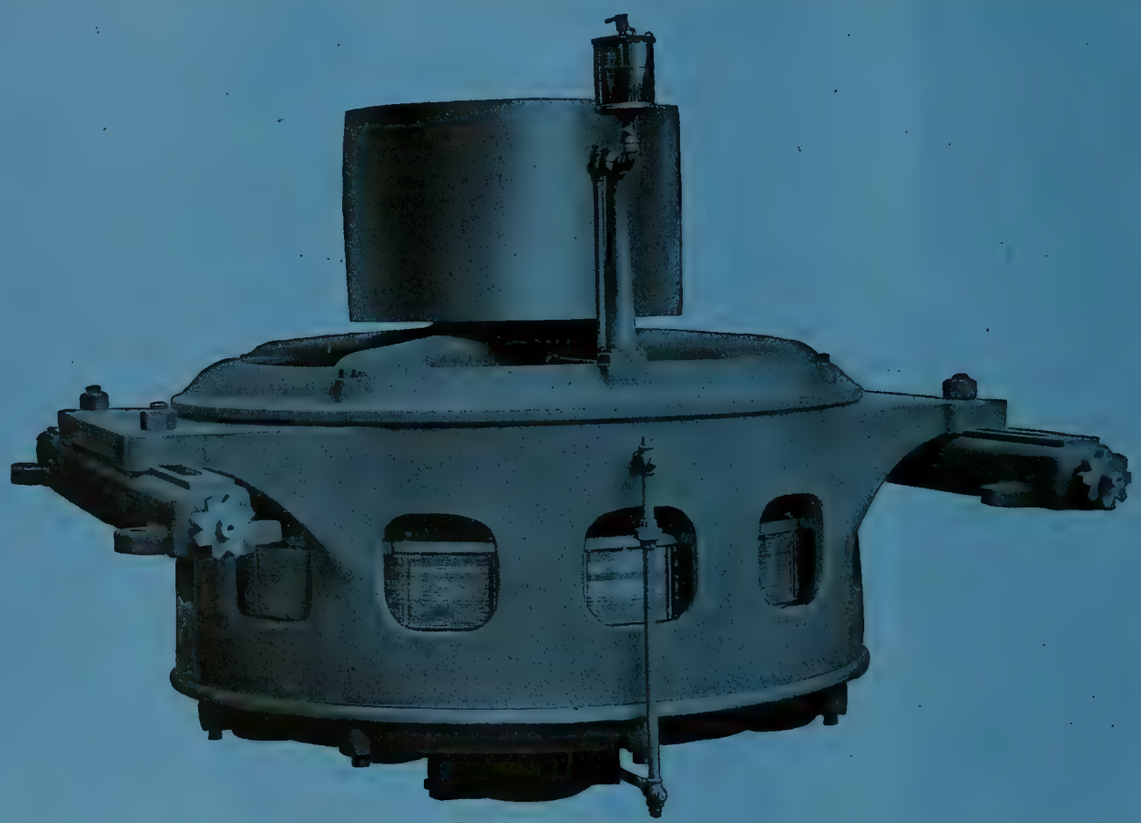

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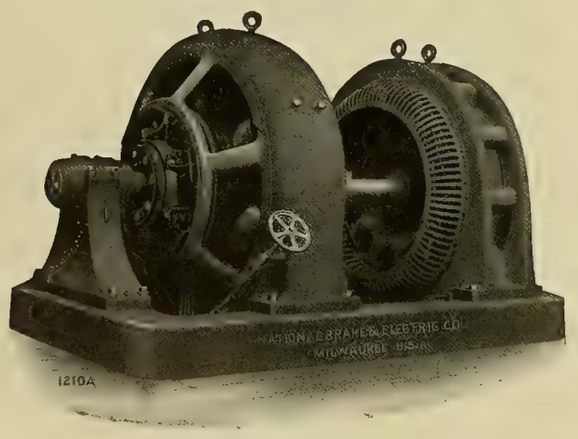

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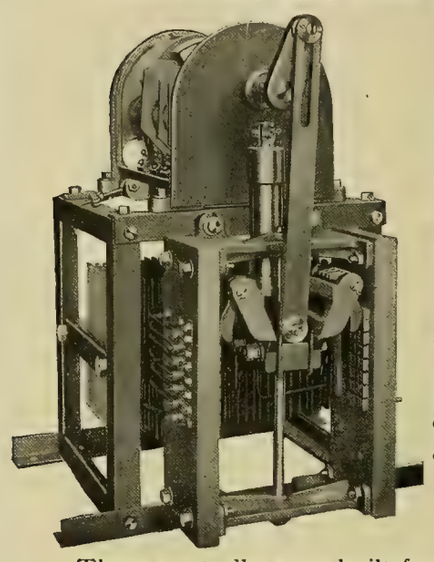

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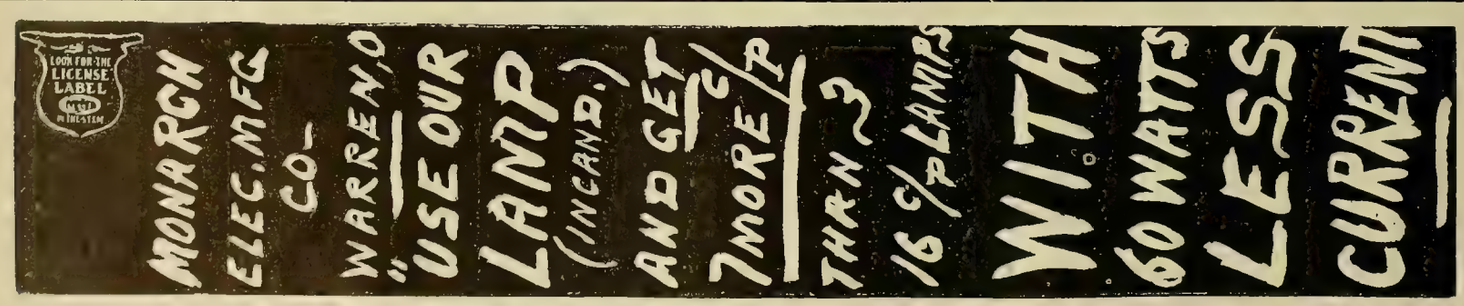

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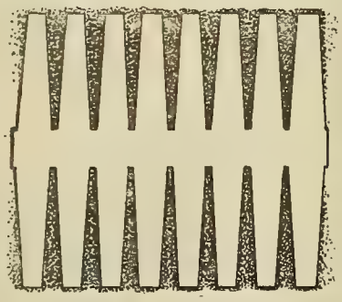

The Active Material of the Gould Battery Plate

is maintained in close mechanical and electrical contact to the support plate.

The illustration shows in cross section (enlarged) a fragment of a Gould Plate and the ribbed formation of the contact surface. The active material is formed, electrochemically, out of the metal composing the ribs, filling the space, as shown, with densely-packed but highly-porous elements. Expansion and contraction are amply compensated for, and mechanical dislodgment of active material is nearly impossible.

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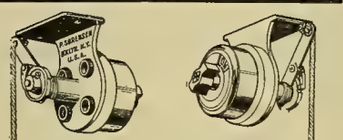

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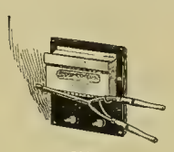

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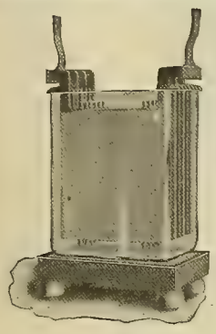

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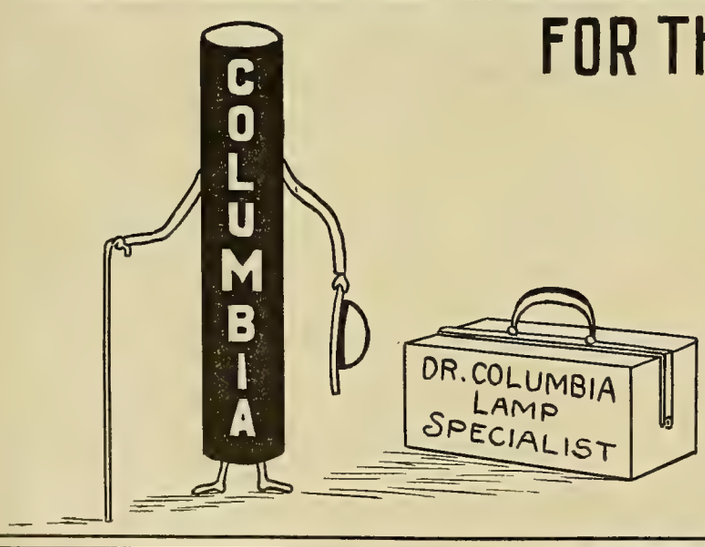

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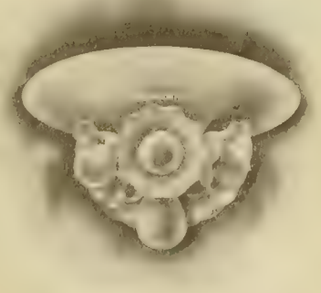
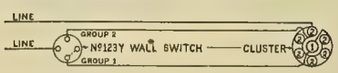


Ceiling Form



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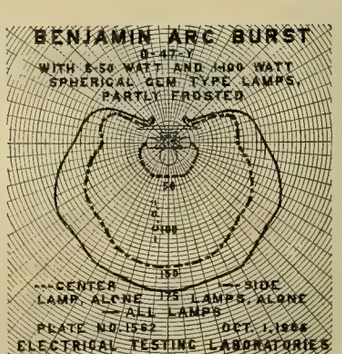

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For 18 years practically every distinct advance in transformer construction has been identified with some step in the development of transformers built by the General Electric Company

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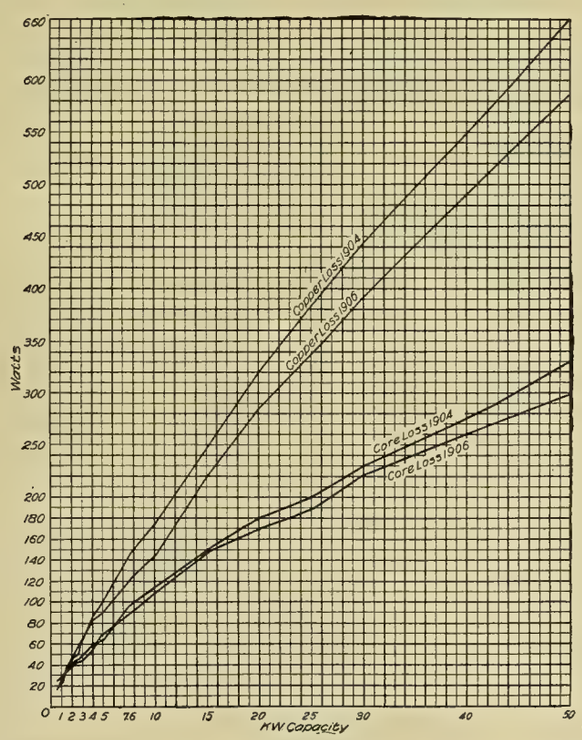

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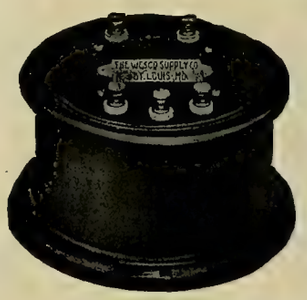

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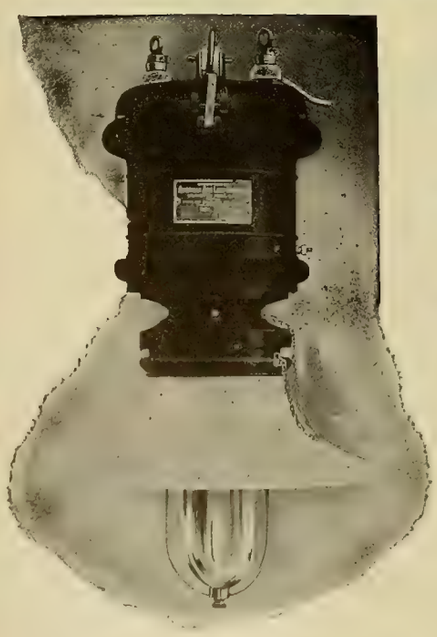

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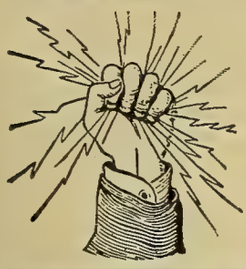

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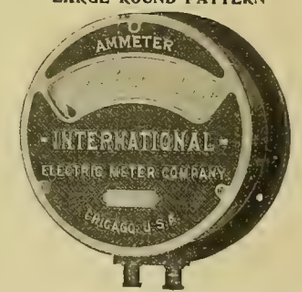

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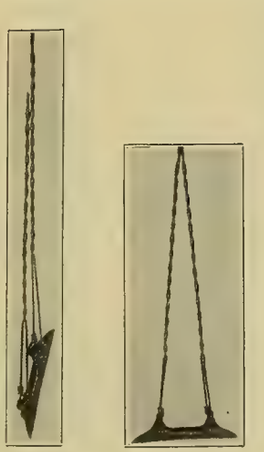

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125 TO 133 CYCLES

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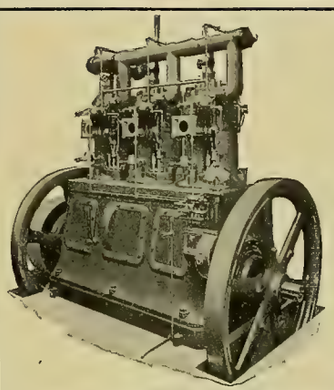

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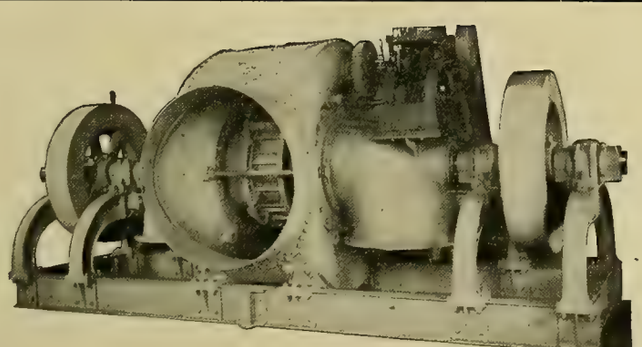

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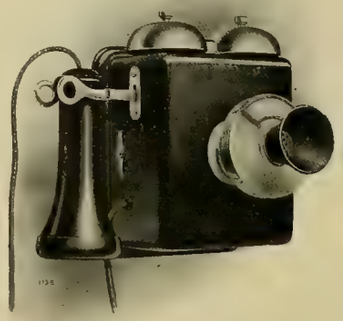

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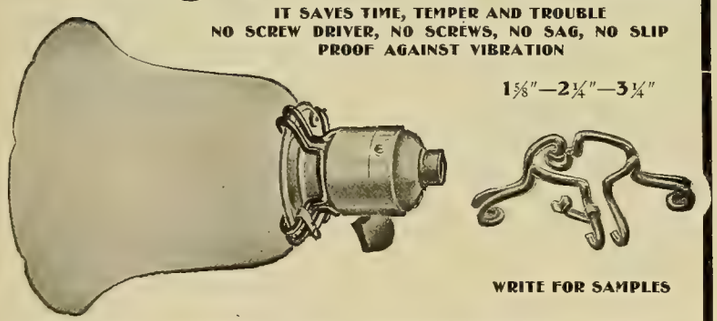

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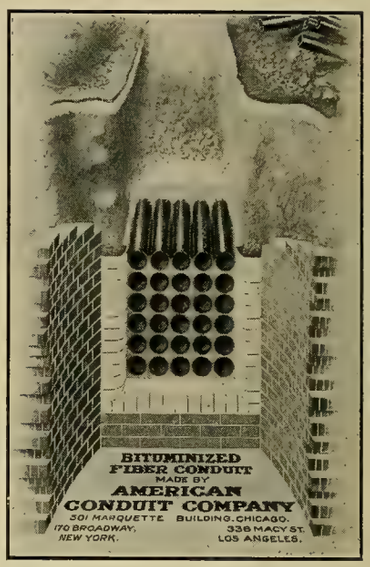

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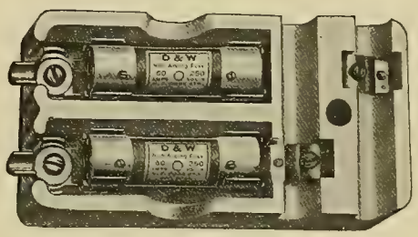

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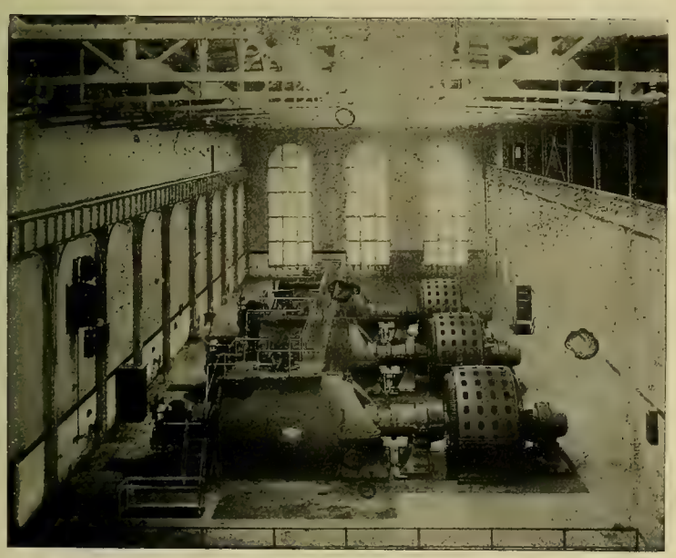

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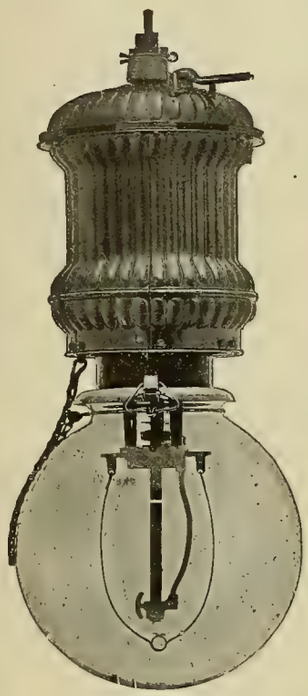

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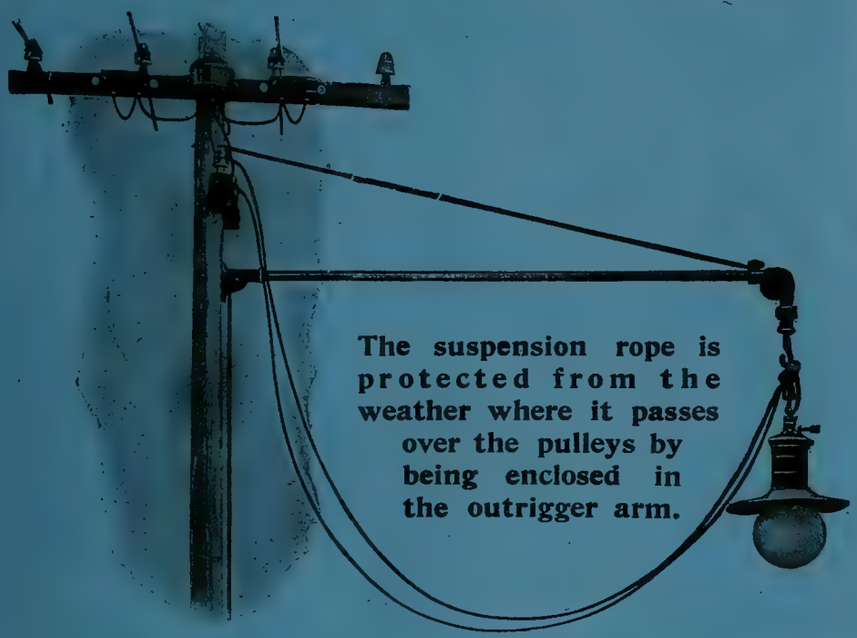

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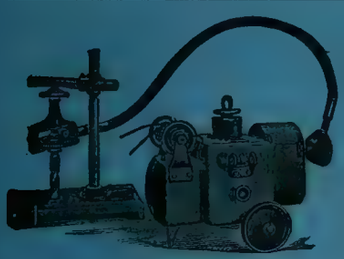

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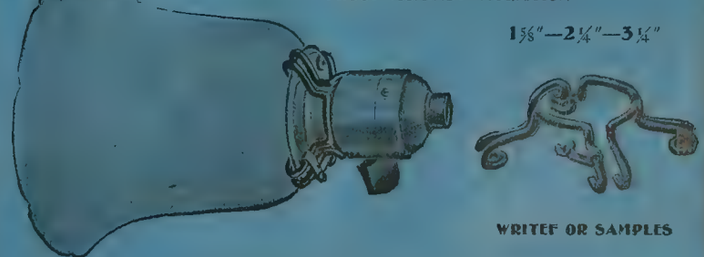

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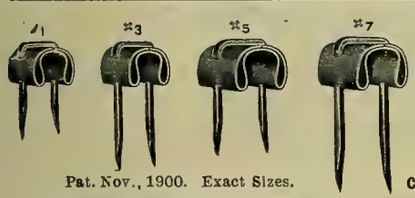

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These machines are in excellent operating condition and are offered at *very low prices*.
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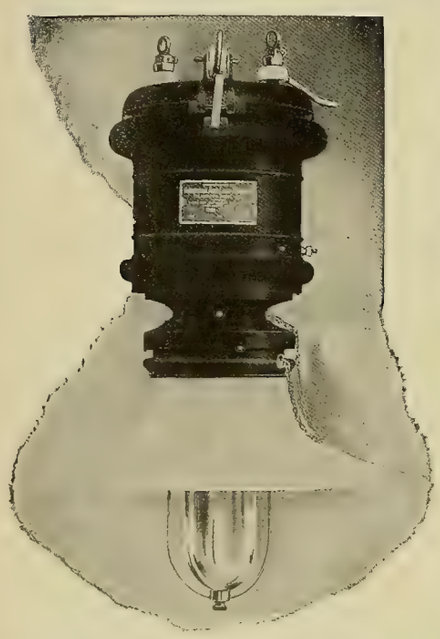

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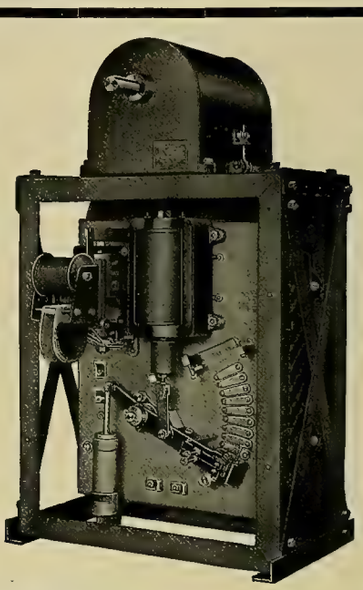

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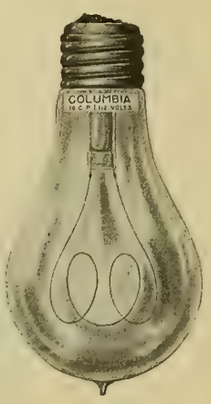

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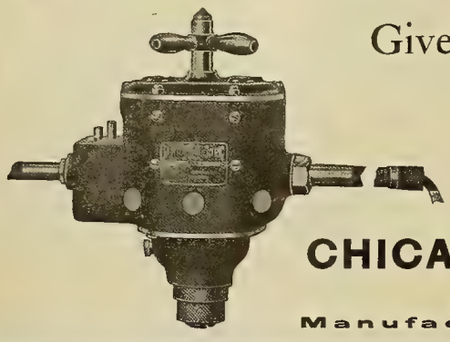

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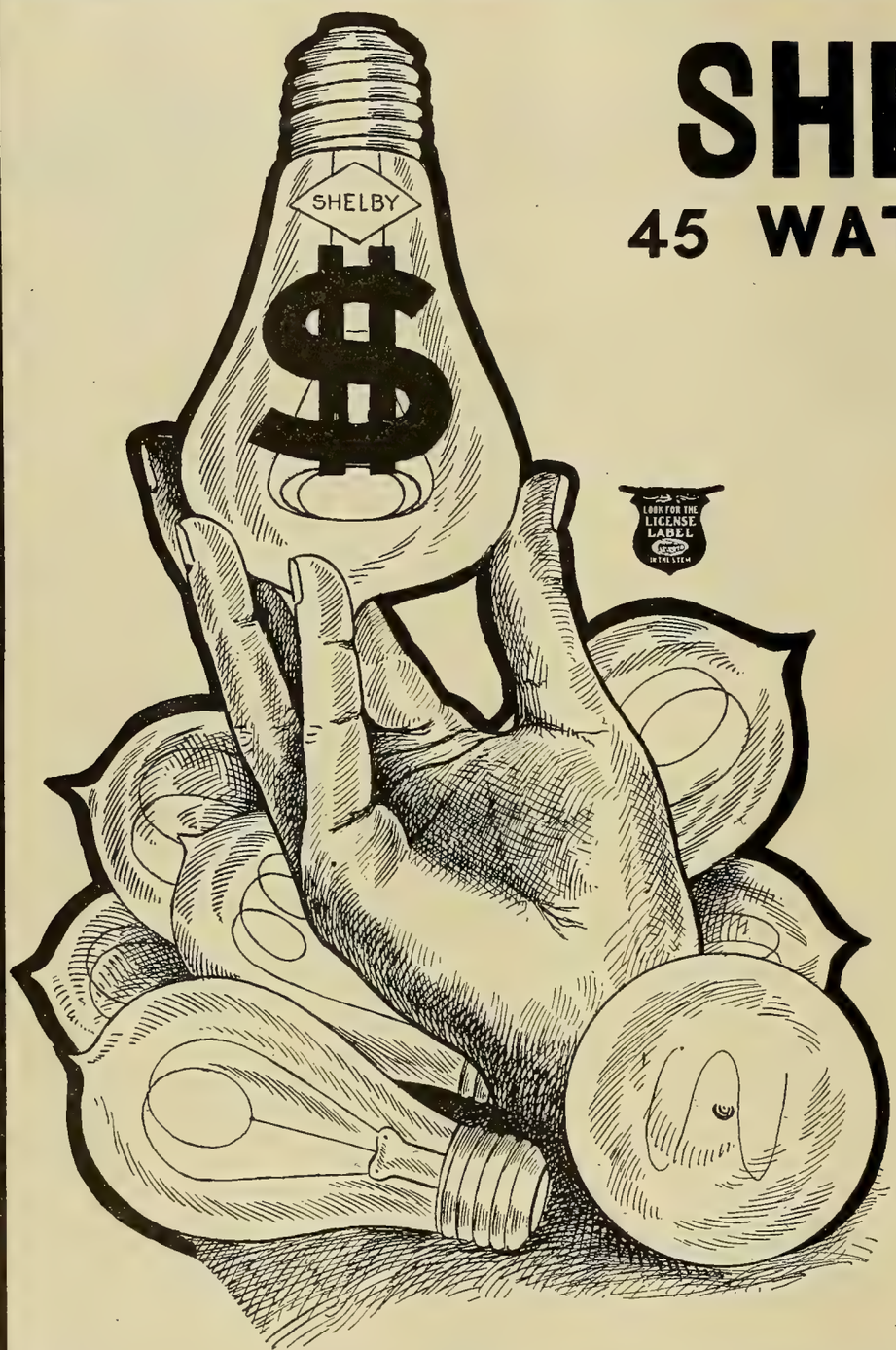

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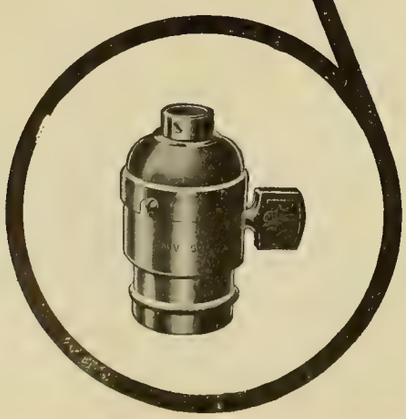

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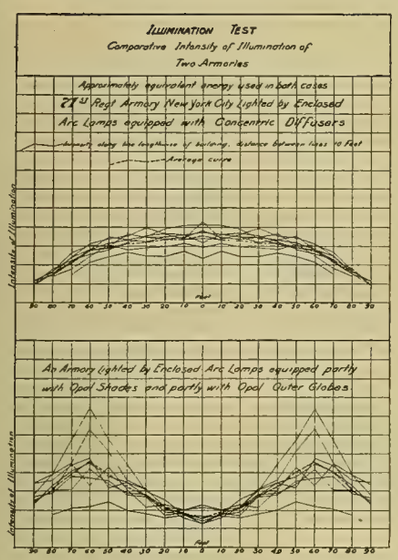

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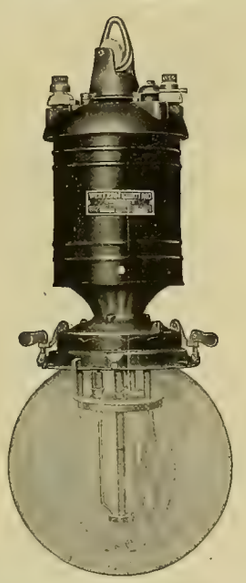

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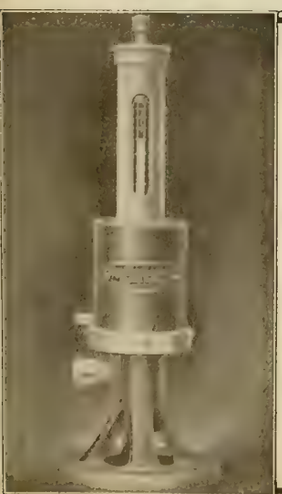

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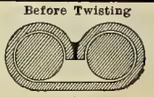

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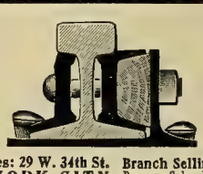

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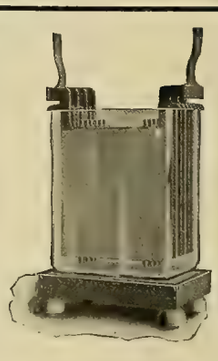

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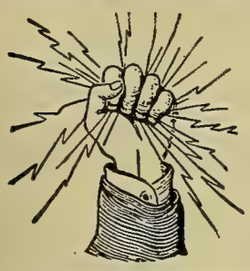

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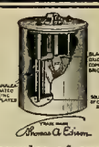

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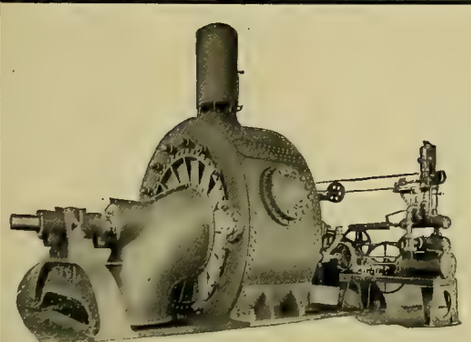

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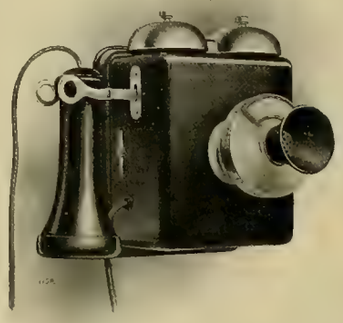

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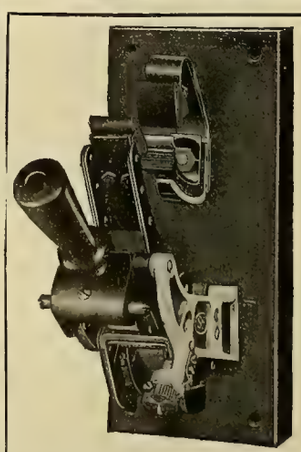

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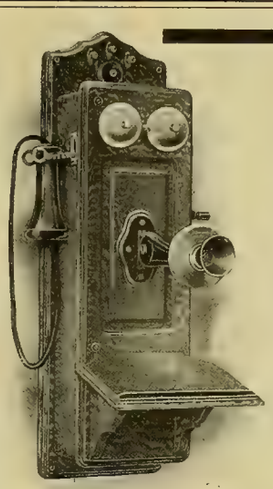

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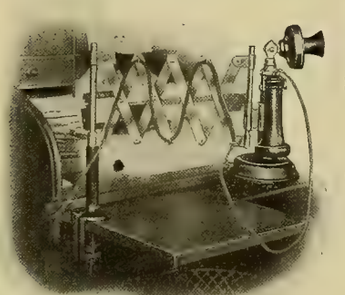

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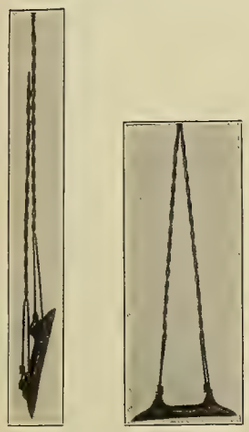

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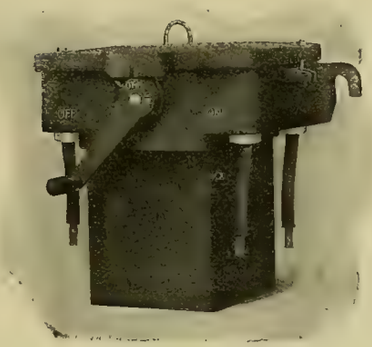

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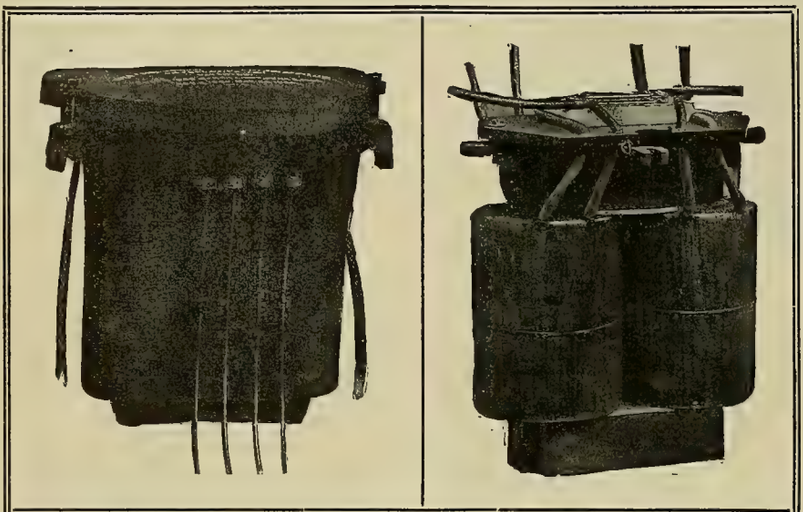

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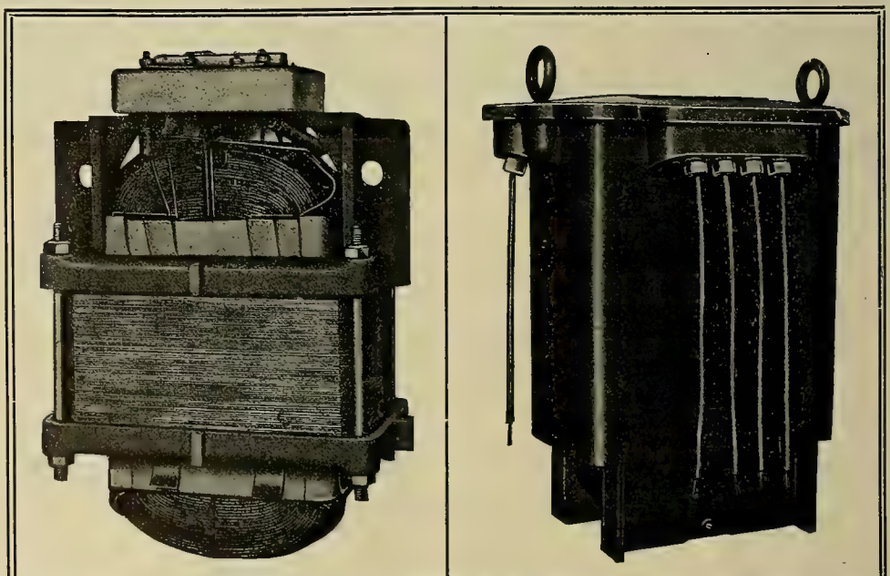

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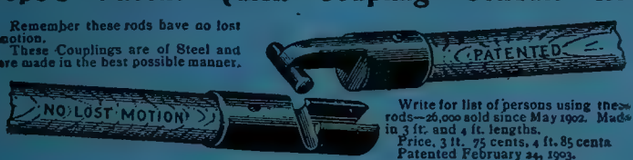

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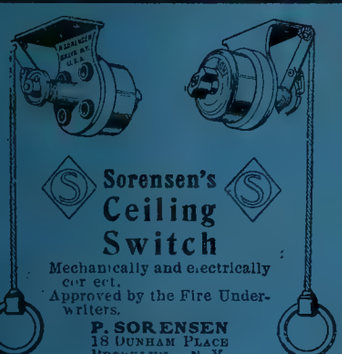
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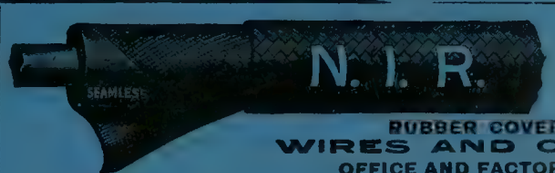

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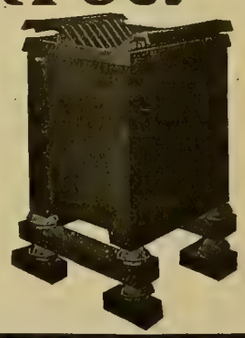

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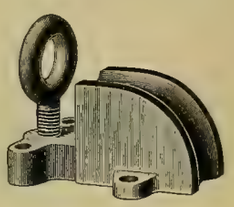

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ELECTRIC SECOND-HAND MACHINERY STEAM

These machines are in excellent operating condition and are offered at *very low prices*.
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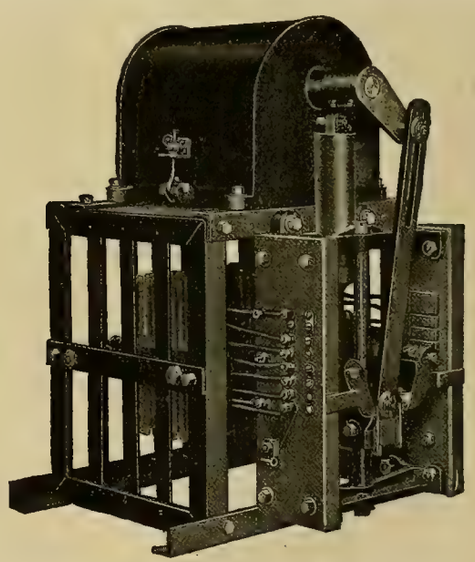

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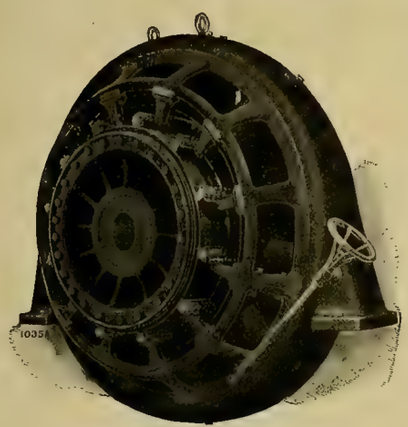

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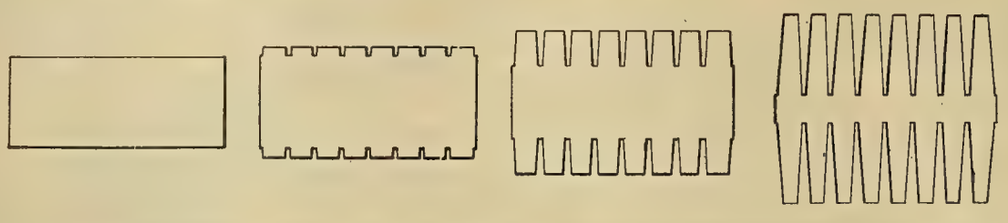

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Central Electric Co.
Duncan Elec. Mfg. Co.
Ft. Wayne Elec. Wks. Inc.
General Electric Co.
Helios Mfg. Co.
International Elec. Meter Co.
Machado & Roller.
Pignolet, L. M.
Stanley—G. I. Elec. Mfg. Co.
Wagner Electric Mfg. Co.
Wesco Supply Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.
Weston Electrical Inst. Co.
Whitney Elec. Inst. Co.

Electro-Magnets.
Acme Wire Co.

Electro-Plating Mach'y
Crocker-Wheeler Co.
General Electric Co.

Elevators—Conveyors.
Jeffrey Mfg. Co.

Enameled Rings.
Star Expansion Bolt Co.

Engines, Gas, Gasoline and Oil.
Allis-Chalmers Company.
American Diesel Engine Co.
Otto Gas Engine Works.
Westinghouse Machine Co.

Engines, Steam.
Allis-Chalmers Company.
Buckeye Engine Co.
Westinghouse Machine Co.

Fans and Fan Motors.
Central Electric Co.
Century Electric Co.
Crocker-Wheeler Co.
Edison Mfg. Co.
General Electric Co.
Robbins & Myers Co.
Wesco Supply Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.

Fibre.
Kartavert Mfg. Co.
Vulcanized Fibre Co.

Field Coils.
Acme Wire Co.

Fittings.
Plume & Atwood Mfg. Co.

Fixtures, Gas and Elec.
Beardslee Chandelier Mfg. Co.
Williamson & Co., R.

Flashers.
Bissell Co., The F.
Haller Machine Co.
Reynolds El. Flasher Mfg. Co.

Flexible Shafts.
Stow Mfg. Co.

Fuses and Fuse Wire.
Bissell Co., The F.
Central Electric Co.
Chicago Fuse Wire & Mfg. Co.
D. & W. Fuse Company.
Manhattan Elec. Supply Co.
Wesco Supply Co.
Western Electric Company.

German Silver, Sheet and Wire.
Seymour Mfg. Co.

Globes, Reflectors and Shades.
Holophane Glass Co.
Phœnix Glass Co.
Wesco Supply Co.
Western Electric Co.

Governors, Water Wheel and Steam Turbine.
Allis-Chalmers Co.
Ludlow Valve Co.

Graphite Specialties.
Dixon Crucible Co., Jos.
Holmes Fibre-Graphite Co.

Heating (Exhaust Steam).
Amer. District Steam Co.

Hydraulic Machinery.
Alton Machine Co.
Allis-Chalmers Company.

Induction Coils.
Acme Wire Co.

Inspection & Insurance
Hartford Steam Boiler Inspection & Insurance Co.

Insulating Machinery.
Alton Machine Co.

Insulators and Insulating Materials
American Electrical Works.
Central Electric Co.
Chicago Edison Co.
Haines, J. Allen, Inc.
Indiana Rub. & Ins. Wire Co.
Kartavert Mfg. Co.
Manhattan Elec. Supply Co.
Mica Insulator Co.
Munsell & Co., Eugene.
National India Rubber Co.
New York Insulated Wire Co
Okonite Co., The.
Phillips Insulated Wire Co
Simplex Electrical Co.
Standard Underground C. Co.
Vulcanized Fibre Co.
Wesco Supply Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.

Joints, Wire.
Cook, Frank B.

Lamps, Arc.
American Arc Lamp Co.
Bissell Co., The F.
Central Electric Co.
Ft. Wayne Elec. Wks. Inc.
General Electric Co.
Manhattan Elec. Supply Co.
Stanley—G. I. Elec. Mfg. Co.
Wesco Supply Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.

Lamp Guards.
Benjamin Elec. Mfg. Co.
Matthews & Bros., W. N.
Morse, Frank W.

Lamps, Incandescent.
Bissell Co., The F.
Buckeye Electric Company.
Central Electric Co.
Chicago Edison Co.
Columbia Incan. Lamp Co.
Edison Decorative & Miniature Lamp Dept.
General Electric Co.
Novelty Incan. Lamp Co.
Sawyer-Man Elec. Co.
Shelby Electric Co., The
St. Marys Incand. Lamp Co.
Standard Elect'l. Mfg. Co.
Wesco Supply Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.

Lamps, Incandescent—Replacers & Cleaners.
Morse, Frank W

Letters, Sign.
Haller Machine Co.
Matthews & Bros. W. N.

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Central Electric Co.
Ft. Wayne Elec. Wks, Inc.
General Electric Co.
Manhattan Elec. Supply Co.
Stanley—G. I. Elec. Mfg. Co.
Wesco Supply Co.
Western Electric Co.

Line Material.
Ajax Line Material Co.

Linemen's Climbers.
Klein & Sons, Mathias.

Machine Construction.
Multi Vending Co.

Magnets, Autom. Wound
Acme Wire Co.

Magnet Wires.
(See Wires and Cables.)

Mica.
Chicago Mica Co.
Mica Insulator Co.
Munsell & Co., Eugene.

Mining Apparatus, Elec.
Allis-Chalmers Company.
Crocker-Wheeler Co.
General Electric Co.
Jeffrey Mfg. Co.
Wesco Supply Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.

Mining Machinery.
Allis-Chalmers Company.

Model and Machine Shop.
Hoffmann, Emil R.

Motors (See Dynamos and Motors)

Nippers and Pliers.
Klein & Sons, Mathias.

Paints, Insulating.
Massachusetts Chemical Co.

Patent Attorneys.
Bain, Foree & May.

Phosphor Bronze.
Phosphor Bronze Sm. Co. Ltd.
Seymour Mfg Co.

Pipe Bending Machines.
Chicago Pneumatic Tool Co.
Wrigley Co., Thos.

Platinum, Wire and Sheet.
Baker & Co. Inc.

Poles, Arc Lamp.
Mott Iron Works, J. L.

Pole Changers.
Sandwich Pole Changer Co.

Poles and Ties.
Berthold & Jennings.
Bissell Co., F. The
Bruer, Will F.
Fowler & Co., John H.
Kellogg Switch. & Sup. Co.
Lindsley Bros. Co., The.
Loud's Sons Co., H. M.
Mueller Company, William.
Pacific Coast Pole Co.
Perrizo & Sons.
Porter Cedar Company.
Sterling & Son, W. C.
Torrey Cedar Co.
Valentine-Clark Co., The
Worcester Co., C. H.

Polish (Metal).
Hoffman, Geo. W.

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Artistic Porcelain Co.

Portables.
Plume & Atwood Mfg. Co.

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Jeffrey Mfg. Co.

Rail Joints.
Rail Joint Company, The

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Chicago Edison Co.
Gregory Electric Co.

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Cutler-Hammer Mfg. Co.
General Electric Co.
Wesco Supply Co.
Westinghouse El. & Mfg. Co.

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Pass & Seymour.

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Alton Machine Co.

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Highland Park College.

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Gregory Electric Co.
Rossiter, MacGovern & Co.

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Jem Shade Holder Co., The.

Signs, Electric.
Haller Machine Co.

Sleeving, Braided.
Belden Mfg. Co.

Solder, Self Fluxing.
Belden Mfg. Co.

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Western Electric Co.

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Acme Wire Co.

Spark Coils.
Acme Wire Co.

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Manhattan Elec. Supply Co.
Ostrander & Co., W. R.
Wesco Supply Co.
Western Electric Co.

Speed Indicators.
Niagara Tachometer & Instrument Co.
Weston Electrical Inst. Co.

Speed Recorders.
Niagara Tachometer & Instrument Co.

Springs.
Manross, F. N.

Staples.
Blake Signal & Mfg. Co.

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Steel Gain Mfg. Co.

Stokers.
Westinghouse Machine Co.

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American Battery Co.
Chicago Pneumatic Tool Co.
Electric Storage Battery Co.
General Storage Battery Co.
Gould Storage Battery Co.
National Battery Co.
Willard Storage Bat. Co.

Supplies, General Elec.
Bissell Co., The F.
Central Electric Co.
Century Electric Co.
Chicago Edison Co.
Haines, J. Allen, Inc.
Manhattan Elect'l Supply Co
Wesco Supply Co.
Western Electric Co.

Switches.
(See Cut-outs and Switches.)

Tapes.
Haines, J. Allen, Inc.
Massachusetts Chemical Co.

Telephones, Telephone Material and Switchboards.
American El. Telephone Co.
Automatic Electric Co.
Bissell Co., The F.
Central Electric Co.
Cook, Frank B.
International Tel. Mfg. Co.
Kellogg Switchb. & Sup. Co.
Long Distance Tel. Mfg. Co.
North Electric Co.
Stromberg-Carlson Tel. M. Co.
Wesco Supply Co.
Western Electric Co.

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Chicago Telephone Co
Long Distance Tel. Mfg. Co.

Time Stamps.
American Clock Co.

Time Switches.
Bissell Co., The F.

Toggle Bolts.
(See Bolts, Toggle.)

Tools.
Klein & Sons, Mathias.

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Chicago Pneumatic Tool Co.

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Zeidler Lamp & Brass Co.

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Allis-Chalmers Company.
Crocker-Wheeler Co.
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General Electric Co.
Kuhlman Electric Co.
La Fayette Elect'l. Mfg. Co.
National Brake & Elec. Co.
Stanley—G. I. Elec. Mfg. Co.
Wagner Electric Mfg. Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.

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General Electric Co.
Westinghouse El. & Mfg. Co.

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General Electric Co.
Westinghouse Machine Co.

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Allis-Chalmers Co.
Leffel & Co., Jas.

Vacuum Drying.
Devine Co., Joseph P.

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Massachusetts Chemical Co.

Vulcanized Fibre.
Vulcanized Fibre Co.

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Duncan Elec. Mfg. Co.

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Acme Wire Co.
American Electrical Works.
Belden Mfg. Co.
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Crescent Ins. Wire & Cble. Co.
Driver-Harris Wire Co.
General Electric Co.
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Hazard Manufacturing Co.
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India Rubber & Gutta Percha Insulating Co.
Manhattan Elec. Supply Co.
Marion Ins. Wire & Rub. Co.
National India Rubber Co
New York Insulated Wire Co.
Okonite Co., The.
Phillips, Eugene F.
Phillips Insulated Wire Co
Roebling's Sons Co., J. A
Runzel-Lenz Elec. Mfg. Co.
Safety Ins. Wire & Cable C
Simplex Electrical Co.
Standard Underground Cable Co.
Wesco Supply Co.
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are far superior to all others. They are neat, handy, do not get out of order and never make mistakes. Stamps date to the minute on your mail, orders and business transactions. Your desk and your business establishment are incomplete without one. Any number can be operated by our electric clock, either with lighting circuit or dry batteries. There is no other time stamp "just as good." Electric Time Stamps are in a class by themselves. Send for illustrated catalogue. Would like to hear from dealers.

AMERICAN CLOCK COMPANY

Wabash Ave. and 20th St. **Chicago**

Two Kearney Ways

1

THE WAY TO SAVE

COPPER AND LABOR

AND GET

BETTER AND STRONGER

CORNERS

IS TO USE THE

KEARNEY CABLE CLAMP

MADE IN ONE SIZE

FITS 000 TO 1,500,000 C. M. CABLES. IT WILL SAVE MORE THAN ITS COST IN LABOR, IN CABLE, IN TIME AND IN MATERIAL, SUCH AS SOLDER, TAPE, SAW-BLADES, GASOLINE AND BLOW TORCHES.

SEND YOUR ORDER IN NOW

YOU CAN'T LOSE

BECAUSE YOU CAN ORDER THEM ON 30 DAYS' TRIAL, AND PAY FOR OR RETURN THEM AS YOU LIKE. FREIGHT IS ONLY PREPAID ON THE FIRST ORDER WHEN FOR 25 OR MORE.

W. N. MATTHEWS & BRO.

203 N. SECOND ST., ST. LOUIS

2

The Old Way

SPECIFY

UNION

ENCLOSED FUSES

Approved by Underwriters
National Electric Association

BEST BY TEST

PERFECT OPERATION

- **NO EXCESSIVE HEATING on full load.**
- **SURE OPERATION on overload.**
- **NO FLASH or ERUPTION on most severe short circuits.**

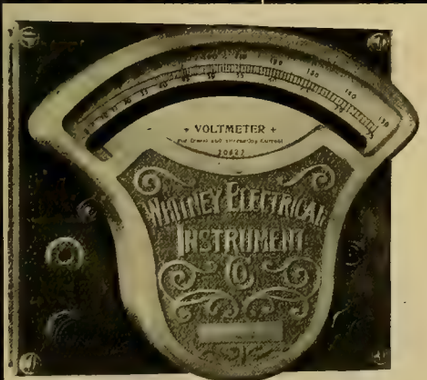
Chicago Fuse Wire & Mfg. Co.

CHICAGO **NEW YORK**

"UNION"

ENCLOSED

FUSES



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Hot Wire Meters

are the ideal instruments for the measurement of alternating current. They are unaffected by changes in temperature, are equally correct on direct current and on varying frequency, and are not affected by magnetic fields. The ammeters of this type work on shunts. Made in both portable and switchboard forms.

Send for description of mechanism and prices.

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Machado & Roller, Gen'l Sales Agents

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"Diamond H"
Switches

Trade H Mark

This Trade-Mark guarantees quality.

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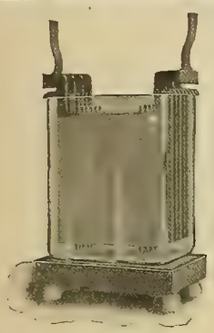
FOR ALL PURPOSES

Manufactured by

THE WILLARD STORAGE BATTERY CO.

CLEVELAND, OHIO



Storage Batteries

for Central Stations, Electric Railways, Isolated Lighting, Power Stations, Signal Service, Train Lighting, Telephone and Telegraph.

Write for estimates and information on the reliable "Unit Accumulators"

National Battery Company

ELECTRIC STORAGE BATTERIES

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EXPERIENCED ELECTRICIANS

Know that a screw connection never equals a soldered joint. All

"Fancleve" Specialties

Provide ample space and fireproof protection for thoroughly made splices.

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290 South St., Jamaica Plain, Mass.

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ENCLOSED ARC CARBONS

LONGEST LIFE

NATIONAL CARBON CO., CLEVELAND, O.

COLUMBIA CARBON PRODUCTS

Insulated Electrical Wires and Cables

JOHN A. ROEBLING'S SONS CO.

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Trenton, N. J.

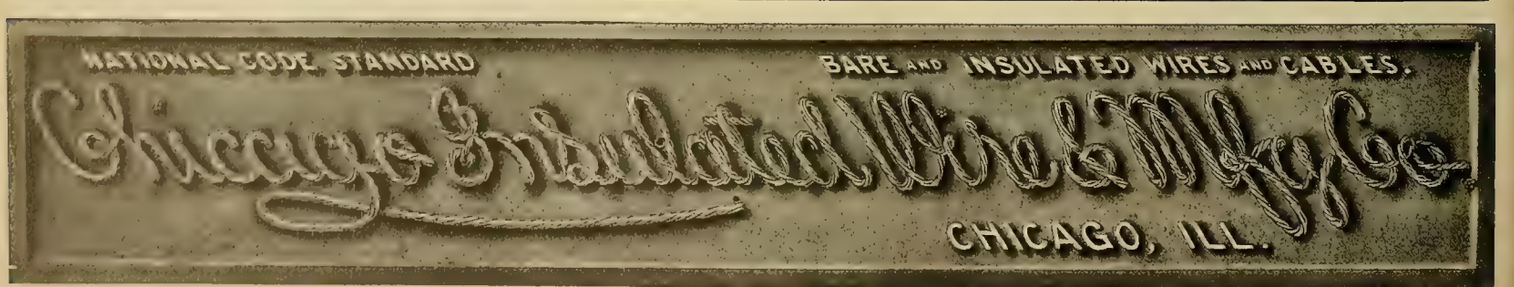
Locust Pins in Toledo

stock for quick shipment at right prices.

Get our figures on genuine Locust before buying some other kind which will rot quick. Locust lasts.

TOLEDO, OHIO — THE F. BISSELL COMPANY

THE F. BISSELL COMPANY, TOLEDO, O.



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The Modern Idea of Doing Business Means

COMPLETE STOCK
PROMPT SHIPMENTS
COURTEOUS TREATMENT
THE BEST OF EVERYTHING OF ITS KIND

TO PROTECT THE TRADE
TO MAINTAIN PRICES
FOR HIGH CLASS ARTICLES,
PRICES ALWAYS THE LOWEST

WE FOLLOW IT ABSOLUTELY

THEREFORE

WE WANT AND WARRANT YOUR BUSINESS

J. ALLEN HAINES INC. ELECTRICAL NECESSITIES

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American Steel Clad Irons, Electrical Heating Apparatus.

The Dayton Electrical Mfg. Co.

"Apple" Ignition Apparatus, Generators, Storage Batteries, etc.

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Manufacturers of Rubber and Lead covered Wires and Cables of every description; Elevator Annunciator, Control and Lighting Cables, Special Rubber Insulated Wires and Cables, R. R. Signal Wire, etc.

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Faraday Bells, Simplex Annunciators, Matchless Flashlight Novelties, Fielding Receptacles, Newcode Sockets and Receptacles, Competition Bells, Hubbell Floor Boxes, etc.

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Schwarze Electric Company

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Chicago, U.S.A.

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New and instructive catalogues on request; also our 5X Ready Reference List, the handiest possible thing for you.

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OUTLET DEVICES

Stand For

Convenience, Simplicity and Range of Application, Indestructibility and High Insulation.

Up-to-date architects, electrical engineers and contractors have shown their appreciation of the superiority of **Bossert Devices** by adopting them.

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The "Up-to-Date" line of Voltmeters and Ammeters is THE INTERNATIONAL

Prominent Engineers are specifying them

Write for descriptive catalog.

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P and S Sockets have won first prize every time in comparative tests.

On any voltage up to 250 volts or any amperage up to 3 amperes—direct or alternating current—P and S have proven best.

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SALES OFFICES: New York. Chicago. San Francisco.

General Electric Company

Get the Edison Ready-to-Use Electric Decorative Lighting Outfits

NOW

and take advantage of the holiday season

The Edison outfits provide the safest means for the illumination of all kinds of decorations. They are in demand at all seasons for the adornment of the home or for use on a larger scale at public gatherings.

The outfit is simple, flexible, thoroughly constructed, perfectly safe and forms a most serviceable decoration which should be in every electrically lighted home.

These outfits are supplied with 8, 16, 24 and 32 lamps neatly packed in an attractively decorated wooden box. Each lamp gives two candle power and each series of eight lamps takes only one-third of an ampere. These outfits are supplied for any commercial voltage. The junction plug is so constructed that extra festoons can be connected and various decorative effects obtained. Lamps are plain and colored. Each outfit includes extra lamps.

The Edison outfit is approved for Christmas Trees by the National Board of Fire Underwriters.

1150

Chicago Office: Monadnock Bldg.

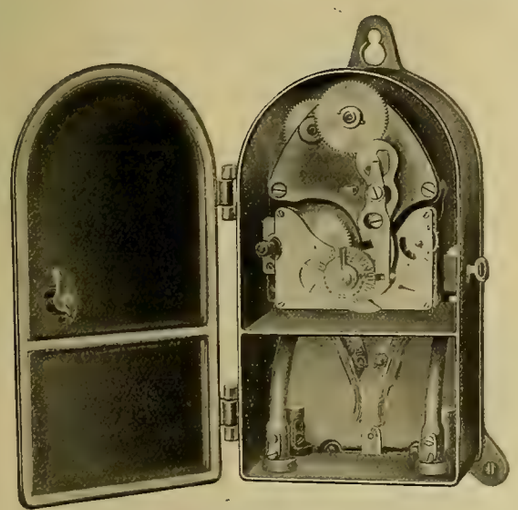
Main Lamp Sales Office: Harrison, N. J.

Sales Offices in all large cities

General Electric Company

Automatic Time Switches

For Use on Direct or Alternating Current



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Built Substantially

For Commercial Service

This automatic time switch consists of a circuit breaker and timing mechanism both of which are controlled and operated by a single mainspring.

Action is entirely mechanical. The few simple, rugged parts insure thorough reliability. The whole is enclosed in an iron case with a dustproof cover.

Rated at 25 Amperes and 250 Volts

1143

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Edison Ready-To-Use Electric Decorative Lighting Outfits

You Have Just Time Enough

To lay in a stock of these popular outfits, which afford by far the safest and most beautiful method of illuminating Christmas Trees or other inflammable decorations. Useful for interior adornment all the year around. Always ready—always complete.

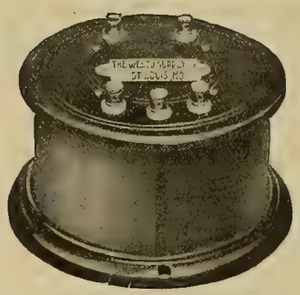
The Edison outfit is approved for Christmas Trees by the National Board of Fire Underwriters.

For fuller details write our nearest district office, or

GENERAL ELECTRIC COMPANY
Main Lamp Sales Offices: Harrison, N. J.

Offices in all the principal cities 744

A BATTERY SAVER



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If an all-day alternating current is available you can operate your Gas Lighters, Door Bells, Burglar Alarms and annunciator systems of all kinds with the

Adams Secondary Generator

and do away with batteries entirely. It **costs nothing to operate** it when once installed and it is a perfect substitute for batteries.

THE WESCO SUPPLY CO.
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CHICAGO MICA CO., VALPARAISO, IND.

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Of all Qualities, in any Form at Lowest Prices
EUGENE MUNSELL AND CO.
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That Is.

Micanite, Linotape, M. I. C. Compound, Empire Cloth and Paper. For Years the Standard.

MICA INSULATOR CO., Originators
NEW YORK and CHICAGO

USE
"SAFETY" RUBBER COVERED WIRE AND CABLE
FOR EVERY ELECTRICAL SERVICE

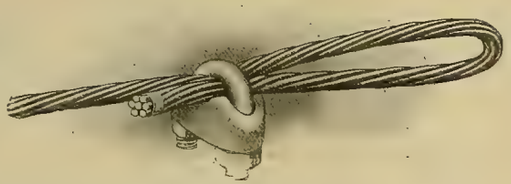
M. B. AUSTIN & CO.,
CHICAGO REPRESENTATIVE
THE SAFETY INSULATED WIRE & CABLE CO.
BAYONNE, NEW JERSEY

GENERAL STORAGE BATTERY CO. BIJUR HIGH DUTY NEW YORK

For CENTRAL STATIONS
GENERAL
STORAGE BATTERY CO
42 Broadway, New York

TRADE MARK BIJUR HIGH-DUTY

Cook Clips



Made on new principles. The strands lie side by side and the U bolt grips both strands. Cook's Clips hold twice as much as any other and cost less. Made of best grade material, heavily galvanized. Assembled by hand. Write for prices on all sizes.

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The only article that will PREVENT SPARKING. Will keep the Commutator in good condition and PREVENT CUTTING.

Absolutely Will Not Gum The Brushes.

It will put that high gloss on the Commutator you have so long sought after.

50 Cents per Stick. $5.00 per Dozen.
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For sale by all supply houses, or
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Measure low and high voltages, besides amperes and ordinary resistances. They are inexpensive and reliable. Send for catalog of portable and switchboard voltmeters and ammeters.
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PITTSBURG, 1218 FRICK BUILDING.
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CLEVELAND, 706 NEW ENGLAND BLDG.
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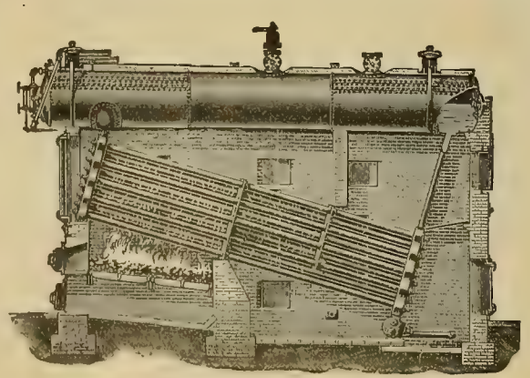
HAVANA, CUBA, 116 1-2 CALLE DE LA HABANA



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STEAM SUPERHEATERS

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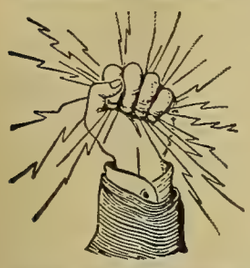
PROVIDENCE, R. I.



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Anti-Volt INSULATING COMPOUND
DOES QUALITY DOES PRICE
Interest YOU?
For Pot-Heads, Wire Joints, Armatures, Field Coils, etc.
Write for Particulars.
Anti-Volt Mfg. Co., 72 and 74 Wabash Ave., Chicago

SPOT THE SPOT
SAMSON SPOT CORD
FOR
ARC LAMP AND TROLLEY CORD
SAMSON CORDAGE WORKS, BOSTON, MASS.

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WEATHER-PROOF TRADE MARK "O.K." LINE AND HOUSE WIRES

"O. K." Weatherproof Wire.
Slow-Burning Weatherproof and Ideal Wire.

Prices and Samples on Application.

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To replace 5¼-ampere D. C. enclosed arc lamp.
No. 66—6 Light $23.40 No. 65-5 Light, $22.10 No. 64—4 Light. $20.80
These are list prices and do not include lamps. Write for Discounts
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FOR ELECTRICAL INDICATING AND RECORDING INSTRUMENTS. MADE FROM MY SPECIAL BRONZE ALLOY

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Describes the
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IT SAVES TIME, TEMPER AND TROUBLE
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In Iron
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for public buildings, hotels, etc
In bronze and iron
Catalogues on application
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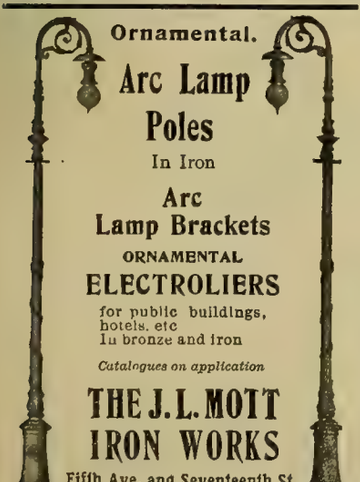

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Burns Without Air Pressure

THE "Baby" Gasoline Torch is the smallest torch made which gives perfect results, and fills the long-felt want for a torch which fits the hand and can be used in contracted places and corners. It can be turned in any position, as it burns equally well in all positions. It is perfectly automatic; has no cocks or valves to get out of order; lights with a match; self-feeding; requires no pumping of air and is always ready for use. It is indispensable to the Telephone and Telegraph linemen and ELECTRICIANS. It burns about two hours from one filling.

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In 1905

The Western Electrician published 1042 LARGE pages of reading matter and 1575 illustrations. This is 3126 columns or about 3,000,000 words. Equivalent in amount to 23 average $2 technical Books. On the book basis $46 worth given for $3. If you are not a subscriber, send in your order now.

Western Electrician
507 Marquette Building, Chicago

WANTED, FOR SALE *and similar* **WANT COLUMN** *advertisements (50 words or less), $1.50 an insertion; additional words 3c each.*
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At once, competent man as manager of new business department for progressive electric and gas company in city of 20,000. Also one first-class solicitor who has had new-business experience with electrical and gas company. Address Box 672, care Western Electrician, 507 Marquette Building, Chicago.

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To buy—one second hand, 75 to 100 K. W. 60-cycle 2,080-volt alternator, one 150 H. P. engine and one 150 H. P. boiler. Address Hennessey Electric Light, Power and Ice Co., Hennessey, Okla.

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FOR SALE

One 62 K. W. 250-volt, one 50 K. W. 125-volt direct-connected dynamos and engines.
One 35 K. W. 220-volt 4-pole generator, direct connected to 50-horsepower Nash gasoline engine.
Two 25 K. W. and three 45 K. W. 125-volt Edison machines.
One 17 K. W. 125-volt 4-pole generator. One 14x8½x10 Worthington pump, 150 and 400 horse Berryman heaters, 18x36-inch Allis Corliss engine, 10x12 Acme Vertical engine.

JAMES A. GRAHAM, 206 BROADWAY.

FOR SALE — Bargains
500-VOLT MOTORS

	H. P.	
1	1	Crocker-Wheeler.
1	1	Towle.
1	1	New England.
1	1½	Northern, series.
1	1½	Belknap, self-oiler.
1	1½	Crocker-Wheeler.
1	3	T. H., self-oiler.
1	3½	Roth.
1	4	Fort Wayne.
1	5	Card.
1	5	Browning, M. P.
1	6	Westinghouse, M. P.
1	7½	Roth, self-oiler.
2	7½	Gen. Elec., M. P.
1	7½	Eddy, M. P.
1	7½	Crocker-Wheeler.
2	10	Kester, M. P.
2	10	Belknap, M. P.
2	12	Thomson-Houston.
1	15	Kester, M. P.
2	20	Bernard, M. P.
1	25	Belknap.
1	35	Gen. Elec., M. P.
1	40	Crocker-Wheeler, M. P.
1	50	Eddy, M. P., type G.
1	65	Gen. Elec., M. P.
1	100	Westinghouse, M. P.

Everybody says our new shops are "immense!" They are. We have the largest repair shops in this country. Send for our **Monthly Bargain Sheet** showing our complete stock with net prices.

GREGORY ELECTRIC CO.
Cor. 16th and Lincoln Streets, Chicago

ROSSITER, MACGOVERN & CO., Inc.

ELECTRICAL AND STEAM MACHINERY, GUARANTEED, and at a PRICE considerably lower than for the same apparatus purchased from the manufacturers.

DIRECT CONNECTED A. C. UNITS.

6770—400 K. W. Westinghouse generator, 60 cycles, 2-phase, 1,150 volt, 150 RPM, direct connected to Williams vertical non-condensing engine 18x26.
6399—250 K. W. General Electric generator, 60 cycles, mono-cyclic, 2,400 volt, 200 RPM, direct connected to Ames horizontal, compound engine, 15½ and 26x18.
8659—150 K. W. Westinghouse, 60 cycles, single phase, 2,200 volt, 257 RPM, direct connected to Harrisburg tandem compound engine, 12 and 24x14, complete with switchboard and exciters.

BELTED A. C. GENERATORS 60-Cycle, 3-Phase.

8476—450 K. W. Stanley, 2,200 volt, 360 RPM.
1517—150 K. W. General Electric, type A. T., class 12-150-600.
1136—100 K. W. General Electric, 2,300 volts type A. T. R., class 8-100-900.
1448—70 K. W. Thomson-Houston, 2,200 volt, class A-70, 515 RPM.

60-Cycle, 2-Phase.

1763—240 K. W. Stanley, 1,200-2,400 volt, 450 RPM.
1791—135 K. W. Stanley, 2,300 volt, 900 RPM.
7232—75 K. W. Westinghouse, 2,200 volt, 720 RPM.

60-Cycle, Single-Phase.

7546—Two 300 K. W. Bullock, 110 volt, 16 poles, 465 RPM.
7634—Three 180 K. W. General Electric, 1,040 volt, type A. S., form A, 600 RPM.
1823—150 K. W. General Electric 1,040-1,150 volts, type A. M., class 12-150-600.
1219—75 K. W. Westinghouse, 2,200 volt, class 10-75-900.

125-133-Cycle, Single-Phase.

6300—300 K. W. Westinghouse, 1,100-2,300 volts.
1279—120 K. W. Westinghouse, 1,100-2,200 volts, class 12-120-1375.
1344—90 K. W. General Electric, 2,300 volt, type A-6, class 12-90-1250.

ALTERNATING CURRENT MOTORS.

25-cycle, 60-cycle, 133 cycle, single-phase, 2-phase and 3-phase of various sizes and makes. Write for prices. Let us know your needs and we will quote you low prices.

Machinery For All Power Station Purposes.

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Experimental Work a Specialty
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778

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and tools, heavy punch press and sheer work, accurate machine and novelty construction. MULTI-VENDING CO., 198 S. Clinton Street, Chicago, Ill.

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As your ad in the Western Electrician will be read, you will never be blue.

TELEPHONE TROUBLES
Price 25 Cts.

DO YOU NEED ONE IN YOUR BUSINESS?

Electrician Pub. Co., 507 Marquette Bldg., Chicago

DEPARTMENT OF THE INTERIOR, Office of Superintendent U. S. Capitol Building and Grounds, Washington, D. C., November 21, 1906. Pursuant to the directions of the Commission of the House of Representatives, etc., advertisement is hereby made for sealed proposals (in duplicate) for the furnishing and erection of apparatus to completely equip the heating, lighting and power plant for the Capitol building and other buildings, which apparatus will consist of engines, generators, switchboards, boilers, pumps, condensers, steam fitting and all other necessary appliances to connect the same in the several parts, and for complete sub-station apparatus for the various buildings. Proposals for the first section of the work, that is, for prime movers and generators and sub-station apparatus and complete switchboard equipment therefor, will be received and opened at the above office on Wednesday, the 26th day of December, 1906, at twelve o'clock noon, and publicly opened. Subsequent proposals will be received for the other apparatus, and the date of opening will be stated in the specifications. Applications for plans and specifications may be made at once, and the issuance will be in the discretion of the Superintendent. Bidders will be required in the first instance to furnish with their proposal a certified check or surety bond in the sum of five per cent of the amount of their bid. A certified check in the sum of $50.00 will be required as a guarantee for the return of plans and specifications. The right is reserved to reject any or all bids, and to waive technicalities and informalities. Elliott Woods, Superintendent U. S. Capitol Building and Grounds. Approved: E. A. HITCHCOCK, Secretary.

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Favorable Freight Rates,
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Healthful Communities,
ON THE LINES OF
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FIRST CLASS EQUIPMENT THROUGHOUT

Dynamos, Armatures, Motors, Arc Lamps, Fans, Instruments.

Wagner Electric Mfg. Company

ST. LOUIS, U. S. A.

Combination Volt Wattmeter

For testing lamps, motors and other devices consuming a small amount of current.

This instrument will operate on 150-volt or 300-volt circuits, either alternating or direct. It does not have to be sent in for recalibration every sixty or ninety days, as is the case with other lamp-testing volt wattmeters.

This instrument operates on the moving coil dynamometer principle, and not on the balanced coil dynamometer principle, which latter type requires constant balancing and compensation in order to make the zeros coincide, and makes it impossible to take readings on a fluctuating load. Our instrument is light in weight, compact and neat in appearance, not easily deranged or put out of order, maintains its calibration for a long period of time, and owing to its adaptability to 300-volt circuits, the constant dread of a burn-out when used inadvertently on 250-volt circuits is removed.

This instrument is so simple in construction that it can be sold for almost half the price of a balanced coil dynamometer instrument of the old type. These instruments are put out under our full guarantee, which is practically an insurance policy in your favor, guaranteeing their good behavior.

WRITE FOR DESCRIPTION OF THIS INSTRUMENT

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NEW subscribers who order the WESTERN ELECTRICIAN for the year 1907 will receive the remaining issues of this year FREE. Order at once.

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Street.....

Date..... City..... State.....

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IS THE WAY TO MORE REVENUE

To all lamp users who have been using lamps that consume 56 watts, we offer this 45-watt lamp and guarantee it to give equal illumination, and, furthermore—to produce it in useful directions.

Why should you pay for more current than you need to produce a given illumination?

Let us send you a few testimonials from prominent engineers as to the comparative values of the different lamps.

THE SHELBY ELECTRIC CO.

Nos. 6 to 30 High Street, SHELBY, OHIO

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Dearborn Water Treatment made to suit the case takes off the scale, keeps it off, stops corrosion and foaming. Send gallon of water for analysis. :: :: ::

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IF SO, GET A COPY OF
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BOTH MAGNETO AND COMMON BATTERY SYSTEMS.
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"ELEPHANT BRAND PHOSPHOR-BRONZE"
INGOTS, CASTINGS, WIRE, RODS, SHEETS, ETC.
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ORIGINAL AND SOLE MAKERS IN THE U.S.

JEFFREY CHAIN BUCKET **DREDGES** FOR CATALOGUE, ADDRESS THE JEFFREY MFG. CO. COLUMBUS, OHIO.

1866 1906

HARTFORD STEAM BOILER
INSPECTION & INSURANCE COMPANY

39th ANNUAL STATEMENT

JANUARY 1, 1906

CAPITAL	$ 500,000.00
SURPLUS	1,261,459.69
RESERVES	1,926,686.81
ASSETS	3,688,146.50

The **Hartford** is the only company which makes a specialty of, and does exclusively, a steam boiler inspection and insurance business.

The **Hartford** is the only company whose entire talent and energies are applied to the study of steam, to the scientific construction and installation of boilers, and to their periodical inspection by expert mechanics.

The **Hartford** is the only company whose entire assets and resources are held exclusively for the protection of steam users, and the payment of losses occasioned by the explosion of steam boilers, and for no other hazard whatsoever.

The **Hartford** is now doing nearly nine-tenths of the Inspection and Insurance of Steam Boilers in the New England States, and nearly two-thirds of the entire amount done throughout the United States.

29 YEARS EXPERIENCE

THAT IS WHY WE HAVE THE MOST PERFECT UNDERGROUND HEATING SYSTEM

WRITE FOR THE STORY OF "DISTRICT STEAM HEATING"

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MONADNOCK BLDG.
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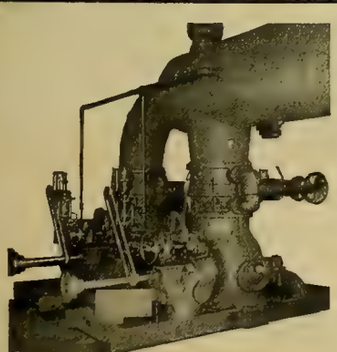

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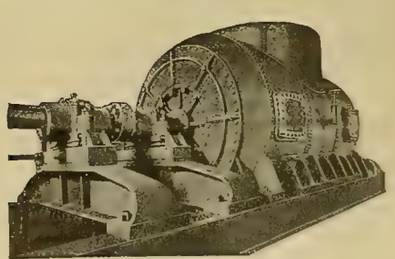
We construct the gates on the SAMSON so that all movable parts will have a maximum wearing surface. As we use only the best material in their construction we are assured that the life of the gate will be prolonged and there will be no trouble from leakage.



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IN CHICAGO

If the franchise of Chicago Telephone Company in the City of Chicago is extended, the following rates have been proposed for the Chicago Exchange.

SINGLE LINE TELEPHONES:

50 calls per month : : $5.00
Next additional 50 calls in the month 5 cents each
Third 50 calls in the month : : 4 cents each
All calls in the month beyond 150 : 3 cents each

RESIDENCE RATES WITH UNLIMITED SERVICE:

Single line : : : : $75.00 per annum
Two-party line : : : 60.00 per annum

NICKEL SERVICE:

Direct line, 20 cents per day, including 4 calls
Direct line, 15 cents per day, including 2 calls
Two-party line, 15 cents per day, including 3 calls
Two-party line, 10 cents per day, including 1 call
Two-party line, residences only, 10 cents per day
Four-party line, residences only, 5 cents per day
Extension telephones : : : $1.00 per month

CHICAGO TELEPHONE COMPANY,
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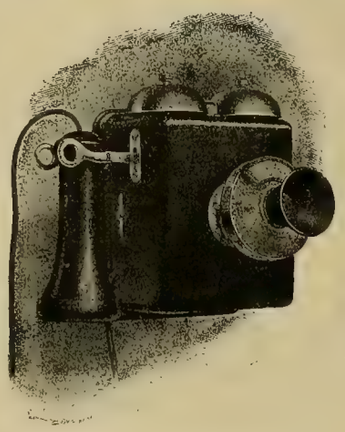
QUALITY

is of first importance and is essential to reliable and efficient service

Estimates promptly furnished on complete systems for manufacturing plants, hotels, etc.



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ROCHESTER, N. Y. CHICAGO, ILL.

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(ALL IMPORTED CARBON)

HAVE YOU TRIED IT?

Long Distance Telephone Mfg. Co., South Bend, Ind.

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The Holden Guy-Anchor

NONE BETTER

The rods are of one piece
No welds nor threads to weaken them

Greatest surface in ground

A 15-inch Anchor squares up in a 6-inch hole, over 55 square inches in solid earth

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Pat. Jan. 9, 1906 Write for Circular

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KUHLMAN ELECTRIC CO., - - ELKHART, IND.

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DRY AND IMPREGNATE BY VACUUM

LARGEST ELECTRICAL FACTORIES IN U. S. AND ABROAD NOW USE OUR—THE PASSBURG—SYSTEM.
INVESTIGATE—YOU MAY BE SURPRISED.

J. P. DEVINE CO., BUFFALO, N. Y.
428 MOONEY-BRISBANE BLDG.

There's No Friction

with the Fibre-Graphite Commutator Brush Being 90 per cent. pure graphite, it insures low resistance, no sparking under a varying load, and longer wear. There is no greasing required. The Fibre-Graphite is therefore the most economic brush on the market. Send for price list.

HOLMES FIBRE-GRAPHITE MFG. CO.
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HIGHEST AWARD. CHICAGO WORLDS FAIR, 1893. LOUISIANA PURCHASE EXPOSITION 1904.

YOU WOULDN'T START A HORSE CAR LINE

in this age of electric cars? Not if you wanted to make money out of the business of transportation.

Then why should you start a manual telephone exchange in this age of automatics, if you want to make money out of the telephone business?

The automatic system of telephony bears the same relation to the manual system that the electric car does to the horse car. It is the apotheosis of telephone development, as the electric car is of transportation development.

The automatic telephone system produces the best service more economically than indifferent service can be produced with manual equipment.

There is no more question as to the relative popularity of the automatic and manual telephone service where the two kinds are in competition than there is as to the relative popularity of the trolley car and the horse car.

And, as for the securities—the same comparison may be applied with the same results.

Our automatic system has been adopted in the following cities:

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Akron, Ohio.
Albuquerque, N. M.
Allentown, Pa.
Auburn, Me.
Auburn, N. Y.
Battle Creek, Mich.
Bellingham, Wash.
Berlin, Germany.
Buxton, Iowa.
Cadillac, Mich.
Champaign, Ill.
Chicago, Ill.
Clayton, Mo.
Cleburne, Texas.
Columbus, Ga.
Columbus, Ohio.
Dayton, Ohio.
El Paso, Texas.
Fall River, Mass.
Ferguson, Mo.
Grand Rapids, Mich.
Hastings, Neb.
Havana, Cuba.
Hazleton, Pa.
Hopkinsville, Ky.
Jonesboro, Ark.
Lake Benton, Minn.
Lewiston, Me.
Lincoln, Neb.
Los Angeles, Cal.
Manchester, Iowa.
Marianao, Cuba.
Marion, Ind.
Medford, Wis.
Miamisburg, Ohio.
Mount Olive, Ill.
New Bedford, Mass.
Oakland, Cal.
Ocean Park, Cal.
Pentwater, Mich.
Portland, Me.
Portland, Ore.
Princeton, N. J.
Richmond, Ind.
Riverside, Cal.
San Diego, Cal.
San Francisco, Cal.
Santa Monica, Cal.
Sioux City, Iowa.
South Bend, Ind.
Spokane, Wash.
Springfield, Mo.
St. Marys, Ohio.
Tacoma, Wash.
Toronto Jct., Can.
Traverse City, Mich.
Urbana, Ill.
Van Wert, Ohio.
Walla Walla, Wash.
Watch Hill, R. I.
Wausau, Wis.
Westerly, R. I.
Wilmington, Del.
Woodstock, N. B., Can.

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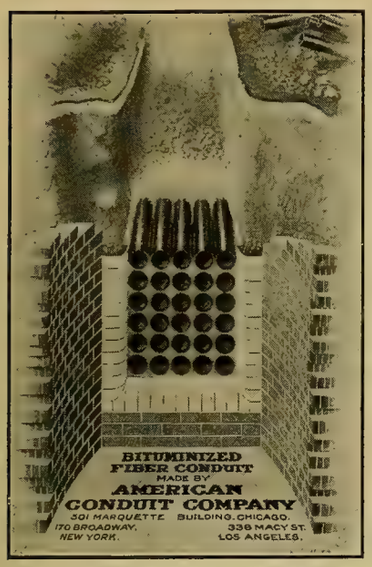

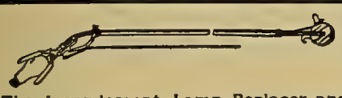

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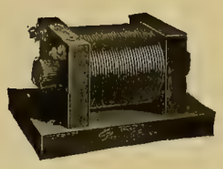

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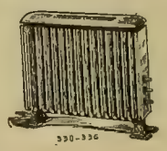

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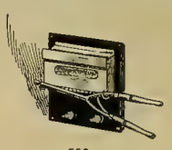

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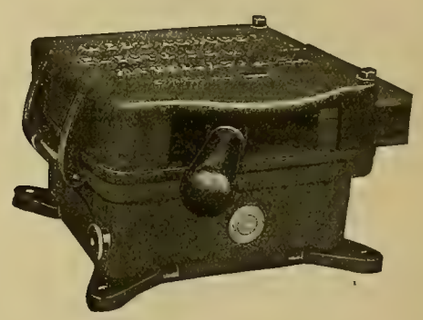

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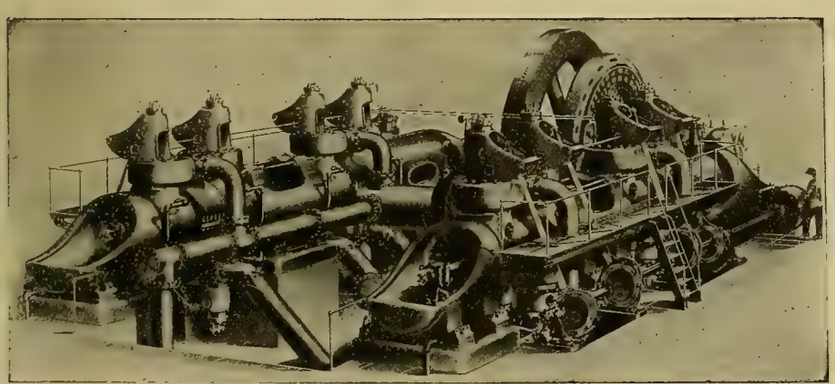

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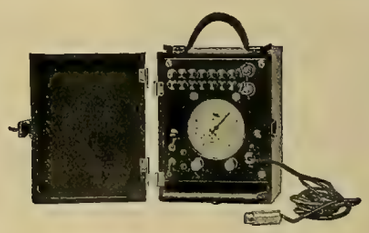
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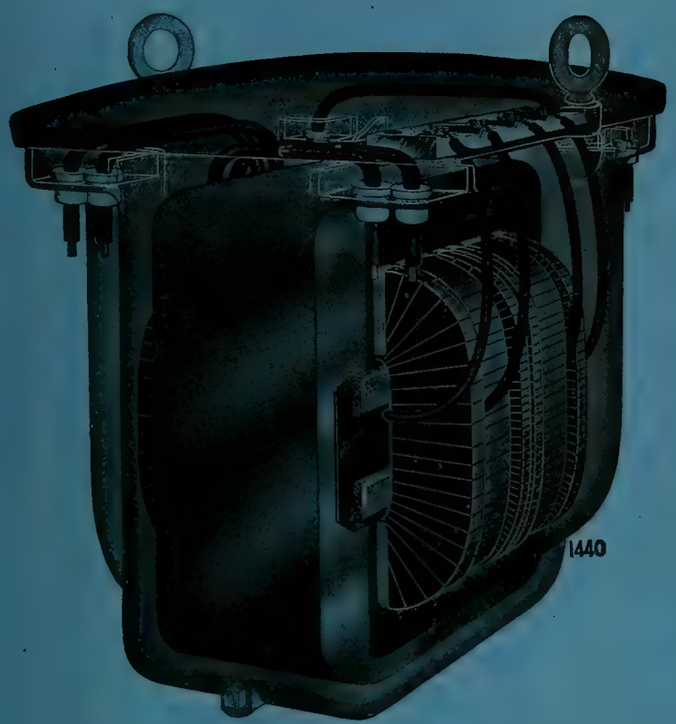

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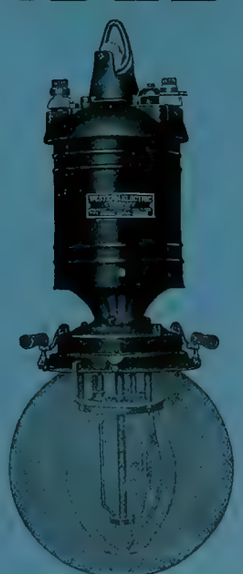

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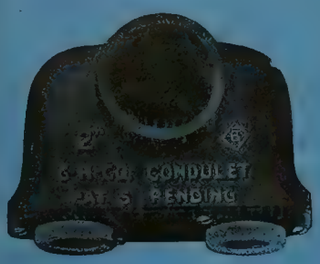

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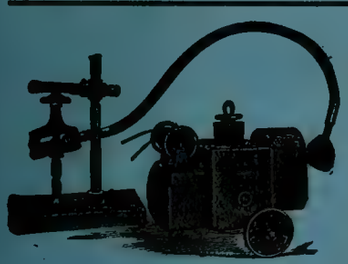

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199 LAKE ST., CHICAGO

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THE PLUME & ATWOOD MFG. CO.

New York Chicago

ALLIS-CHALMERS CO
MILWAUKEE WIS U S A

Where the Responsibility for Complete Power Equipments is Divided

The Results can Hardly Be as Satisfactory as When the Machinery is all Designed, Built and Installed by One Company

How is it Possible to Realize the Highest Efficiency Except Through Harmonious Working of Every Detail

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Any Efficiency Short of the Highest Attainable Means Proportionate Loss

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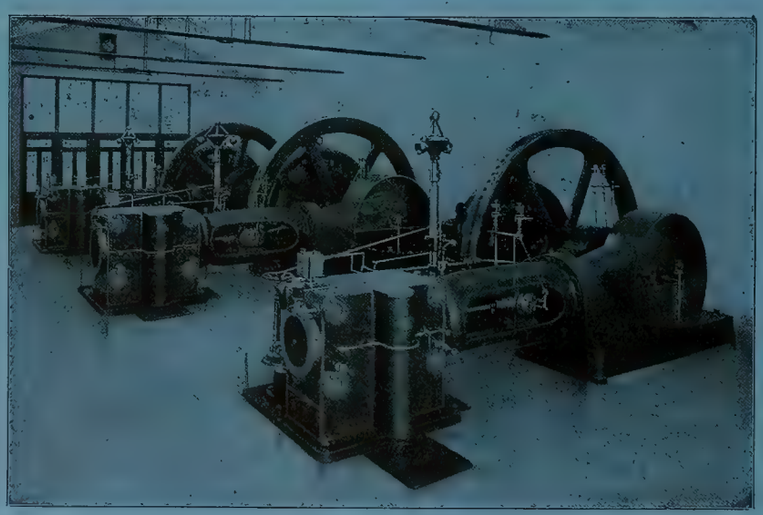

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Allis-Chalmers Heavy Duty Engines Driving Allis-Chalmers Direct Current Generators

We Take Complete Contracts for Equipping Power Stations Electric Lighting Plants and Electric Railway Lines

For the Power House Choose Whichever Type of Prime Mover Best Suits Your Requirements

STEAM TURBINE RECIPROCATING STEAM ENGINE HYDRAULIC TURBINE GAS ENGINE

WE WILL BUILD THE COMPLETE GENERATING UNIT ESPECIALLY DESIGNED FOR THE SERVICE AND FURNISH ALL AUXILIARY ELECTRICAL EQUIPMENT

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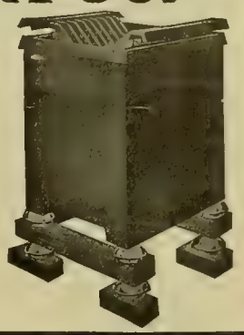
"Chloride Accumulator"

For Central Stations, Electric Railways, Isolated Lighting and Power Stations, Fire Alarm, Telegraph, Train Lighting, etc., etc.



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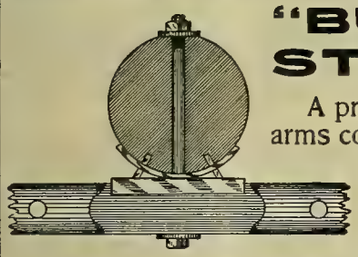

A pressed steel support for cross arms consisting of two plates, one engaging the arm and the other the pole. It provides a means of mounting arms without cutting gains. It strengthens the arm and pole. It facilitates the placing and alignment of cross arms. It saves braces on four and six pin arms. It can be purchased at a cost slightly exceeding the cost of cutting a gain. It is made for telephone and standard arms and will fit any pole.

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WE HAVE CAUSE TO BE PROUD OF OUR MOTORS AND GENERATORS

Let us send you a list of users in the Chicago territory. It is an eloquent proof of the confidence our customers have in **C-W** apparatus.

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COMPANY
ALTERNATING AND DIRECT CURRENT MACHINERY
AMPERE, N. J.
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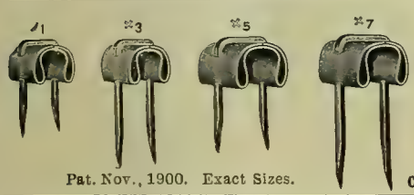

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Universal Exposition
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ELECTRIC SECOND-HAND MACHINERY STEAM

These machines are in excellent operating condition and are offered at *very low prices*.
They consist of Motors of various makes, Generators, Direct Connected D. C. Units, Engines, etc.
Prices and all necessary information will be promptly given on request.

CHICAGO EDISON COMPANY

Telephone Main 1280. Edison Building, 139 Adams Street, CHICAGO

Why Do We Succeed?

WE KNOW, but you don't

INVESTIGATE FOR YOURSELF

There have been fakes and fakirs in the battery business. Therefore, we do not ask you to accept our unsupported statement.

Any test which you may make with a **"Fleur de Lis"** Dry Cell will support it and will make you believe in the **FRENCH STUFF.**

Four Types No. 6 Cells, 2½x6.

Bell Type **Ignition Type**
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FRENCH BATTERY COMPANY
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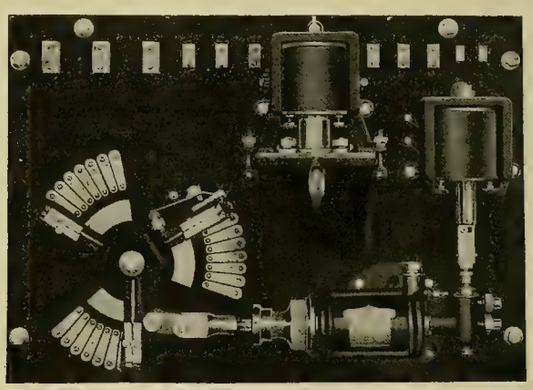
Problems in Alternating Current Control

are made simple by the use of C. & H. Self Starters, which are built for single, two or three phase motors.

The accompanying illustration shows a Starter for a squirrel-cage type Alternating Current Motor.



These Starters are built to be operated by either a float switch or pressure regulator when used in conjunction with pump motors.

Bulletin 33 Starters are designed for small A. C. motors which can be thrown directly across the line. They consist simply of a solenoid-operated oil switch suitably mounted and controlled by a snap switch, or automatically by a float switch or pressure regulator.

Bulletin 34 and 35 Starters are for squirrel-cage or slip-ring type motors respectively, the rheostat lever being moved automatically by air or hydraulic pressure.

The Cutler-Hammer Mfg. Co.
MILWAUKEE
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THE BRIGHTEST IN THE FIRMAMENT
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AITON MACHINE CO.

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126 LIBERTY ST., NEW YORK
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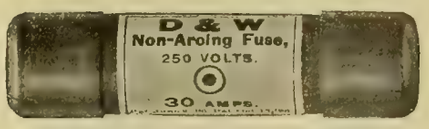
Type C indicating fuse before blowing

FOR ANY CIRCUIT



Type C indicating fuse after blowing

D. & W. ENCLOSED FUSES

Equally well adapted and effective on Lighting, Heating, Power, Railway Signal, Telephone and Telegraph Circuits.

RELIABLE ***ACCURATE*** ***EFFICIENT***

Complete line carried in Chicago stock.

Central Electric Company,

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NOW MADE UP TO 20 AMPERES
FOR ALL VOLTAGES, DIRECT CURRENT

READS DIRECT IN K. W. HOURS

SIMPLE

ACCURATE

RELIABLE

PRACTICAL

LOWEST PRICED

NO COILS

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NO MECHANISM

NO TROUBLES

NO BURN-OUTS

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Less in quantities. Less under yearly contract.

IT WILL PAY YOU TO ORDER AT ONCE.

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Does not become brittle by repeated heating and cooling.

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Describes the J-E-M SHADE HOLDER
IT SAVES TIME, TEMPER AND TROUBLE
NO SCREW DRIVER, NO SCREWS, NO SAG, NO SLIP
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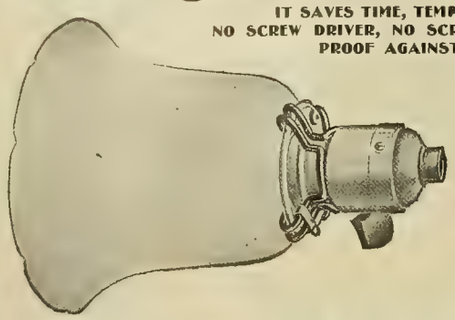

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Alton Machine Co.

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Chicago Edison Co.
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Kartavert Mfg. Co.
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Mica Insulator Co.
Munsell & Co., Eugene.
National India Rubber Co.
New York Insulated Wire Co
Okonite Co., The.
Phillips Insulated Wire Co
Simplex Electrical Co.
Standard Underground C. Co.
Vulcanized Fibre Co.
Wesco Supply Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.

Joints, Wire.
Cook, Frank B.

Lamps, Arc.
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Central Electric Co.
Ft. Wayne Elec. Wks. Inc.
General Electric Co.
Manhattan Elec. Supply Co.
Wesco Supply Co.
Western Electric Co.
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Lamp Guards.
Benjamin Elec. Mfg. Co.
Matthews & Bros., W. N.
Morse, Frank W.

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Bissell Co., The F.
Buckeye Electric Company.
Central Electric Co.
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Edison Decorative & Miniature Lamp Dept.
General Electric Co.
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Sawyer-Man Elec. Co.
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Western Electric Co.
Westinghouse El. & Mfg. Co.

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(See Wires and Cables.)

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Crocker-Wheeler Co.
General Electric Co.
Jeffrey Mfg. Co.
Wesco Supply Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.

Mining Machinery.
Allis-Chalmers Company.

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Hoffmann, Emil R.

Motors (See Dynamos and Motors)

Nippers and Pliers.
Klein & Sons, Mathias.

Paints, Insulating.
Massachusetts Chemical Co.

Patent Attorneys.
Bain, Foree & May.

Phosphor Bronze.
Phosphor Bronze Sm. Co. Ltd.
Seymour Mfg Co.

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Chicago Pneumatic Tool Co.
Wrigley Co., Thos.

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Baker & Co. Inc.

Poles, Arc Lamp.
Mott Iron Works, J. L.

Poles and Ties.
Berthold & Jennings.
Bissell Co., F. The
Bruer, Will F.
Fowler & Co., John H.
Kellogg Switch. & Sup. Co.
Lindsley Bros. Co., The.
Loud's Sons Co., H. M.
Mueller Company, William.
Pacific Coast Pole Co.
Perrizo & Sons.
Porter Cedar Company.
Sterling & Son, W. C.
Torrey Cedar Co.
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Worcester Co., C. H.

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Hoffman, Geo W.

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Artistic Porcelain Co.

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Plume & Atwood Mfg. Co.

Power Transmission Machinery.
Allis-Chalmers Company.
Jeffrey Mfg. Co.

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Rail Joint Company, The

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Highland Park College.

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Rossiter, MacGovern & Co.

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Jem Shade Holder Co., The.

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Haller Machine Co.

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Century Electric Co
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Western Electric Co.

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(See Cut-outs and Switches.)

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Telephone Service.
Chicago Telephone Co
Long Distance Tel. Mfg. Co.

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Bissell Co., The F.

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(See Bolts, Toggle.)

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Zeidler Lamp & Brass Co.

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Crocker-Wheeler Co.
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Marion Ins. Wire & Rub. Co.
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New York Insulated Wire Co.
Okonite Co., The.
Phillips, Eugene F.
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Roebling's Sons Co., J. A
Runzel-Lenz Elec. Mfg. Co.
Safety Ins. Wire & Cable C
Simplex Electrical Co.
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For Alphabetical Index of Advertisements See Page 8.

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HALL OF RECORDS, NEW YORK CITY

Habirshaw Red Core Wire Installed Throughout

OFFICE AND WORKS
YONKERS, N. Y.
W. M. HABIRSHAW
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Type for All Purposes
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P and S Sockets break the current in two parts of the circuit simultaneously. P and S Sockets, therefore, reduce one-half the energy of the arc.

This saves wear and tear.

That's one of the reasons why P and S *endure* while others expire.

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COMPLETE STOCK
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TO PROTECT THE TRADE
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WE WANT AND WARRANT YOUR BUSINESS

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The Dayton Electrical Mfg. Co.

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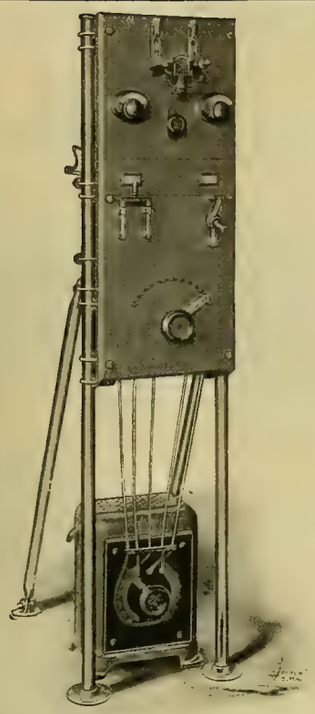
New and instructive catalogues on request; also our 5X Ready Reference List, the handiest possible thing for you.

General Electric Company



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More efficient—Lower operating cost—Simpler in operation—Occupy less floor space—In every way preferable to any other charging outfit

These panels are so designed that starting resistance is automatically cut out when starting switch is released.

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All large permanent adjustments are made by compensator steps.

Fine current adjustment throughout all parts of charge without affecting efficiency is made possible by use of regulating reactance.

The necessary amount of reactance used in the circuit is small and has no appreciable effect on the power factor of the circuit.

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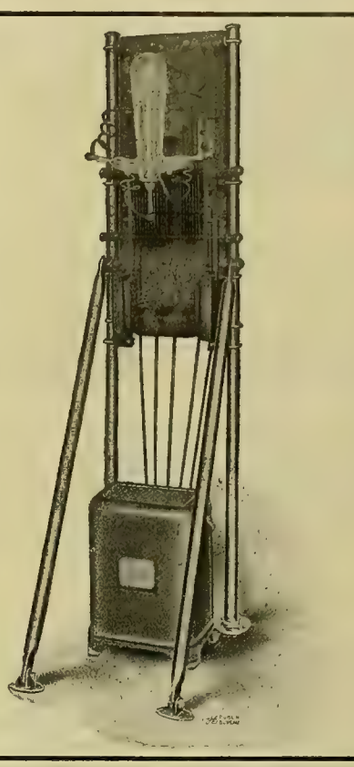

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1070

IT IS SAID THAT GLADSTONE SAID:

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IT IS TRUE, WHETHER GLADSTONE SAID IT OR NOT.

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ENCLOSED ARC CARBONS

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COLUMBIA CARBON PRODUCTS

$100.000 PENNA. CORPORATION

FIGHTING THE "ORGANIZATION"!

INTERESTING QUOTATIONS

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LOOK FOR THE PATENT PROTECTION LABEL IN THE STEM

Edison Ready-to-Use Electric Decorative Lighting Outfits

Excellent sellers during the holiday season because they afford such a convenient and beautiful method of decorating the Christmas tree. Useful on any occasion when decorative effects are desired for home or public entertainments. They are durable because made in a substantial manner from the best material.

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Offices in all of the principal cities 742

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Of all Qualities, in any Form at Lowest Prices

EUGENE MUNSELL AND CO.

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Micanite, Linotape, M. I. C. Compound, Empire Cloth and Paper. For Years the Standard.

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MICABOND

will save you money in your repair work as well as in your new machines. It is good insulation—made out of the best materials and is sold at reasonable prices.

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YOU NEED IT!

Gale's Commutator Compound.

The Only Article That Will Prevent Sparking.

Will keep the Commutator in good condition and prevent cutting. Absolutely will not gum the brushes.

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Are easy to sell. You make a fine profit. Everybody with an electric sign wants one. Write us today for particulars and prices. Also pointers on electric signs.

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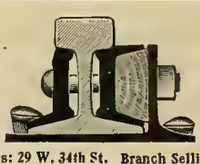

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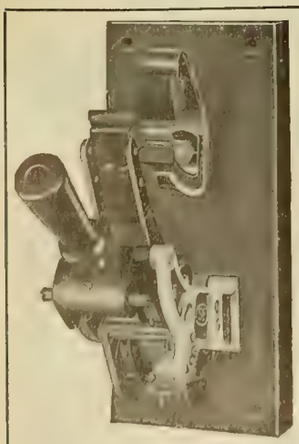

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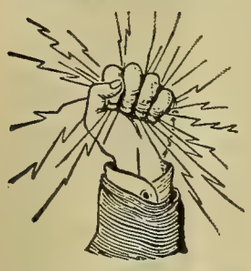
PROVIDENCE, R. I.



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FOR
ARC LAMP AND TROLLEY CORD
SAMSON CORDAGE WORKS, BOSTON, MASS.

Anchors that hold

Showing the 5, 6 and 7 in. style.

Holds 12,500, 15,000 and 17,500 lbs. respectively.

Popular with Street Railway, Electric Light and Telephone Companies.

The 5, 6 and 7 inch
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HAVE NO WELDS

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The rods of Stombaugh Guy Anchors are not weakened by holes for pins or rivets.

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"O. K." Weatherproof Wire.
Slow-Burning Weatherproof and Ideal Wire.

Prices and Samples on Application.

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Save time and money over cast iron boxes, which require filing or reaming.

Our boxes are drawn from one piece of sheet steel under heavy pressure which renders them absolutely indestructible. Send for new booklet.

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We offer you a strictly first class lamp at a reasonable price — **and that price is less than the "association price."**

It is "up to you," Mr. Lamp Buyer.

Ours is a New Lamp, but we know the business. Give us a trial and we will prove our proposition so you will stay with us.

As we mean business and want your trade, we urge you to "look us up," to investigate us fully, financially and otherwise, and we, therefore, refer you to the First National Bank of Emporium, Pa., and the Farmers & Merchants Bank of St. Marys, Pa.

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SERVICE is what is wanted in a Battery and the *best* service is *always* given by the

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NEW PATENT
DRY CELLS

Made of the right material by experts and subjected to thoro tests, every Rock Island CELL that leaves our factory is really given a certificate of character, for our trademark is as good as a warranty deed for dependability.

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Our standard No. 8 for all high class work—gasoline and gas engines, and telephone exchanges—has given eminent satisfaction. Standard No. 6 is the battery for general purposes. No. 8 costs more, but is really cheaper because it lasts longer.

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POSITION WANTED

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One 62 K. W. 250-volt, one 50 K. W. 125-volt direct-connected dynamos and engines.

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1	1500	General Electric, 75 K.W., three-phase, 3300 volts.
1	1500	Warren-Medberry, 75 K.W., two-phase, 1100 or 2200 volts.
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125 TO 133 CYCLES

	Lights	
1	900	Westinghouse, 45 K.W., latest type.
1	1200	Westinghouse, 60 K.W., 1100 volts.
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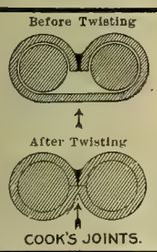

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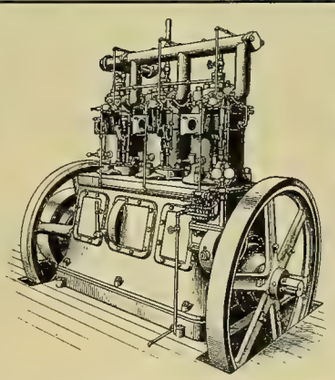

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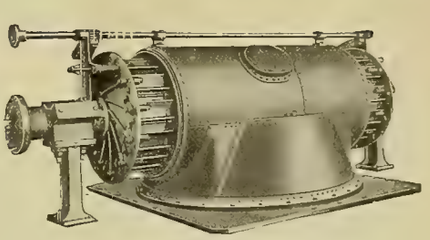

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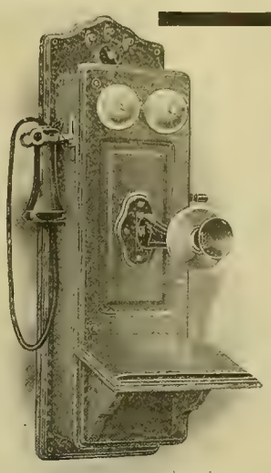

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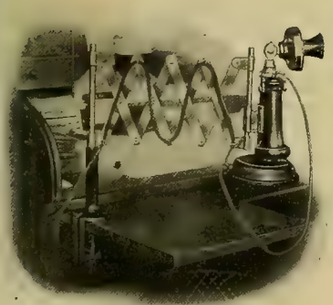

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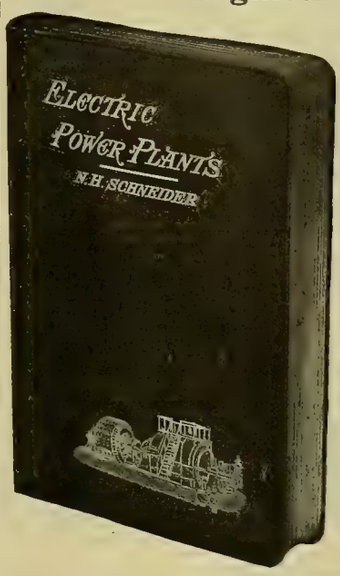

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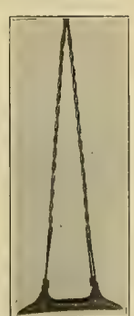

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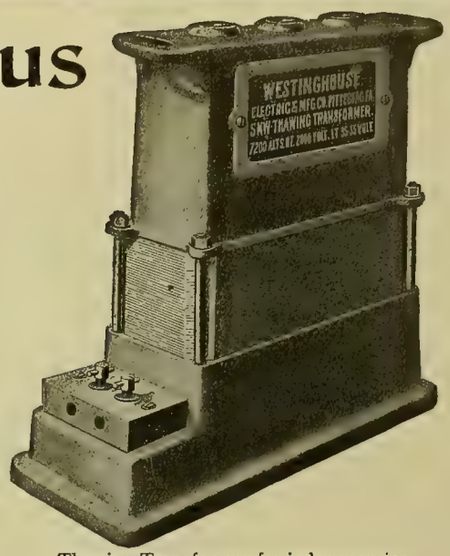

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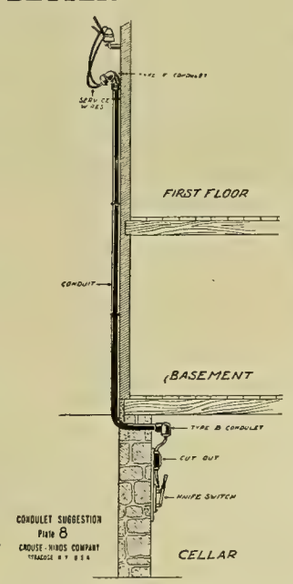

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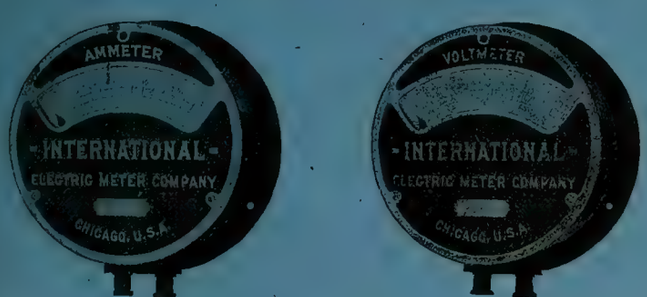

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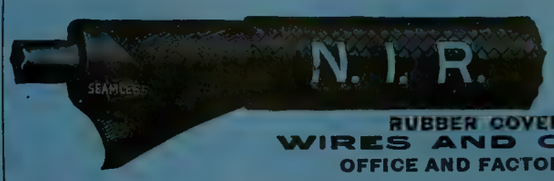

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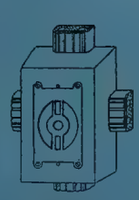
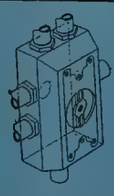
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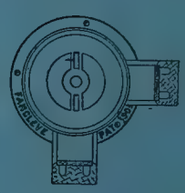
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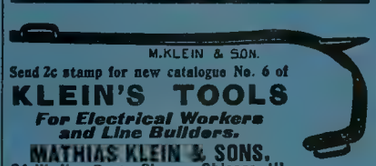
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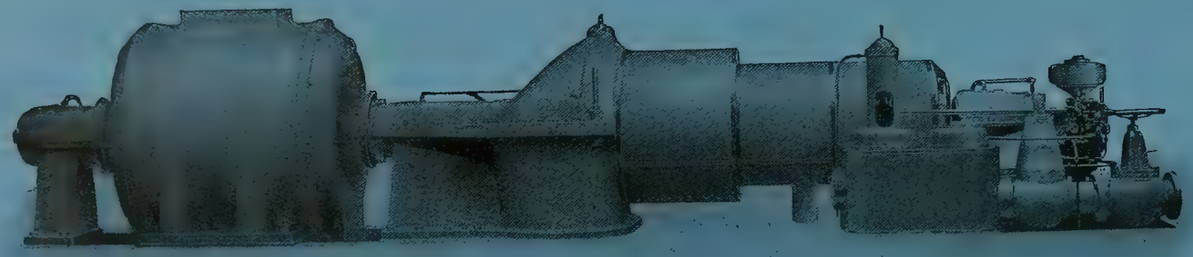

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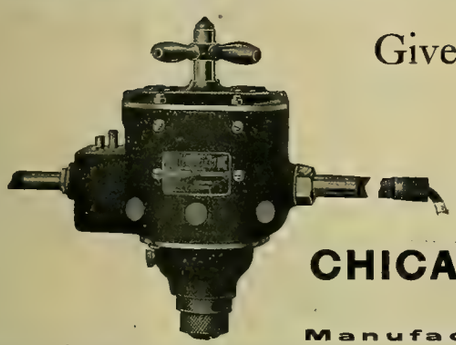

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These machines are in excellent operating condition and are offered at *very low prices.*
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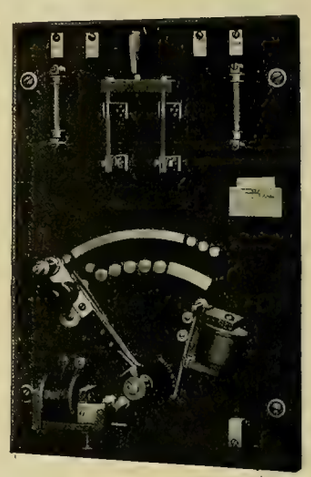

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"Prometheus"

Electric Cooking
And
Heating Apparatus

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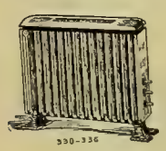

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Workmanship
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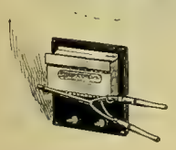

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Consumption
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Heating Apparatus

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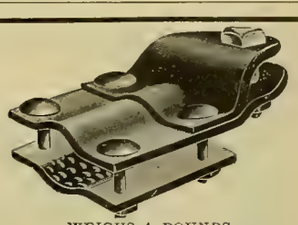

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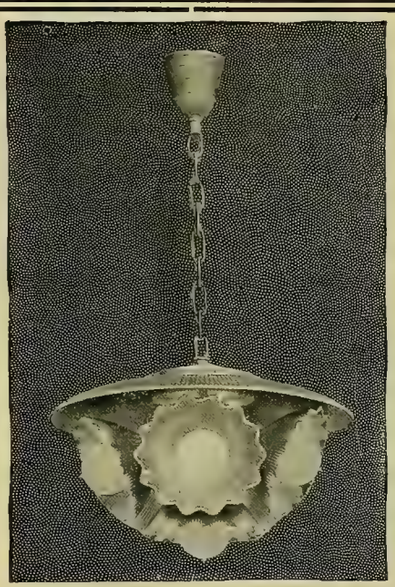

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Prices, discounts and circulars with full particulars furnished upon application.

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Bulletin No. 63 T gives list of **C-W** *users.*

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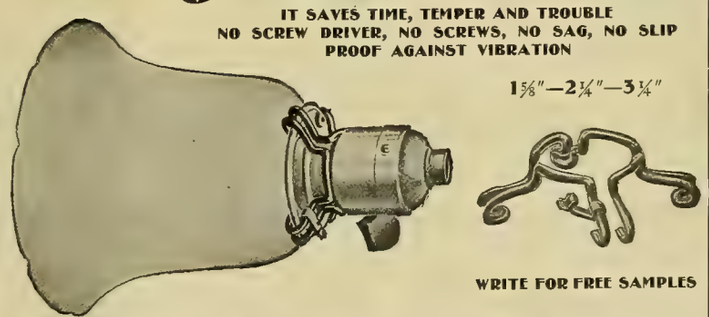

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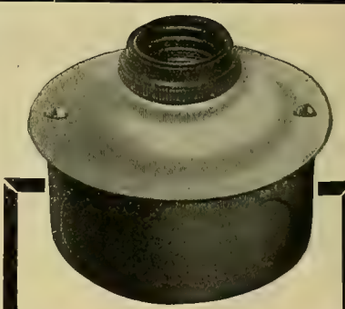

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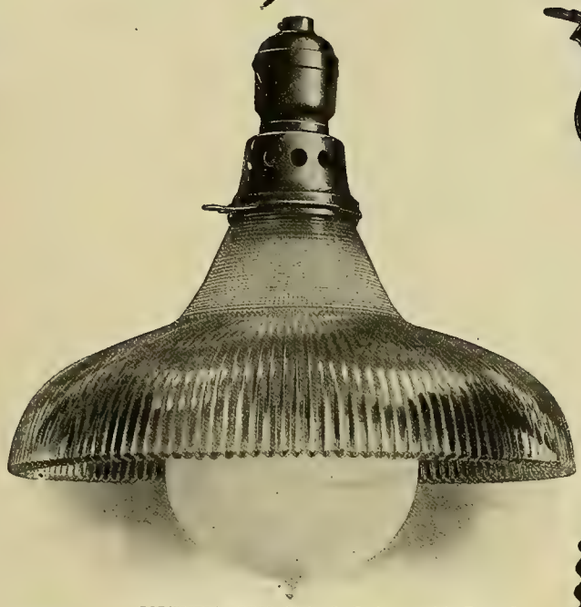

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NOTICE IS HEREBY GIVEN

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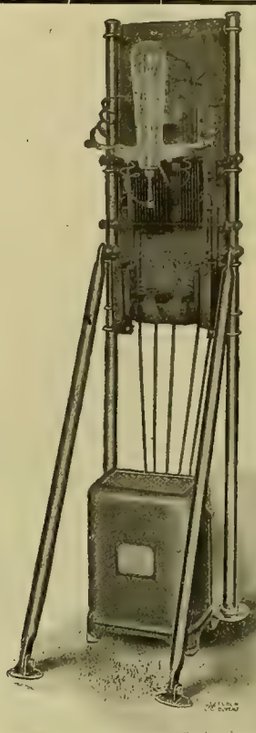

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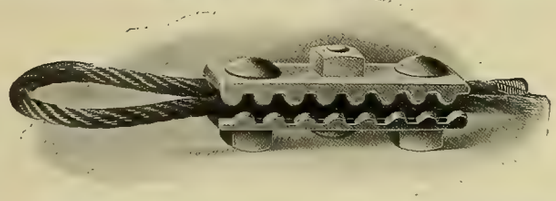

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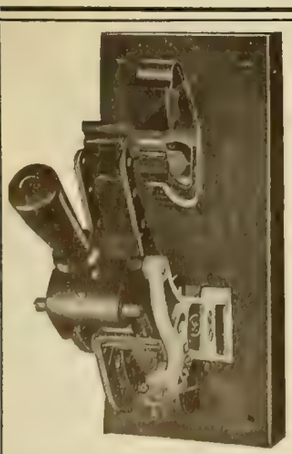

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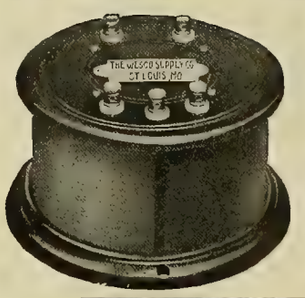

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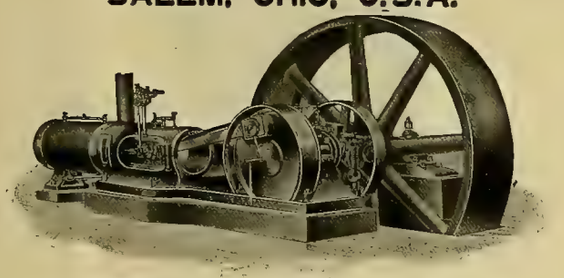

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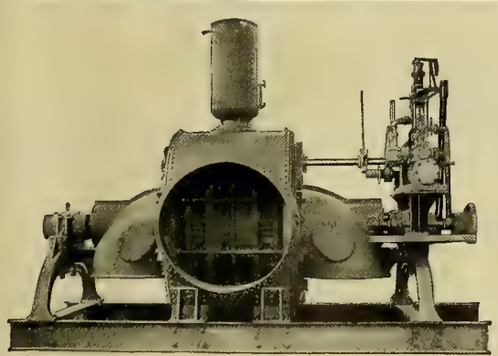

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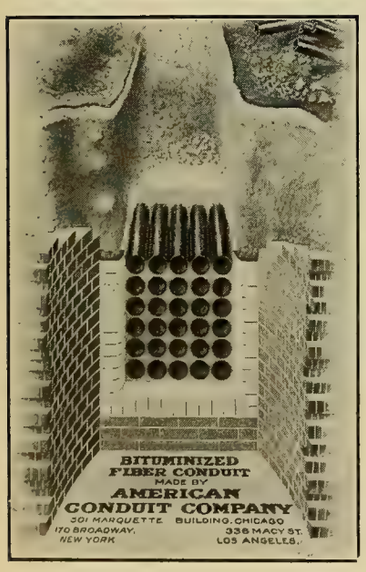

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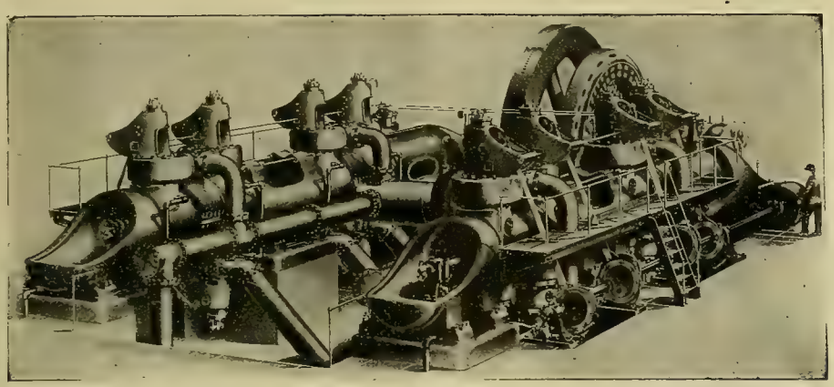

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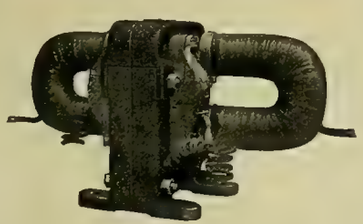

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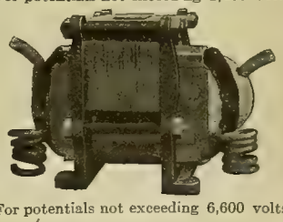

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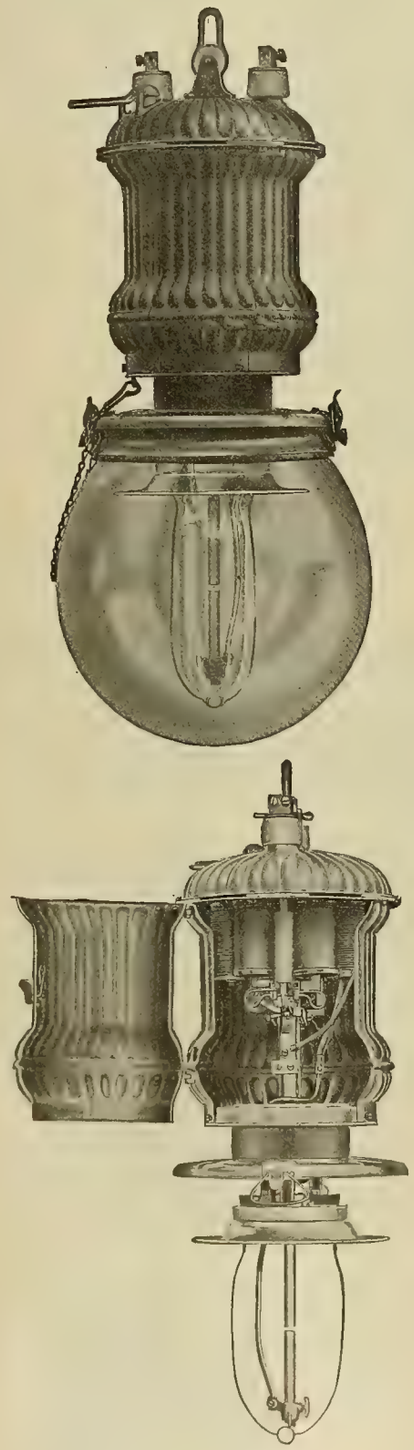

Some Details

Ventilation. The ultimate temperature rise is so low, namely, 45° centigrade, that practically no ventilation is required in the case, making the lamps storm and insect proof.

Insulation. Each lamp is thoroughly insulated between the terminals and frame. The construction is such that insulation is required in only a few places to insulate the controlling and operating mechanism from the housing, practically eliminating the insulation troubles which are so frequent in other lamps.

Alignment. No one part depends upon another for its alignment. A lamp can be taken apart and reassembled by an inexperienced person.

Housing. The housing, which forms the frame, is made from very heavy sheet copper pressed into shape, combining great strength and rigidity with a pleasing ornamental effect. A door is provided for the inspection and adjustment of the mechanism.

Switch. A switch is provided for cutting out the lamp when desired. It is contained in the top of the lamp housing and has no movable leads or other connections to become grounded or broken.

Binding Posts. The binding posts are located on the top of the lamp in square receptacles to prevent turning. They are insulated from the housing by large porcelain pieces similar to petticoat insulators, insuring the least possible trouble from leakage and breakage.

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Baltimore Cincinnati Denver Minneapolis Philadelphia Salt Lake City Syracuse
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MOST ECONOMICAL WAYS

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"Wood" Systems — Fort Wayne, Ind.

520

INDESTRUCTIBLE ARC LAMPS

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No Rewinding of Magnets

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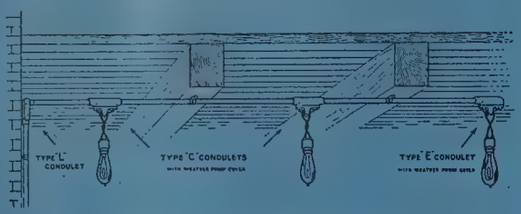

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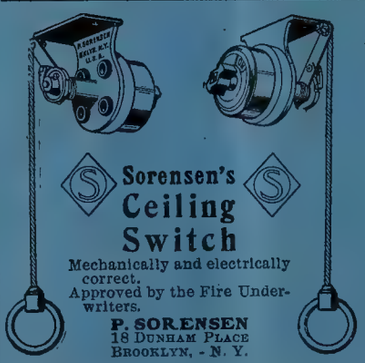

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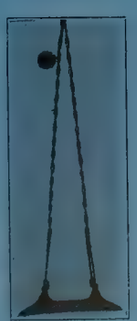

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Western Electrician

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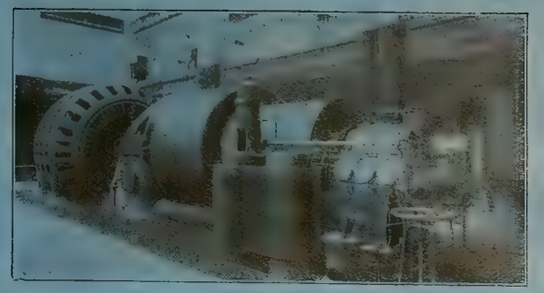

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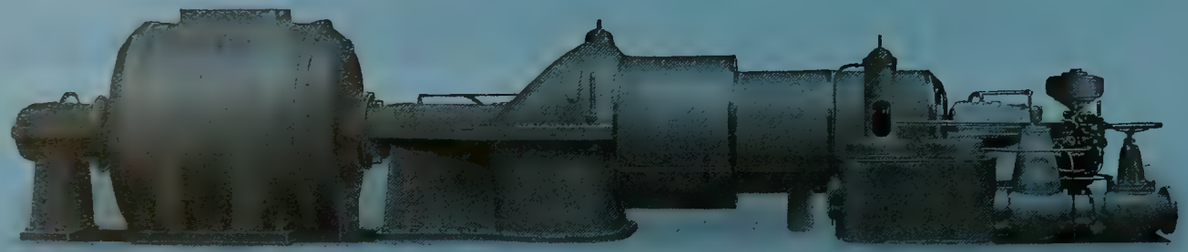
Are demonstrating in daily service that they have no equal on this continent.



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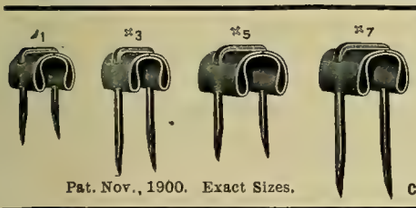

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These machines are in excellent operating condition and are offered at *very low prices*.
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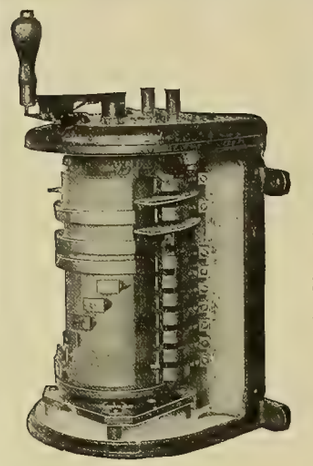

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THE MOTOR CONTROLLER

C & H Drum Controllers for machine tools always give satisfaction. **Why?**

They give absolute control of the motor through a wide range of speeds.
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Take up minimum space on machine tool.
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WORKS: HARRISON, N. J.

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Get our figures on genuine Locust before buying some other kind which will rot quick. Locust lasts.

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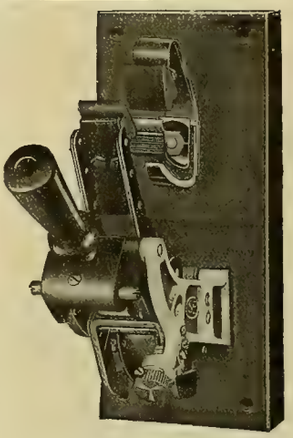

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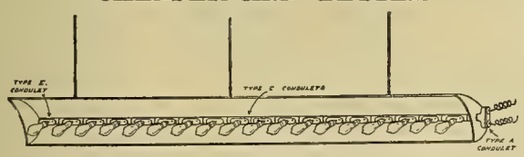

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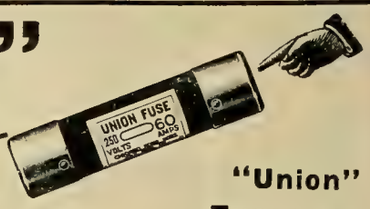

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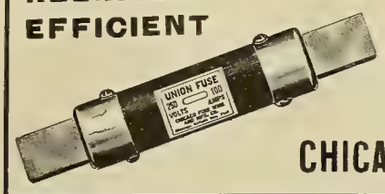

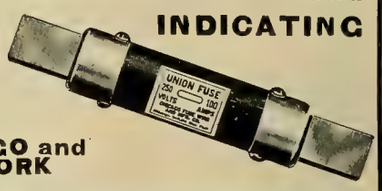

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This style holds up to 17,500 lbs.

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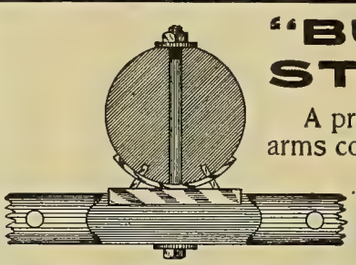
NO WELDS. NO BACK PULL TO SET THEM.



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A pressed steel support for cross arms consisting of two plates, one engaging the arm and the other the pole. It provides a means of mounting arms without cutting gains. It strengthens the arm and pole. It facilitates the placing and alignment of cross arms. It saves braces on four and six pin arms. It can be purchased at a cost slightly exceeding the cost of cutting a gain. It is made for telephone and standard arms and will fit any pole.

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STEEL GAIN MANUFACTURING CO.
10 South Clinton St. Chicago, Ill.

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COMPLETE STOCK
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TO PROTECT THE TRADE
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DO IT NOW!

It will be a notable contribution to technical journalism, and of the greatest importance to the entire electrical fraternity. Send in your order and copy TODAY.

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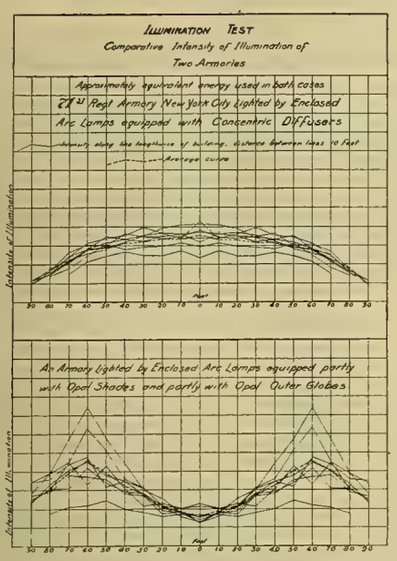
General Electric Company

ILLUMINATING ENGINEERING



A COMPARISON

This graphical comparison of curves of illumination intensity shows the results of actual tests made with the candle-foot photometer in two armories differently lighted but using the same energy per square foot of floor area.

The single example shown here is typical of many where the use of the combination of General Electric arc lamps with concentric diffusers has improved the illumination of large and small interiors.

The decision of the engineer who advocates the use of concentric diffusers with enclosed arc lamps is well fortified by such results.

1121

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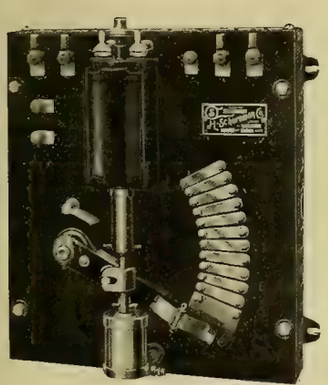

Type "A" Starter

The bottom segment on this starter is made of insulating material. By means of a "lost motion" arrangement in the vacuum dashpot, the contact arm jumps to the first copper segment as soon as the solenoid is energized. As the circuit is thus made and broken positively, no additional solenoid or magnet switch is required. Prices on request.

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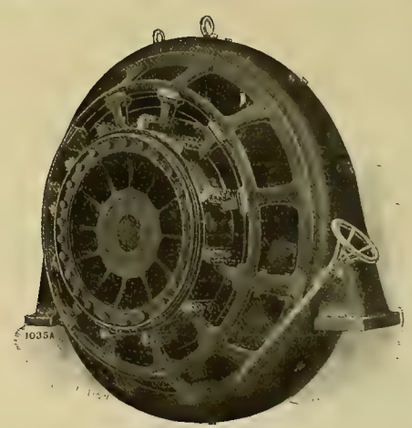
Lighting—Power and Railway Service



300 Kw. Engine Type Generator

Large Overload Capacity
High Efficiencies
Modern Design

National Brake & Electric Co.

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Edison Ready-to-Use Electric Decorative Lighting Outfits

Useful all the year around for adornment of table or house. The only safe means of illuminating Christmas trees or other inflammable decorations. Get the Edison outfit—the most attractive holiday specialty. Always ready, always complete.

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Reduces the working capacity of a motor or dynamo, wears out the commutator, wastes power and may cause a fire. All this may be avoided if you use . . . . . .

The only article that will PREVENT SPARKING. Will keep the Commutator in good condition and PREVENT CUTTING.

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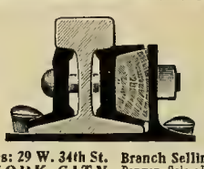

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FOR ALL VOLTAGES, DIRECT CURRENT

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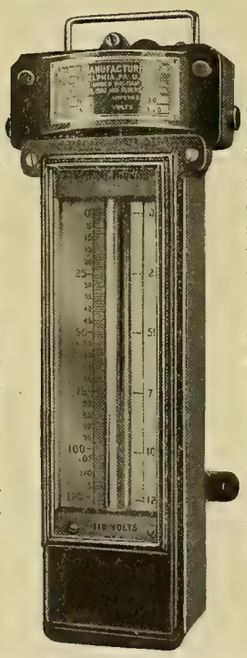

The Bastian consists simply of an iron case, a glass tube, two nickel electrodes and a plain scale.

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¶ Nature's law of electrolysis guarantees its accuracy and that it will positively register even the smallest current.

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The Bastian is not to be confused with obsolete types based on same electrolytic law, but where a deposit had to be weighed.

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IT WILL PAY YOU TO ORDER AT ONCE.

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Western Electrician
507 Marquette Building, Chicago

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POSITION WANTED

By young man who has ten years' experience in the Electrical Supply business. Capable of taking any inside position or will accept position as traveling salesman. Have had experience as purchasing agent, sales manager and both corresponding and traveling salesman. American nationality, married and am 29 years old, and can furnish best of references. Address Box 677, care Western Electrician, 507 Marquette Building, Chicago.

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On account of building a brand-new light and power plant, this company will sell at a bargain, for delivery immediately after March 1st next, the entire equipment of the present plant, consisting of boilers, engines, generators, switchboards, etc. Call on or address us for particulars and prices. Palestine Electric Light Company, Palestine, Texas.

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Treasury stock in electrical supply and contracting company, located in one of the best cities in the Southwest. Business during 1906 amounted to $20,000 and additional capital needed to take care of the increase next year. Parties who will take an active part in the business will be given preference, and they must be experienced. Address Box 678, care of Western Electrician, 507 Marquette Bldg., Chicago, Ill.

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SPECIAL BARGAINS
TELEPHONE RINGERS

	H.P.		R.P.M.	Each.
6	1/6	Crocker-Wheeler,	110-80v 1,000	$10.00
45	1/6	Roth,	110-80v 1,000	10.00
6	1/6	Roth,	220-80v 1,000	10.00
1	1/4	Crocker-Wheeler,	500vdc 110vac	20.00
1	1/2	Crocker-Wheeler,	500vdc to 75vac	25.00
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3	2	Crocker-Wheeler,	110vdc to 6vdc	60.00

Every one as good as new. Send for our **Monthly Bargain Sheet** showing complete list of machines on hand, with net prices.

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Complicated and Difficult Dies
and tools, heavy punch press and sheer work, accurate machine and novelty construction. MULTI-VENDING CO., 198 S. Clinton Street, Chicago, Ill.

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1448—70 K. W. Thomson-Houston, 2,200 volt, class A-70, 515 RPM.

60-Cycle, 2-Phase.

1763—240 K. W. Stanley, 1,200-2,400 volt, 450 RPM.
1791—135 K. W. Stanley, 2,300 volt, 900 RPM.
7232—75 K. W. Westinghouse 2,200 volt, 720 RPM.

60-Cycle, Single-Phase.

7546—Two 300 K. W. Bullock, 110 volt, 16 poles, 465 RPM.
7634—Three 180 K. W. General Electric, 1,040 volt, type A. S., form A, 600 RPM.
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1219—75 K. W. Westinghouse, 2,200 volt, class 10-75 900.

125-133-Cycle, Single-Phase.

6300—300 K. W. Westinghouse, 1,100-2,300 volts.
1279—120 K. W. Westinghouse, 1,100-2,200 volts, class 12-120-1375.
1344—90 K. W. General Electric, 2,300 volt, type A-6, class 12-90-1250.

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25-cycle, 60-cycle, 133-cycle, single-phase, 2-phase and 3-phase of various sizes and makes. Write for prices. Let us know your needs and we will quote you low prices.

Machinery For All Power Station Purposes.

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NORTHERN VARIABLE SPEED MOTOR drives for all kinds of machine tools, fans, pumps, blowers, etc., enable increased production and reduced operating costs. Northern variable speed apparatus operates from any ordinary 2-wire single-voltage power circuit and affords variations as high as 6 to 1.

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771

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"SAFETY" RUBBER COVERED WIRE AND CABLE
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THE SAFETY INSULATED WIRE & CABLE CO.
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COMBINATION OF
Stow Flexible Shaft
—AND—
MULTI-SPEED MOTOR
Practically dust and water proof. For Portable Drilling, Tapping, Reaming, Emery Grinding, etc. Write for Catalogue and Prices.
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Gen'l European Agents, Selig, Sonnenthal & Co., 85 Queen Victoria Street, London, England

DEPARTMENT OF THE INTERIOR, Office of Superintendent U. S. Capitol Building and Grounds, Washington, D. C., November 21, 1906. Pursuant to the directions of the Commission of the House of Representatives, etc., advertisement is hereby made for sealed proposals (in duplicate) for the furnishing and erection of apparatus to completely equip the heating, lighting and power plant for the Capitol building and other buildings, which apparatus will consist of engines, generators, switchboards, boilers, pumps, condensers, steam fitting and all other necessary appliances to connect the same in the several parts, and for complete sub-station apparatus for the various buildings. Proposals for the first section of the work, that is, for prime movers and generators and sub-station apparatus and complete switchboard equipment therefor, will be received and opened at the above office on Wednesday, the 26th day of December, 1906, at twelve o'clock noon, and publicly opened. Subsequent proposals will be received for the other apparatus, and the date of opening will be stated in the specifications. Applications for plans and specifications may be made at once, and the issuance will be in the discretion of the Superintendent. Bidders will be required in the first instance to furnish with their proposal a certified check or surety bond in the sum of five per cent of the amount of their bid. A certified check in the sum of $50.00 will be required as a guarantee for the return of plans and specifications. The right is reserved to reject any or all bids, and to waive technicalities and informalities. Elliott Woods, Superintendent U. S. Capitol Building and Grounds. Approved: E. A. HITCHCOCK, Secretary.

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in sheet, wire, rods blanks, etc.
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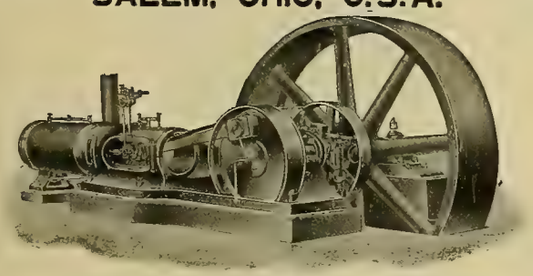

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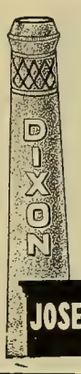

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Get free sample 125-C.

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Gateage	Head	R. P. M.	Cu. Ft. per Sec.	H. P.	Efficiency
Full	13.27	109	247	310	83.58%
15-16	13.50	104	235	304	84.60%
⅞	13.79	101	223	296	85.01%
13-16	14.18	100	209	280	83.56%
¾	14.69	100	189	254	81.06%
11-16	15.12	102	174	239	80.86%

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Single line : : : :	$75.00 per annum
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Direct line, 20 cents per day, including 4 calls
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Two-party line, 10 cents per day, including 1 call
Two-party line, residences only, 10 cents per day
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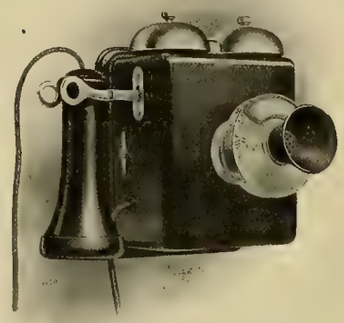
QUALITY

is of first importance and is essential to reliable and efficient service

Estimates promptly furnished on complete systems for manufacturing plants, hotels, etc.



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Also complete systems for steam, electric and interurban railways, mining systems, etc.

Designers and Builders of Telephone Apparatus of the Highest Grade for all classes of service. Our knowledge and experience are at your command.

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we will send you a
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Moonlight Schedule
for 1907.
Every lighting man
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507 Marquette Bldg., Chicago.

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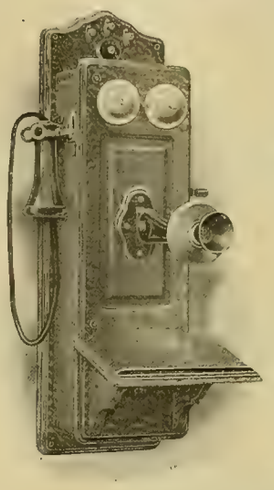

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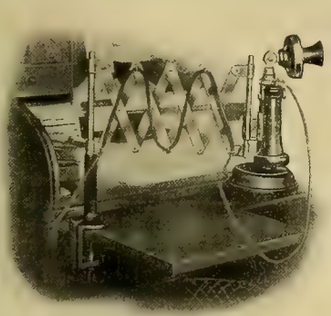

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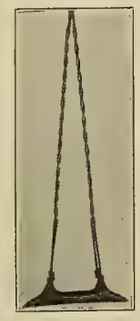

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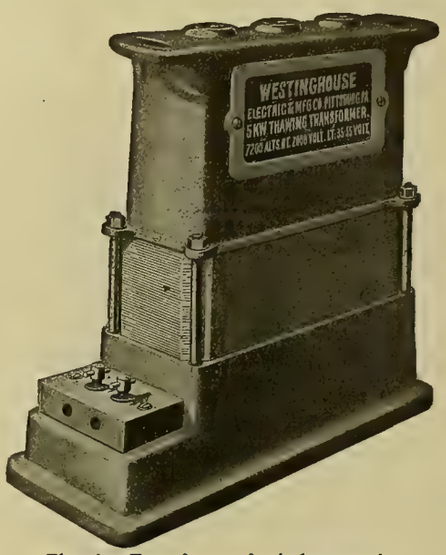

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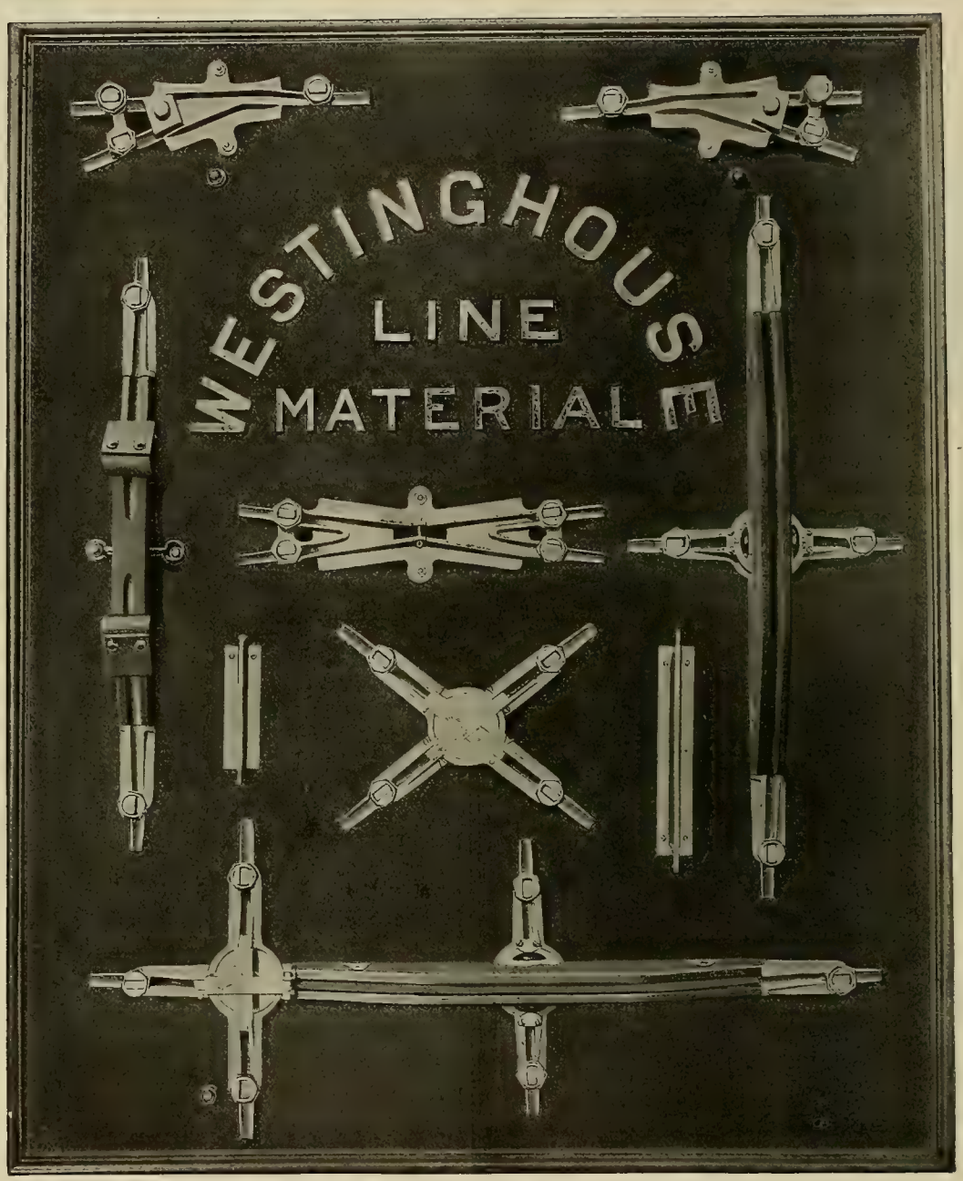

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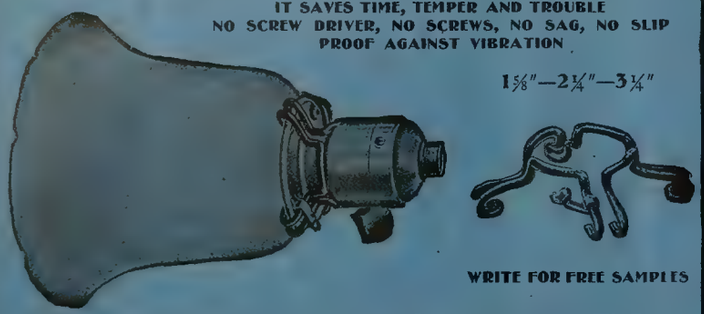

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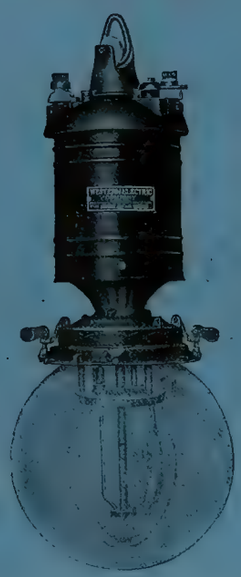

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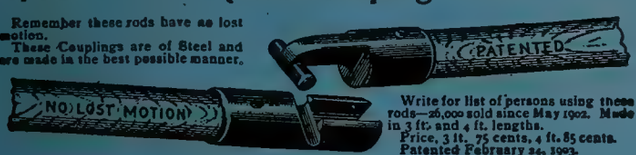

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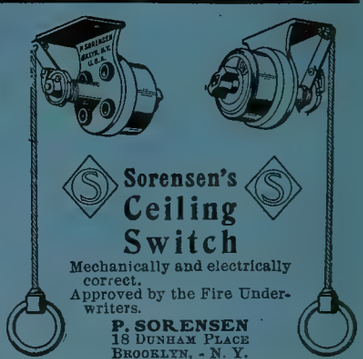

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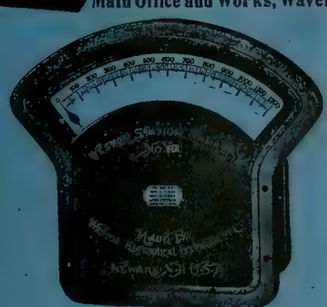

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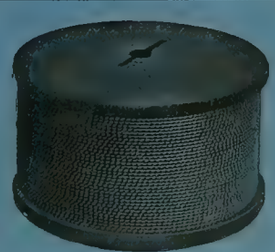

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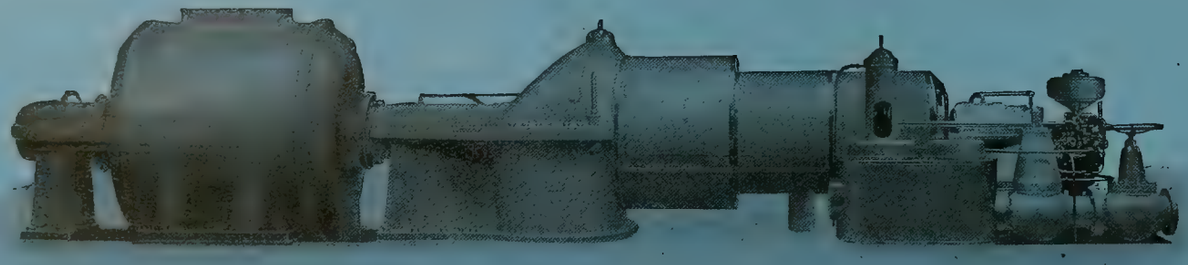

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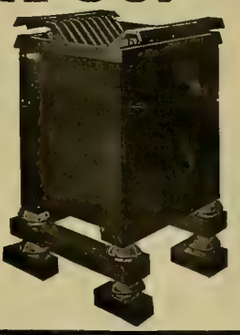

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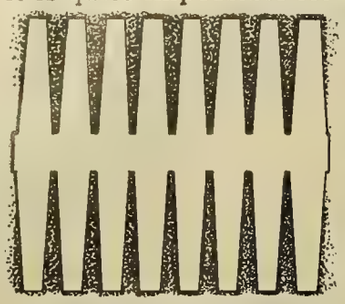

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Western Electric Company.

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Phoenix Glass Co.
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Acme Wire Co.

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Insulators and Insulating Materials
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Chicago Edison Co.
Haines, J. Allen, Inc.
Indiana Rub. & Ins. Wire Co.
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Mica Insulator Co.
Munsell & Co., Eugene.
National India Rubber Co.
New York Insulated Wire Co
Okonite Co., The.
Phillips Insulated Wire Co
Simplex Electrical Co.
Standard Underground C. Co.
Vulcanized Fibre Co.
Wesco Supply Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.

Joints, Wire.
Cook, Frank B.

Lamps, Arc.
Bissell Co., The F.
Central Electric Co.
Ft. Wayne Elec. Wks. Inc.
General Electric Co.
Manhattan Elec. Supply Co.
Wesco Supply Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.

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Benjamin Elec. Mfg. Co.
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Morse, Frank W.

Lamps, Incandescent.
Bissell Co., The F.
Buckeye Electric Company.
Central Electric Co.
Chicago Edison Co.
Columbia Incan. Lamp Co.
Economy Electric Co.
Edison Decorative & Miniature Lamp Dept.
General Electric Co.
Novelty Incan. Lamp Co
Sawyer-Man Elec. Co.
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Western Electric Co.
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Lamps, Incandescent—Replacers & Cleaners.
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General Electric Co.
Manhattan Elec. Supply Co.
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Multi Vending Co.

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Magnet Wires.
(See Wires and Cables.)

Mica.
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Mica Insulator Co.
Munsell & Co., Eugene.

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Allis-Chalmers Company.
Crocker-Wheeler Co.
General Electric Co.
Jeffrey Mfg. Co.
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Western Electric Co.
Westinghouse El. & Mfg. Co.

Mining Machinery.
Allis-Chalmers Company.

Model and Machine Shop.
Hoffmann, Emil E.

Motors (See Dynamos and Motors)

Nippers and Pliers.
Klein & Sons, Mathias.

Paints, Insulating.
Massachusetts Chemical Co.

Patent Attorneys.
Bain, Foree & May.

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Phosphor Bronze Sm. Co. Ltd.
Seymour Mfg Co.

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Chicago Pneumatic Tool Co.
Wrigley Co., Thos.

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Baker & Co. Inc.

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Mott Iron Works, J. L.

Poles and Ties.
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Fowler & Co., John H.
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Loud's Sons Co., H. M.
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Pacific Coast Pole Co.
Perrizo & Sons.
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Sterling & Son, W. C.
Torrey Cedar Co.
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Worcester Co., C. H.

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Hoffman, Geo. W.

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Artistic Porcelain Co.

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Jeffrey Mfg. Co.

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Schureman Co., J. L.

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Rail Joint Company, The

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Jem Shade Holder Co., The.

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Manhattan Elect'l Supply Co
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(See Cut-outs and Switches.)

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Automatic Electric Co.
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Cook, Frank B.
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Chicago Telephone Co
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(See Bolts, Toggle.)

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Klein & Sons, Mathias.

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Zeidler Lamp & Brass Co.

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Crocker-Wheeler Co.
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Chicago Ins. Wire & Mfg. Co.
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Manhattan Elec. Supply Co.
Marion Ins. Wire & Rub. Co.
National India Rubber Co
New York Insulated Wire Co.
Okonite Co., The.
Phillips, Eugene F.
Phillips Insulated Wire Co
Roebling's Sons Co., J. A
Runzel-Lenz Elec. Mfg. Co.
Safety Ins. Wire & Cable C
Simplex Electrical Co.
Standard Underground Cable Co.
Wesco Supply Co.
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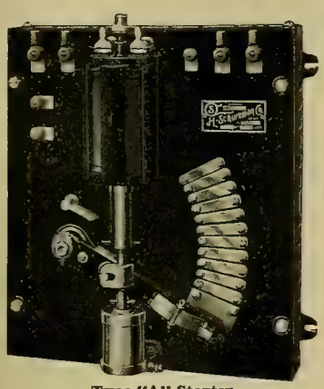
For Alphabetical Index of Advertisements See Page 3.

AUTOMATIC PUMP STARTERS



Type "A" Starter

The bottom segment on this starter is made of insulating material. By means of a "lost motion" arrangement in the vacuum dashpot, the contact arm jumps to the first copper segment as soon as the solenoid is energized. As the circuit is thus made and broken positively, no additional solenoid or magnet switch is required. Prices on request.

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They make stronger corners and save cable, time, labor and money. They do away with splicing and tapping at corners and dead ends.

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MADE IN ONLY ONE SIZE

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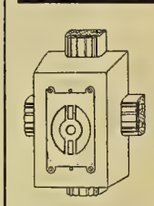
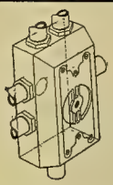
MOTORS-DYNAMOS-FANS
ARE WELL MADE AND YOU'LL LIKE THEM
FOR ALL DIRECT CURRENT CIRCUITS
THE ROBBINS & MYERS CO.
SPRINGFIELD, OHIO.





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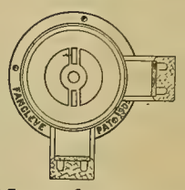

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with the Fibre-Graphite Commutator Brush. Being 90 per cent. pure graphite, it insures low resistance, no sparking under a varying load, and longer wear. There is no greasing required. The Fibre-Graphite is therefore the most economic brush on the market. Send for price list.

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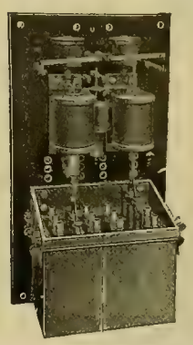
For Three-Phase Induction Motors

Adapted for pumping plants or similar works. Operation is entirely automatic.

Started by a push-button switch or its equivalent. Motor may be controlled by a float switch adjustable to depth of water in reservoir.

Or by a pressure switch using a regular G. E. M. C. governor similar to that employed in air-brake work.



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Each consists essentially of a regular subdivided compensator winding with automatic interconnecting switches.

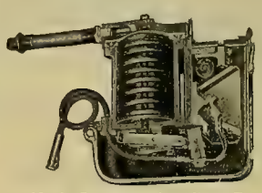
Interconnections between motors and line are made by two oil-immersed switches controlled by solenoid magnets.

One solenoid switch connects motor to compensator; the second throws motor directly across line

All operating circuits are broken when motor is running; no energy wasted in coils, and no disagreeable humming.

Auxiliary Float Switch

Built for potentials up to 550 volts



M. C. Governor-Auxiliary P

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EDISON DECORATIVE AND MINIATURE LAMP DEPARTMENT

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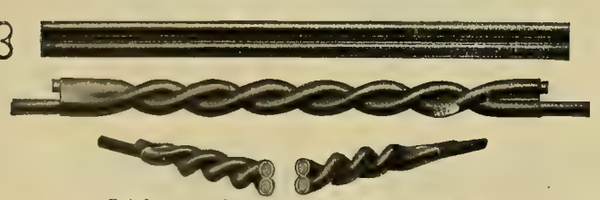
Insures a permanently perfect contact. No corrosion. Makes joint stronger than the wire itself.



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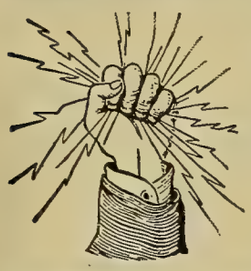

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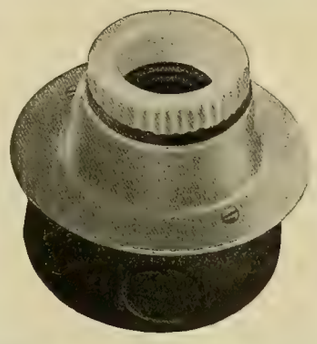

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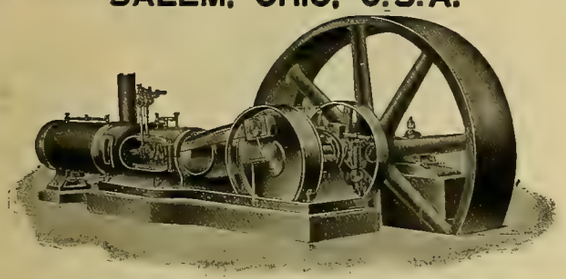

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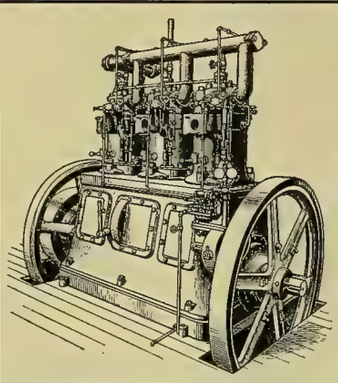

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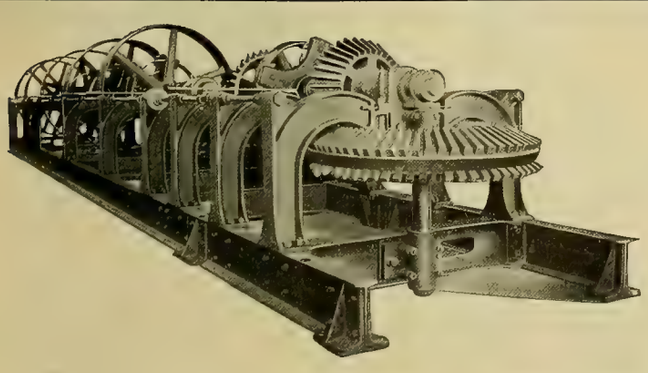

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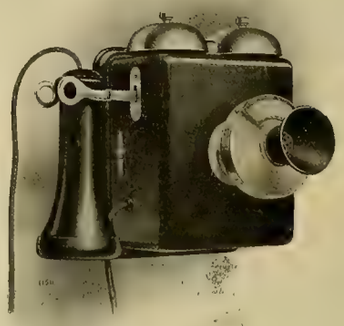

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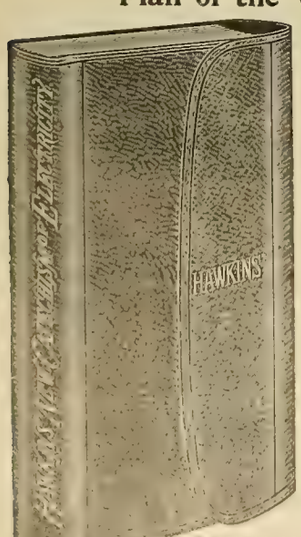

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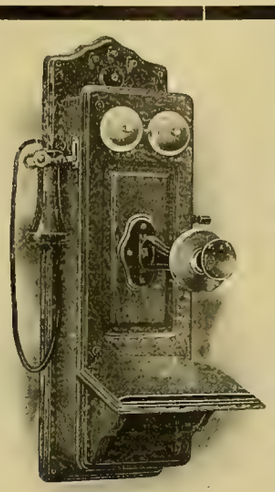

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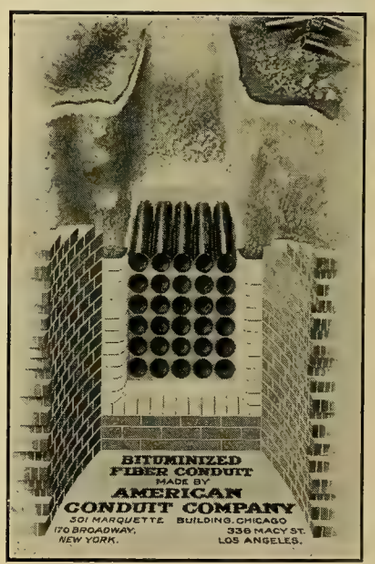

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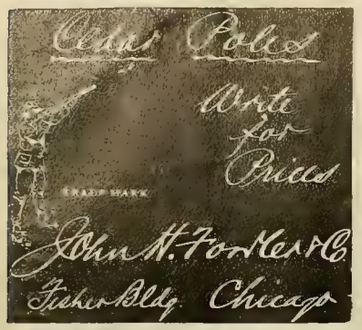

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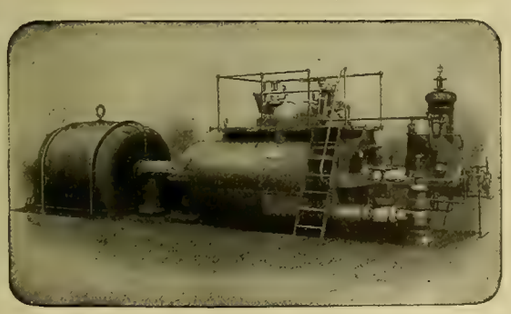

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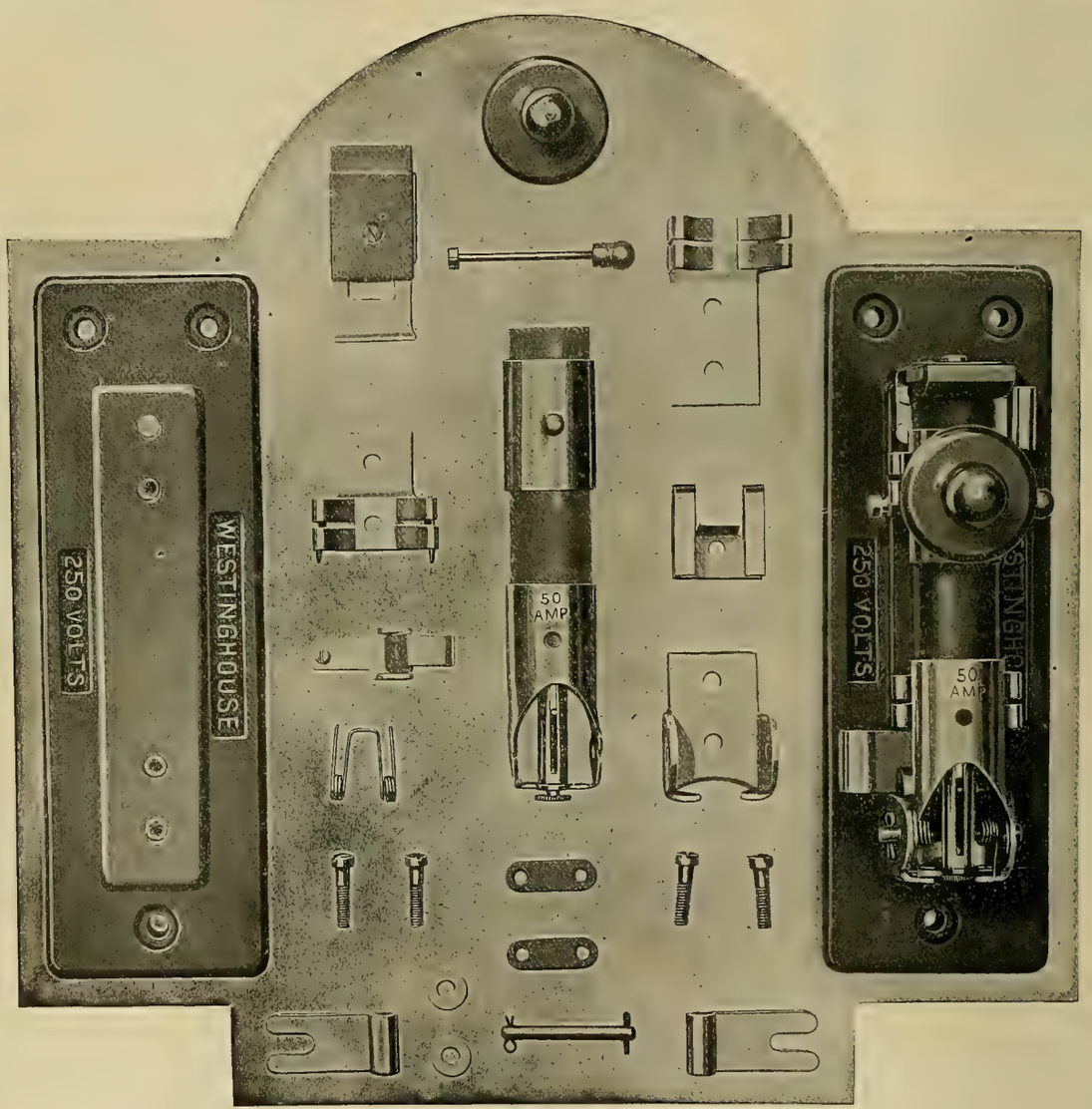

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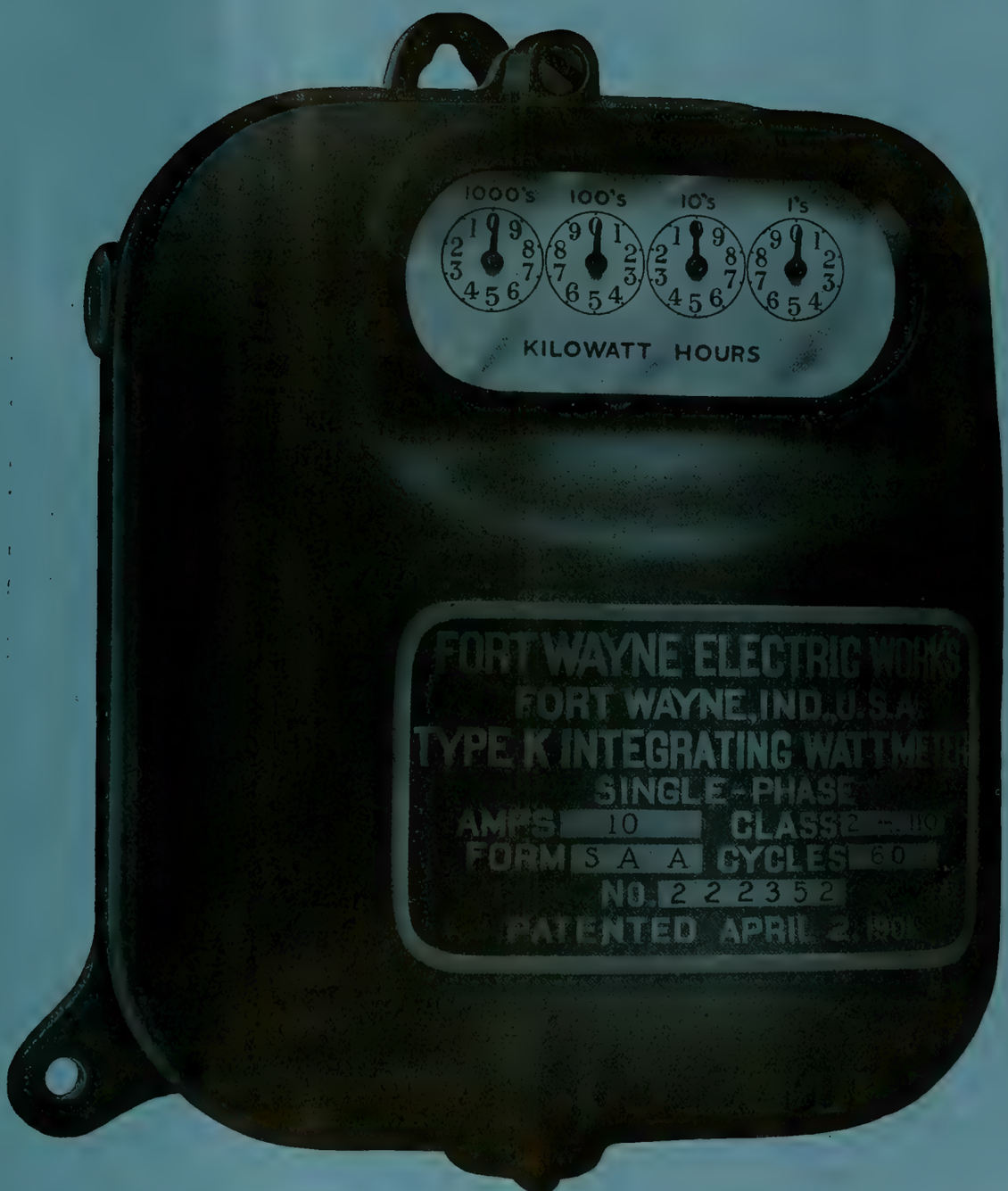

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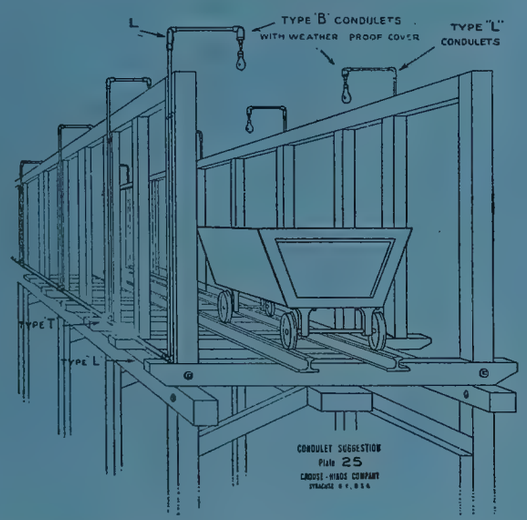

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